



Conference of Radiation Control Program Directors, Inc.

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March 26, 2012

Brian J. McDermott, Director
Division of Materials Safety and State Agreements
US Nuclear Regulatory Commission
Two White Flint North
11545 Rockville Pike
Rockville, MD 20852

Dear Brian:

Please find enclosed the finished copy of the latest revisions to the *Suggested State Regulations for Control of Radiation* from the Conference of Radiation Control Program Directors, Inc. (CRCPD):

Part U – Licensing Requirements for Uranium and Thorium Processing

2012 Rationale Part U – Licensing Requirements for Uranium and Thorium Processing

Part Z – Medical Credentialing

2012 Rationale Part Z – Medical Credentialing

The CRCPD Board of Directors on January 31, 2012 approved the publication of Part U and Part Z. CRCPD now requests concurrence from your agency. CRCPD requests that a written response relative to federal concurrence by your agency be submitted within 60 days of receipt of this correspondence.

Thank you for your attention to this important matter.

Sincerely,

Ruth E. McBurney, CHP
Executive Director

Enclosure

cc: CRCPD Board of Directors
Kathleen Schneider, State Regulation Review Coordinator (NRC)
Charles R. (Russ) Meyer, Technical Assistant (CRCPD)
Bruce Hirschler, SSRCR Publication Manager (CRCPD)

PART U

LICENSING REQUIREMENTS FOR URANIUM AND THORIUM PROCESSING

Sec. U.1 - Purpose. This Part establishes criteria for issuance and terms and conditions upon which the Agency issues licenses to receive title to, receive, possess, use, transfer, or deliver source and byproduct materials and for the operation of facilities for, and the disposition of the byproduct material resulting from, uranium or thorium processing. These regulations also provide for the long-term care and custody of byproduct material.

Sec. U.2 - Scope.

- a. This Part establishes performance objectives and procedural requirements applicable to any source material milling operation and to waste systems for byproduct material including specific technical requirements for siting, construction, operation, monitoring, decontamination, reclamation and ultimate stabilization, as well as requirements for financial assurance, license transfer and termination, long-term site monitoring, surveillance, ownership and ultimate custody.
- b. The requirements of this Part apply to byproduct material that is located at a site where milling operations are no longer active, if such site is not covered by the remedial action program of Title I of the Uranium Mill Tailings Radiation Control Act (UMTRCA) of 1978 (92 Stat. 3021; 42 U.S.C. 7901). [The regulations in this Part do not establish criteria and procedures for the issuance of licenses for materials covered under Title I of UMTRCA of 1978 unless remedial action is not completed under that program.]
- c. The requirements of this Part are in addition to, and not in substitution for, other applicable requirements of these regulations.
- d. A person subject to the regulations in this Part may not receive title to, own, receive, possess, use, transfer, provide for long-term care, deliver or dispose of byproduct material as defined in this Part, or any source material after removal from its place of deposit in nature, unless authorized in a specific or general license issued by the Agency under the regulations in this Part.

Sec. U.3 - Definitions. As used in this Part, the following definitions apply:

"Aquifer" means a geologic formation, group of formations, or part of a formation capable of yielding a significant amount of ground water to wells or springs. Any saturated zone created by uranium or thorium operations would not be considered an aquifer unless the zone is or potentially is:

- (1) Hydraulically interconnected to a natural aquifer;
- (2) Capable of discharge to surface water; or

- (3) Reasonably accessible because of migration beyond the vertical projection of the boundary of the land transferred for long-term government ownership and care in accordance with Criterion 11 of Appendix A to this Part U.

"As expeditiously as practicable considering technological feasibility", for the purposes of Criterion 6A of Appendix A, means as quickly as possible considering: the physical characteristics of the tailings and the site; the limits of available technology; the need for consistency with mandatory requirements of other regulatory programs; and factors beyond the control of the licensee. The phrase permits consideration of the cost of compliance only to the extent specifically provided for by use of the term available technology.

"Available radon barrier technology" means technologies and methods for emplacing a final radon barrier on uranium mill tailings piles or impoundments. This term shall not be construed to include extraordinary measures or techniques that would impose costs that are grossly excessive as measured by practice within the industry (or one that is reasonably analogous), (such as, by way of illustration only, unreasonable overtime, staffing, or transportation requirements, etc., considering normal practice in the industry; laser fusion of soils, etc.), provided there is reasonable progress toward emplacement of the final radon barrier. To determine grossly excessive costs, the relevant baseline against which cost shall be compared is the cost estimate for tailings impoundment closure contained in the licensee's approved reclamation plan, but costs beyond these estimates shall not automatically be considered grossly excessive.

"Byproduct material" [as in Part A of these regulations] [as used in this Part means the tailings or wastes produced by the extraction or concentration of uranium or thorium from ore processed primarily for its source material content, including discrete surface wastes resulting from uranium or thorium solution extraction processes. Underground ore bodies depleted by these solution extraction operations do not constitute "byproduct material" within this definition.] NOTE: with the addition of types 11e.(3) and 11e.(4), the Agency may have the entire definition in their Part A and can be referenced.

"Closure" means the activities following operations to decontaminate and decommission the buildings and site used to produce byproduct materials and reclaim the tailings and/or waste disposal area.

"Closure plan" means the Agency-approved plan to accomplish closure.

"Commencement of construction" means any clearing of land, excavation or other substantial action related to a proposed activity for specific licensing that would adversely affect the natural environment of a site; this term does not include changes desirable for the temporary use of the land for public recreational uses, limited borings to determine site characteristics as necessary for environmental assessment or other pre-construction monitoring to establish background information related to the suitability of a site, or to the protection of environmental values.

"Compliance period" begins when the Agency sets secondary ground-water protection standards and ends when the owner or operator's license is terminated and the site is transferred to the state or federal agency for long-term care.

"Decommission" means to remove a facility or site safely from service and reduce residual radioactivity to a level that permits (1) release of the property for unrestricted use and termination of the license or (2) release of the property under restricted conditions and termination of the license.

"Dike" means an embankment or ridge of either natural or man-made materials used to prevent the movement of liquids, sludges, solids, or other materials.

"Disposal area" means the area containing byproduct materials to which the requirements of Criterion 6 of Appendix A to this Part U apply.

"Existing portion" means that land surface area of an existing surface impoundment on which significant quantities of uranium or thorium byproduct material had been placed prior to September 30, 1983.

"Factors beyond the control of the licensee" means factors proximately causing delay in meeting the schedule in the applicable reclamation plan for the timely emplacement of the final radon barrier notwithstanding the good faith efforts of the licensee to complete the barrier in compliance with paragraph (1) of Criterion 6A of Appendix A to this Part U. These factors may include, but are not limited to:

- (1) Physical conditions at the site;
- (2) Inclement weather or climatic conditions;
- (3) An act of god;
- (4) An act of war;
- (5) A judicial or administrative order or decision, or change to the statutory, regulatory, or other legal requirements applicable to the licensee's facility that would preclude or delay the performance of activities required for compliance;
- (6) Labor disturbances;
- (7) Any modifications, cessation or delay ordered by state, federal, or local agencies;
- (8) Delays beyond the time reasonably required in obtaining necessary government permits, licenses, approvals, or consent for activities described in the reclamation plan proposed by the licensee that result from Agency failure to take final action after the licensee has made a good faith, timely effort to submit legally sufficient applications, responses to requests (including relevant data requested by the agencies), or other information, including approval of the reclamation plan; and
- (9) An act or omission of any third party over whom the licensee has no control.

"Final radon barrier" means the earthen cover (or approved alternative cover) over tailings or waste constructed to comply with Criterion 6 of Appendix A to this Part U (excluding erosion protection features).

"Ground water" means water below the land surface in a zone of saturation. For purposes of Appendix A to this Part U, ground water is the water contained within an aquifer as defined above.

"Leachate" means any liquid, including any suspended or dissolved components in the liquid, that has percolated through or drained from the byproduct material.

"Licensed site" means the area contained within the boundary of a location under the control of persons generating or storing byproduct material under an Agency license.

"Liner" means a continuous layer of natural or man-made materials, beneath or on the sides of a surface impoundment which restricts the downward or lateral escape of byproduct material, hazardous constituents, or leachate.

"Milestone" means an action or event that is required to occur by an enforceable date.

"Operation" means that a uranium or thorium mill tailings pile or impoundment is being used for the continued placement of byproduct material or is in standby status for such placement. A pile or impoundment is in operation from the day that byproduct material is first placed in the pile or impoundment until the day final closure begins.

"Point of compliance" is the site specific location in the uppermost aquifer where the ground-water protection standard must be met.

"Principal activities" as used in this Part, means activities authorized by the license which are essential to achieving the purpose(s) for which the license was issued or amended. Storage during which no licensed material is accessed for use or disposal and activities incidental to decontamination or decommissioning are not principal activities.

"Reclamation plan", for the purposes of Criterion 6A of Appendix A to this Part U, means the plan detailing activities to accomplish reclamation of the tailings or waste disposal area in accordance with the technical criteria of Appendix A to this Part. The reclamation plan must include a schedule for reclamation milestones that are key to the completion of the final radon barrier including as appropriate, but not limited to, wind blown tailings retrieval and placement on the pile, interim stabilization (including de-watering or the removal of freestanding liquids and re-contouring), and final radon barrier construction. (Reclamation of tailings must also be addressed in the closure plan; the detailed reclamation plan may be incorporated into the closure plan.)

"Residual Radioactive Material" means: (1) Waste (which the Secretary of Energy determines to be radioactive) in the form of tailings resulting from the processing of ores for the extraction of uranium and other valuable constituents of the ores; and (2) other waste (which the Secretary of Energy determines to be radioactive) at a processing site which relates to such processing, including any residual stock of unprocessed ores or low-grade materials. This term is used only with respect to materials at sites subject to remediation under title I of the Uranium Mill Tailings Radiation Control Act of 1978, as amended.

"Source material" [as defined in Part A of these regulations] means:

- (1) Uranium or thorium, or any combination thereof, in any physical or chemical form; or

- (2) Ores that contain by weight one-twentieth of 1 percent (0.05 percent) or more of uranium, thorium, or any combination of uranium and thorium. Source material does not include special nuclear material.

"Source material milling [uranium milling]" means any activity that results in the production of byproduct material as defined in this Part.

"Surface impoundment" means a natural topographic depression, man-made excavation, or diked area, which is designed to hold an accumulation of liquid wastes or wastes containing free liquids, and which is not an injection well.

"Uppermost aquifer" means the geologic formation nearest the natural ground surface that is an aquifer, as well as lower aquifers that are hydraulically interconnected with this aquifer within the facility's property boundary.

Sec. U.4 - Special Requirements for Issuance of Specific Licenses For Source Material Milling. In addition to the requirements set forth in Part C of these regulations, a specific license for source material milling will be issued if the applicant submits to the Agency a complete and accurate application that clearly demonstrates how the requirements and objectives of this Part are met. Failure to clearly demonstrate that the requirements and objectives of this Part are met shall be grounds for refusing to accept an application.

- a. An applicant for a license (or to amend or renew an existing license) to receive, possess, and use source material for milling or byproduct material shall submit all information required under these regulations and such other material as the Agency may deem necessary and shall address the following:
 - i. Description of the proposed project or action;
 - ii. Site characteristics including regional and site specific geology, topography, hydrology and meteorology;
 - iii. Radiological and non-radiological impacts of the proposed project or action, including waterway and groundwater impacts;
 - iv. Environmental effects of accidents;
 - v. Tailings disposal and decommissioning;
 - vi. Site and project alternatives.
- b. The applicant shall provide written specifications describing the means employed to meet the following requirements during the operational phase of any project.
 - i. Milling operations shall be conducted so that all airborne effluent releases are reduced to levels as low as is reasonably achievable.
 - ii. The mill operator shall conduct at least a daily inspection of any tailings or waste retention systems. The inspection shall be performed by a person who is qualified and

approved by the Agency. Records of such inspections shall be maintained for review by the Agency.

- iii. The mill operator shall immediately notify the Agency of the following:
 - (1) Any failure in a tailings or waste retention system which results in a release of tailings or waste into unrestricted areas [the environment]; and
 - (2) Any unusual conditions which are not contemplated in the design of the retention system and which if not corrected could lead to failure of the system and result in a release of tailings or waste into unrestricted areas [the environment].
- c. At least one full year prior to any major site construction, the applicant/licensee shall conduct a preoperational monitoring program to provide complete baseline data on a milling site and its environs. Throughout the construction and operating phases of the mill, the applicant/licensee shall conduct an operational monitoring program to measure or evaluate compliance with applicable standards and regulations, to evaluate performance of control systems and procedures, to evaluate environmental impacts of operation, and to detect potential long-term effects.
- d. An application for a license to receive, possess and use source material for milling or byproduct material shall contain proposed specifications relating to the milling operations and the disposition of tailings or wastes resulting from such milling activities to achieve the requirements and objectives set forth in the criteria listed in Appendix A to this Part U. Each application for a new license or for license renewal must clearly demonstrate how the requirements and objectives set forth in Appendix A to this Part U have been addressed.

Sec. U.5 - Pre-licensing Construction. An application for a license, or to amend or renew an existing license, for source material milling shall be filed with the Agency at least nine (9) months prior to the anticipated commencement of construction of the plant or facility in which the activity will be conducted and shall be accompanied by the environmental report required by U.6, unless an exemption from the requirement of furnishing such a report has been obtained from the Agency. No construction shall be commenced until the license has been issued.

Sec. U.6 - Applicant's Environmental Report.

- a. For each license application (or application to amend or renew an existing license) to receive, possess, and use source material for uranium or thorium milling or byproduct material, an environmental report shall be required of the applicant and shall contain all information deemed necessary by the Agency.
- b. The applicant's environmental report, or supplement to applicant's environmental report, as appropriate, shall include information to assist the Agency in the evaluation of the short-term and long-range environmental impact of the project and activity so that the Agency may weigh environmental, economic, technical, and other benefits against environmental costs, while considering available alternatives.
- c. The following types of actions require an applicant's environmental report:

- i. Issuance or renewal of a source material milling license or byproduct material license;
- ii. Issuance of an amendment that would authorize or result in:
 - (1) A significant expansion of a site;
 - (2) A significant change in the types of effluents;
 - (3) A significant increase in the amounts of effluents;
 - (4) A significant increase in individual or cumulative occupational radiation exposure; or
 - (5) A significant increase in the potential for or consequences from radiological accidents.
- d. If the application is for an amendment to or a renewal of a license for which the applicant has previously submitted an environmental report, the supplement to an applicant's environmental report may be limited by incorporating by reference, updating or supplementing the information previously submitted to reflect any significant environmental change, including any significant environmental change resulting from operational experience or a change in operations or proposed decommissioning activities.
- e. In the event that an applicant's environmental report acceptable to the Agency is on file with the Agency in regard to the specific licensed activity authorized under an existing license, and upon request of the applicant to amend or renew an existing license or at the initiation of the Agency, the Agency may grant an exemption of the requirement to submit an additional environmental report or supplement. The request for exemption shall provide the Agency with such information as the Agency requires of the applicant to demonstrate that no significant environmental impact will result from the licensed activity.

Sec. U.7 - Transmittal of Applicant's Environmental Report for Review and Comment. Upon receipt of the environmental report or any amendment thereto, and of any other documents required, the Agency shall determine the necessity to transmit and, if appropriate, shall transmit the same for review and comment to federal, state, and local agencies having expertise in and jurisdiction over the proposed project and activity. Written comments and reports of reviewing agencies shall be considered by the Agency in its decision-making review process on the license application request.

- a. If an environmental impact statement (EIS) is required of a federal agency pursuant to the National Environment Policy Act of 1969 (NEPA) and is provided by such federal agency, it shall be used by the Agency in its decision-making review process on the license application request.
- b. The Agency shall consider applicable regulations of federal, state, and local regulatory agencies and permit requirements thereof.

Sec. U.8 - Environmental Impact Analysis.

- a. The Agency shall prepare a written analysis for any significant impact on the environment for the following activities: (1) a license application to receive, possess, and use source material for uranium or thorium milling, (2) an application to amend or renew an existing license to receive, possess, and use source material for uranium or thorium milling, or (3) an application to amend or renew an existing license to receive, possess, and use byproduct material. This written analysis shall be available to the public at the time of public notice of hearing. This written analysis shall include:
 - i. An assessment of the radiological and non-radiological impacts to the public health and the environment;
 - ii. An assessment of any impact on any waterway and ground water;
 - iii. Consideration of alternatives to the activities to be conducted; and
 - iv. Consideration of the long-term impacts of the licensed activities.
- b. In preparing the environmental impact analysis, the Agency may use and incorporate by reference the environmental report prepared by the applicant as required by U.6 and environmental assessments prepared by federal, state or local agencies.
- c. The environmental impact analysis, or any part thereof, shall be prepared directly by or under supervision of the Agency.

Sec. U.9 - Financial Assurance Arrangements. Prior to issuance of the license, the applicant shall establish separate financial assurance arrangements to (1) ensure decontamination and decommissioning of the facility and (2) provide a fund adequate and sufficient to cover the payment of the cost for long-term care and monitoring. These required financial assurances shall be as set forth in Appendix A, Criteria 9 and 10 of this Part U. [The Agency may consider proposals to combine the two types of financial assurance.] Financial assurance shall be provided prior to commencement of operations.

Sec. U.10 - Operational Requirements. Each licensee authorized to receive, possess and use source material for milling or byproduct material, shall:

- a. Operate in accordance with the requirements of this Part U: the procedures required by U.4b., the monitoring required by U.4c. and the requirements and objectives of Appendix A to this Part U.
- b. Submit a report to the Agency within 60 days after January 1 and July 1 of each year, specifying the quantity of each of the radioactive materials released to unrestricted areas in liquid and in gaseous effluents during the previous six months of operation, and such other information as the Agency may require to estimate maximum potential annual radiation doses to the public resulting from effluent releases. If quantities of radioactive materials released during the reporting period are significantly above the licensee's design objectives previously reviewed as part of the licensing action, the report shall cover this specifically. On the basis of such reports and any additional information the Agency may obtain from the

licensee or others, the Agency may from time to time require the licensee to take such action as the Agency deems appropriate.

- c. Notify the NRC as soon as possible but not later than 4 hours after the discovery of an event that prevents immediate protective actions necessary to avoid exposures to radiation or radioactive materials that could exceed regulatory limits or releases of licensed material that could exceed regulatory limits (events may include fires, explosions, toxic gas releases, etc.).
- d. Twenty-four hour report. Each licensee shall notify the NRC within 24 hours after the discovery of any of the following events involving licensed material:
 - i. An unplanned contamination event that:
 - (1) Requires access to the contaminated area, by workers or the public, to be restricted for more than 24 hours by imposing additional radiological controls or by prohibiting entry into the area;
 - (2) Involves a quantity of material greater than five times the lowest annual limit on intake specified in appendix B of Part D of these regulations for the material; and
 - (3) Has access to the area restricted for a reason other than to allow isotopes with a half-life of less than 24 hours to decay prior to decontamination.
 - ii. An event in which equipment is disabled or fails to function as designed when:
 - (1) The equipment is required by regulation or license condition to prevent releases exceeding regulatory limits, to prevent exposures to radiation and radioactive materials exceeding regulatory limits, or to mitigate the consequences of an accident;
 - (2) The equipment is required to be available and operable when it is disabled or fails to function; and
 - (3) No redundant equipment is available and operable to perform the required safety function.
 - iii. An event that requires unplanned medical treatment at a medical facility of an individual with spreadable radioactive contamination on the individual's clothing or body.
 - iv. An unplanned fire or explosion damaging any licensed material or any device, container, or equipment containing licensed material when:
 - (1) The quantity of material involved is greater than five times the lowest annual limit on intake specified in appendix B of §§ 20.1001–20.2401 of 10 CFR part 20 for the material; and
 - (2) The damage affects the integrity of the licensed material or its container.

- e. Preparation and submission of reports. Reports made by licensees in response to the requirements of this section must be made as follows:
- i. Licensees shall make reports required by U.10c. and U.10d. by telephone to the NRC Operations Center. To the extent that the information is available at the time of notification, the information provided in these reports must include:
- (1) The caller's name and call back telephone number;
 - (2) A description of the event, including date and time;
 - (3) The exact location of the event;
 - (4) The isotopes, quantities, and chemical and physical form of the licensed material involved; and
 - (5) Any personnel radiation exposure data available.
- ii. Written report. Each licensee who makes a report required by paragraph (a) or (b) of this section shall submit a written follow-up report within 30 days of the initial report. Written reports prepared pursuant to other regulations may be submitted to fulfill this requirement if the reports contain all of the necessary information and the appropriate distribution is made. These written reports must be sent to the NRC's Document Control Desk by an appropriate method listed in § 40.5, with a copy to the appropriate NRC regional office listed in appendix D to Part D of these regulations. The reports must include the following:
- (1) A description of the event, including the probable cause and the manufacturer and model number (if applicable) of any equipment that failed or malfunctioned;
 - (2) The exact location of the event;
 - (3) The isotopes, quantities, and chemical and physical form of the licensed material involved;
 - (4) Date and time of the event;
 - (5) Corrective actions taken or planned and the results of any evaluations or assessments; and
 - (6) The extent of exposure of individuals to radiation or to radioactive materials without identification of individuals by name.

Sec. U.11 - Decommissioning Requirements.

- a. The licensee shall notify the Agency in writing within 60 days of the occurrence of any of the following:

- i. The licensee has decided to permanently cease principal activities at the entire site or in any separate building or outdoor area that contains residual radioactivity such that the building or outdoor area is unsuitable for release in accordance with these regulations; or,
 - ii. No principal activities under the license have been conducted for a period of 24 months; or,
 - iii. No principal activities have been conducted for a period of 24 months in any separate building or outdoor area that contains residual radioactivity such that the building or outdoor area is unsuitable for release in accordance with these regulations.
- b. From the date of notification of the Agency required in U.11a., the licensee shall either:
- i. Begin decommissioning activities; or
 - ii. Within 12 months of notification submit a decommissioning plan, if required by Appendix A [or U.11] of this Part, and begin decommissioning upon Agency approval of that plan.
- c. Coincident with the notification of the Agency required in U.11a., the licensee shall maintain in effect all decommissioning financial assurances established by the licensee as required by Appendix A. The amount of the financial assurance must be increased, or may be decreased, as appropriate, to cover the detailed cost estimate for decommissioning established pursuant to U.12.
- d. The Agency may approve an alternate schedule for the submission of plans and for the completion of decommissioning as required pursuant to U.11a. if the Agency determines that the alternate schedule (1) is necessary to effectively conduct decommissioning, (2) presents no undue risks to public health and safety, and (3) is otherwise in the public interest. The request must be submitted no later than 30 days before notification pursuant to U.11a. The schedule for decommissioning may not commence until the Agency has made a determination on the request.]

Sec. U.12. - Decommissioning Plan.

- a. In addition to the information required by Part C of these regulations, each licensee authorized to receive, possess and use source material for milling or byproduct material shall submit a plan for completion of decommissioning if the procedures necessary to carry out decommissioning:
 - i. Have not been previously approved by the Agency; and
 - ii. Could increase potential health and safety impacts to workers or to the public, such as in any of the following cases:
 - (1) Procedures would involve techniques not applied routinely during cleanup or maintenance operations; or

- (2) Workers would be entering areas not normally occupied where surface contamination and radiation levels are significantly higher than routinely encountered during operation; or
 - (3) Procedures could result in significantly greater airborne concentrations of radioactive materials than are present during operation; or
 - (4) Procedures could result in significantly greater releases of radioactive material to the environment than those associated with operation.
- b. Procedures with potential health and safety impacts may not be carried out prior to approval of the decommissioning plan.
- c. The proposed decommissioning plan, if required by U.11a. or by license condition, must include:
 - i. Description of planned decommissioning activities;
 - ii. Description of methods used to assure protection of workers and the environment against radiation hazards during decommissioning;
 - iii. A description of the planned final radiation survey; and
 - iv. An updated detailed cost estimate for decommissioning, comparison of that estimate with present funds set aside for decommissioning, and plan for assuring the availability of adequate funds for completion of decommissioning.
- d. For decommissioning plans calling for completion of decommissioning later than 24 months after plan approval, the plan shall include a justification for the delay. The proposed decommissioning plan will be approved by the Agency if the information therein demonstrates that the decommissioning will be completed as soon as is reasonable and that the health and safety of workers and the public will be adequately protected.
- e. After submittal and upon approval of the decommissioning plan by the Agency, the licensee shall decommission in accordance with the approved plan. As a final step in decommissioning, the licensee shall submit the information required in Part C of these regulations and shall certify the disposition of accumulated wastes from decommissioning.
- f. If the information submitted hereunder does not adequately demonstrate that the premises are suitable for release for unrestricted use, the Agency will inform the licensee of the appropriate further actions required for termination of license.

Part U**APPENDIX A****CRITERIA RELATING TO THE OPERATION OF MILLS
AND THE DISPOSITION OF RADIOACTIVE TAILINGS OR WASTES**

Introduction: Every applicant for a license to receive, possess and use radioactive material in conjunction with uranium or thorium milling, or byproduct material at sites formerly associated with such milling, is required by the provisions of U.4 to include in a license application proposed specifications relating to milling operations and the disposition of tailings or wastes resulting from such milling activities. This appendix establishes technical, ownership, and long-term site surveillance criteria relating to the siting, construction, operation, decontamination, decommissioning, financial assurance, and reclamation of mills and tailings or waste systems and sites at which such mills and systems are located.

As used in Appendix A, the term "as low as is reasonably achievable" has the same meaning as in Part A.2. of these regulations.

In many cases, flexibility is provided in the criteria to allow achieving an optimum tailings disposal program on a site-specific basis. However, in such cases the objectives, technical alternatives and concerns which must be taken into account in developing a tailings program are identified. As provided by the provisions of U.4, applications for licenses must clearly demonstrate how the criteria have been addressed.

The specifications shall be developed considering the expected full capacity of tailings or waste systems and the lifetime of mill operations. Where later expansions of systems or operations may be likely (for example, where large quantities of ore now marginally uneconomical may be stockpiled), the amenability of the disposal system to accommodate increased capacities without degradation in long-term stability and other performance factors shall be evaluated.

Licensees or applicants may propose to the Agency alternatives to meet the specific requirements in this Appendix. The alternative proposals may take into account local or regional conditions, including geology, topography, hydrology, and meteorology. The Agency may find that the proposed alternatives meet the Agency's requirements if the alternatives will achieve a level of stabilization and containment of the sites concerned and a level of protection for public health, safety, and the environment from radiological and non-radiological hazards associated with the site, which is equivalent to, to the extent practicable, or more stringent than the level which would be achieved by the requirements of this Appendix and the standards promulgated by the Environmental Protection Agency in 40 CFR Part 192, Subparts D and E. Proposed alternatives to specific regulations in this Part U require notice and opportunity for hearing before the U. S. Nuclear Regulatory Commission.

All site-specific licensing decisions based on the criteria in this Appendix or alternatives proposed by licensees or applicants will take into account the risk to the public health and safety and the environment with due consideration to the economic costs involved and any other factors the Agency determines to be appropriate. In implementing this Appendix, the Agency will consider

"practicable" and "reasonably achievable" as equivalent terms. Decisions involving these terms will take into account the state of technology, and the economics of improvements in relation to benefits to the public health and safety, and other societal and socioeconomic considerations, and in relation to the utilization of atomic energy in the public interest.

Criterion 1.

Criterion 1A. The general goal or broad objective in siting and design decisions is permanent isolation of tailings and associated contaminants by minimizing disturbance and dispersion by natural forces, and to do so without ongoing maintenance. For practical reasons, specific siting decisions and design standards must involve finite times (e.g., the longevity design standard in Criterion 6). The following site features which will contribute to such a goal or objective must be considered in selecting among alternative tailings disposal sites or judging the adequacy of existing tailings sites:

- (1) Remoteness from populated areas;
- (2) Hydrologic and other natural conditions as they contribute to continued immobilization and isolation of contaminants from ground-water sources; and
- (3) Potential for minimizing erosion, disturbance, and dispersion by natural forces over the long term.

Criterion 1B. The site selection process must be an optimization to the maximum extent reasonably achievable in terms of the features in Criterion 1A.

Criterion 1C. In the selection of disposal sites, primary emphasis must be given to isolation of tailings or wastes, a matter having long-term impacts, as opposed to consideration only of short-term convenience or benefits, such as minimization of transportation or land acquisition costs. While isolation of tailings will be a function of both site and engineering design, overriding consideration must be given to siting features given the long-term nature of the tailings hazards.

Criterion 1D. Tailings should be disposed of in a manner that no active maintenance is required to preserve conditions of the site.

Criterion 2. To avoid proliferation of small waste disposal sites and thereby reduce perpetual surveillance obligations, byproduct material from *in situ* extraction operations, such as residues from solution evaporation or contaminated control processes, and wastes from small remote above ground extraction operations shall be disposed of at existing large mill tailings sites; unless considering the nature of the wastes, such as their volume and specific activity, and the costs and environmental impacts of transporting the wastes to a large disposal site, such off-site disposal is demonstrated to be impracticable or the advantages of onsite burial clearly outweigh the benefits of reducing the perpetual surveillance obligations.

Criterion 3. The "prime option" for disposal of tailings is placement below grade, either in mines or specially excavated pits (that is, where the need for any specially constructed retention structure is eliminated). The evaluation of alternative sites and disposal methods performed by mill operators in support of their proposed tailings disposal program (provided in applicants' environmental reports) must reflect serious consideration of this disposal mode. In some instances, below grade disposal

may not be the most environmentally sound approach, such as might be the case if a ground-water formation is relatively close to the surface or not very well isolated by overlying soils and rock. Also, geologic and topographic conditions might make full below grade burial impracticable. For example, bedrock may be sufficiently near the surface that blasting would be required to excavate a disposal pit at excessive cost, and more suitable alternative sites are not available. Where full below grade burial is not practicable, the size of retention structures, and size and steepness of slopes associated with exposed embankments must be minimized by excavation to the maximum extent reasonably achievable or appropriate given the geologic and hydrologic conditions at a site. In these cases, it must be demonstrated that an above grade disposal program will provide reasonably equivalent isolation of the tailings from natural erosional forces.

Criterion 4. The following site and design criteria must be adhered to whether tailings or wastes are disposed of above or below grade.

Criterion 4A. Upstream rainfall catchment areas must be minimized to decrease erosion potential and the size of the floods which could erode or wash out sections of the tailings disposal area.

Criterion 4B. Topographic features should provide good wind protection.

Criterion 4C. Embankment and cover slopes must be relatively flat after final stabilization to minimize erosion potential and to provide conservative factors of safety assuring long-term stability. The broad objective should be to contour final slopes to grades which are as close as possible to those which would be provided if tailings were disposed of below grade: this could, for example, lead to slopes of about 10 horizontal to 1 vertical (10h:1v) or less steep. In general, slopes should not be steeper than about 5h:1v. Where steeper slopes are proposed, reasons why a slope less steep than 5h:1v would be impracticable should be provided and compensating factors and conditions which make such slopes acceptable should be identified.

Criterion 4D. A full self-sustaining vegetative cover must be established or rock cover employed to reduce wind and water erosion to negligible levels.

- (1) Where a full vegetative cover is not likely to be self-sustaining due to climatic or other conditions, such as in semi-arid and arid regions, rock cover must be employed on slopes of the impoundment system. The Agency will consider relaxing this requirement for extremely gentle slopes such as those which may exist on the top of the pile.
- (2) The following factors must be considered in establishing the final rock cover design to avoid displacement of rock particles by human and animal traffic or by natural process, and to preclude undercutting and piping:
 - (a) Shape, size, composition, and gradation of rock particles (excepting bedding material average particles size must be at least cobble size or greater);
 - (b) Rock cover thickness and zoning of particles by size; and
 - (c) Steepness of underlying slopes.

- (3) Individual rock fragments must be dense, sound, and resistant to abrasion, and must be free from cracks, seams, and other defects that would tend to unduly increase their destruction by water and frost actions. Weak, friable, or laminated aggregate may not be used.
- (4) Rock covering of slopes may be unnecessary where top covers are very thick (on the order of 10m or greater); impoundment slopes are very gentle (on the order of 10h:1v or less); bulk cover materials have inherently favorable erosion resistance characteristics; and, there is negligible drainage catchment area upstream of the pile and good wind protection as described in Criteria 4A and 4B.
- (5) Furthermore, all impoundment surfaces must be contoured to avoid areas of concentrated surface runoff or abrupt or sharp changes in slope gradient. In addition to rock cover on slopes, areas toward which surface runoff might be directed must be well protected with substantial rock cover (rip rap). In addition to providing for stability of the impoundment system itself, overall stability, erosion potential, and geomorphology of surrounding terrain must be evaluated to assure that there are not ongoing or potential processes, such as gully erosion, which would lead to impoundment instability.

Criterion 4E. The impoundment may not be located near a capable fault that could cause a maximum credible earthquake larger than that which the impoundment could reasonably be expected to withstand. As used in this criterion, the term "capable fault" has the same meaning as defined in section III(g) of Appendix A of 10 CFR Part 100. The term "maximum credible earthquake" means that earthquake which would cause the maximum vibratory ground motion based upon an evaluation of earthquake potential considering the regional and local geology and seismology and specific characteristics of local subsurface material.

Criterion 4F. The impoundment, where feasible, should be designed to incorporate features which will promote deposition. For example, design features which promote deposition of sediment suspended in any runoff which flows into the impoundment area might be utilized; the object of such a design feature would be to enhance the thickness of cover over time.

Criterion 5. Criteria 5A- 5D and Criterion 13 incorporate the basic ground water protection standards imposed by the Environmental Protection Agency in 40 CFR Part 192, Subparts D and E (48 FR 45926; October 7, 1983) which apply during operations and prior to the end of closure. Groundwater monitoring to comply with these standards is required by Criterion 7A.

Criterion 5A.

- (1) The primary ground water protection standard is a design standard for surface impoundments used to manage uranium and thorium radioactive material. Unless exempted under paragraph 5A(3) of this criterion, surface impoundments (except for an existing portion) shall have a liner that is designed, constructed, and installed to prevent any migration of wastes out of the impoundment to the adjacent subsurface soil, ground water, or surface water at any time during the active life (including the closure period) of the impoundment. The liner may be constructed of materials that may allow wastes to migrate into the liner (but not into the adjacent subsurface soil, ground water, or surface water) during the active life of the facility, provided that impoundment closure includes removal or decontamination of all waste residues, contaminated containment system components (liners, etc.), contaminated subsoils, and structures and equipment contaminated with waste and leachate. For impoundments that

will be closed with the liner material left in place, the liner must be constructed of materials that can prevent wastes from migrating into the liner during the active life of the facility.

- (2) The liner required by paragraph 5A(1) above shall be:
 - (a) Constructed of materials that have appropriate chemical properties and sufficient strength and thickness to prevent failure due to pressure gradients (including static head and external hydrogeologic forces), physical contact with the waste or leachate to which they are exposed, climatic conditions, the stress of installation, and the stress of daily operation;
 - (b) Placed upon a foundation or base capable of providing support to the liner and resistance to pressure gradients above and below the liner to prevent failure of the liner due to settlement, compression, or uplift; and
 - (c) Installed to cover all surrounding earth likely to be in contact with the wastes or leachate.
- (3) The applicant or licensee will be exempted from the requirements of paragraph 5A(1) of this criterion if the Agency finds, based on a demonstration by the applicant or licensee, that alternate design and operating practices, including the closure plan, together with site characteristics, will prevent the migration of any hazardous constituents into ground water or surface water at any future time.

In deciding whether to grant an exemption, the Agency will consider:

- (a) The nature and quantity of the wastes;
 - (b) The proposed alternate design and operation;
 - (c) The hydrogeologic setting of the facility, including the attenuative capacity and thickness of the liners and soils present between the impoundment and ground water or surface water; and
 - (d) All other factors which would influence the quality and mobility of the leachate produced and the potential for it to migrate to ground water or surface water.
- (4) A surface impoundment must be designed, constructed, maintained, and operated to prevent overtopping resulting from normal or abnormal operations, overfilling, wind and wave actions, rainfall, or run-on; from malfunctions of level controllers, alarms, and other equipment; and from human error.
 - (5) When dikes are used to form the surface impoundment, the dikes must be designed, constructed, and maintained with sufficient structural integrity to prevent massive failure of the dikes. In ensuring structural integrity, it must not be presumed that the liner system will function without leakage during the active life of the impoundment.

Criterion 5B.

- (1) Uranium and thorium byproduct material shall be managed to conform to the following secondary ground water protection standard: hazardous constituents entering the ground water from a licensed site must not exceed the specified concentration limits in the uppermost aquifer beyond the point of compliance during the compliance period. Hazardous constituents are those constituents identified by the Agency pursuant to paragraph 5B(2) of this criterion. Specified concentration limits are those limits established by the Agency as indicated in paragraph 5B(5) of this criterion. The Agency will also establish the point of compliance and compliance period on a site-specific basis through license conditions and orders. The objective in selecting the point of compliance is to provide the earliest practicable warning that the impoundment is releasing hazardous constituents to the ground water. The point of compliance must be selected to provide prompt indication of ground water contamination on the hydraulically down-gradient edge of the disposal area. The Agency shall identify hazardous constituents, establish concentration limits, set the compliance period, and may adjust the point of compliance if needed to accord with developed data and site information as to the flow of ground water or contaminants, when the detection monitoring established under Criterion 7A indicates leakage of hazardous constituents from the disposal area.
- (2) A constituent becomes a hazardous constituent subject to paragraph 5B(5) only when the constituent meets all three of the following tests:
 - (a) The constituent is reasonably expected to be in or derived from the uranium and thorium byproduct material in the disposal area;
 - (b) The constituent has been detected in the ground water in the uppermost aquifer; and
 - (c) The constituent is listed in Criterion 13 of this appendix.
- (3) Even when constituents meet all three tests in paragraph 5B(2) of this criterion, the Agency may exclude a detected constituent from the set of hazardous constituents on a site-specific basis if it finds that the constituent is not capable of posing a substantial present or potential hazard to human health or the environment. In deciding whether to exclude constituents, the Agency will consider the following:
 - (a) Potential adverse effects on ground water quality, considering:
 - (i) The physical and chemical characteristics of the waste in the licensed site, including its potential for migration;
 - (ii) The hydrogeological characteristics of the facility and surrounding land;
 - (iii) The quantity of ground water and the direction of ground water flow;
 - (iv) The proximity and withdrawal rates of ground water users;
 - (v) The current and future uses of ground water in the area;
 - (vi) The existing quality of ground water, including other sources of contamination and their cumulative impact on the ground water quality;

- (vii) The potential for health risks caused by human exposure to waste constituents;
 - (viii) The potential damage to wildlife, crops, vegetation, and physical structures caused by exposure to waste constituents;
 - (ix) The persistence and permanence of the potential adverse effects.
- (b) Potential adverse effects on hydraulically-connected surface water quality, considering
- (i) The volume and physical and chemical characteristics of the waste in the licensed site;
 - (ii) The hydrogeological characteristics of the facility and surrounding land;
 - (iii) The quantity and quality of ground water and the direction of ground water flow;
 - (iv) The patterns of rainfall in the region;
 - (v) The proximity of the licensed site to surface waters;
 - (vi) The current and future uses of surface waters in the area and any water quality standards established for those surface waters;
 - (vii) The existing quality of surface water, including other sources of contamination and the cumulative impact on surface water quality;
 - (viii) The potential for health risks caused by human exposure to waste constituents;
 - (ix) The potential damage to wildlife, crops, vegetation, and physical structures caused by exposure to waste constituents; and
 - (x) The persistence and permanence of the potential adverse effects.
- (4) In making any determinations under paragraphs 5B(3) and 5B(6) of this criterion about the use of ground water in the area around the facility, the Agency will consider any identification of underground sources of drinking water and exempted aquifers made by the agency having jurisdiction.
- (5) At the point of compliance, the concentration of a hazardous constituent must not exceed:
- (a) The Agency-approved background concentration of that constituent in the ground water;
 - (b) The respective value given in the table in paragraph 5C if the constituent is listed in the table and if the background level of the constituent is below the value listed; or

- (c) An alternate concentration limit established by the Agency.
- (6) Conceptually, background concentrations pose no incremental hazards and the drinking water limits in Criterion 5C state acceptable hazards but these two options may not be practically achievable at a specific site. Alternate concentration limits that present no significant hazard may be proposed by licensees for Agency consideration. Licensees must provide the basis for any proposed limits including consideration of practicable corrective actions, that limits are as low as reasonably achievable, and information on the factors the Agency must consider. The Agency will establish a site-specific alternate concentration limit for a hazardous constituent as provided in paragraph 5B(5) of this criterion if it finds that the proposed limit is as low as reasonably achievable after considering practicable corrective actions, and that the constituent will not pose a substantial present or potential hazard to human health or the environment as long as the alternate concentration limit is not exceeded. In making the present and potential hazard finding, the Agency will consider the following factors:
- (a) Potential adverse effects on ground water quality, considering:
- (i) The physical and chemical characteristics of the waste in the licensed site including its potential for migration;
 - (ii) The hydrogeological characteristics of the facility and surrounding land;
 - (iii) The quantity of ground water and the direction of ground water flow;
 - (iv) The proximity and withdrawal rates of ground water users;
 - (v) The current and future uses of ground water in the area;
 - (vi) The existing quality of ground water, including other sources of contamination and their cumulative impact on the ground water quality;
 - (vii) The potential for health risks caused by human exposure to waste constituents;
 - (viii) The potential damage to wildlife, crops, vegetation, and physical structures caused by exposure to waste constituents;
 - (ix) The persistence and permanence of the potential adverse effects.
- (b) Potential adverse effects on hydraulically-connected surface water quality, considering:
- (i) The volume and physical and chemical characteristics of the waste in the licensed site;
 - (ii) The hydrogeological characteristics of the facility and surrounding land;
 - (iii) The quantity and quality of ground water, and the direction of ground water flow;

- (iv) The patterns of rainfall in the region;
- (v) The proximity of the licensed site to surface waters;
- (vi) The current and future uses of surface waters in the area and any water quality standards established for those surface waters;
- (vii) The existing quality of surface water including other sources of contamination and the cumulative impact on surface water quality;
- (viii) The potential for health risks caused by human exposure to waste constituents;
- (ix) The potential damage to wildlife, crops, vegetation, and physical structures caused by exposure to waste constituents; and
- (x) The persistence and permanence of the potential adverse effects.

Criterion 5C. MAXIMUM VALUES FOR GROUND WATER PROTECTION

<u>Constituent or property</u>	<u>Maximum Concentration</u> Milligrams per liter:
Arsenic	0.05
Barium	1.0
Cadmium	0.01
Chromium	0.05
Lead	0.05
Mercury	0.002
Selenium	0.01
Silver	0.05
Endrin (1,2,3,4,10,10-hexachloro-1,7-epoxy-1,4,4a,5,6,7,8,9a-octahydro-1,4-endo, endo-5,8-dimethano naphthalene)	0.0002
Lindane (1,2,3,4,5,6-hexachloro- cyclohexane, gamma isomer)	0.004
Methoxychlor (1,1,1-Trichloro-2,2-bis,p-methoxyphenylethane)	0.1
Toxaphene (C ₁₀ H ₁₀ Cl ₆ , Technical chlorinated camphene, 67-69)	0.005

percent chlorine)	
2,4-D (2,4-Dichlorophenoxyacetic acid)	0.1
2,4,5-TP Silvex (2,4,5-Trichloro-phenoxypropionic acid)	0.01
	<u>Picocuries per liter:</u>
Combined radium-226 and radium-228	5
Gross alpha-particle activity (excluding radon and uranium when producing uranium byproduct material or radon and thorium when producing thorium byproduct material)	15

Criterion 5D. If the ground water protection standards established under paragraph 5B(1) of this criterion are exceeded at a licensed site, a corrective action program must be put into operation as soon as is practicable, and in no event later than eighteen (18) months after the Agency finds that the standards have been exceeded. The licensee shall submit the proposed corrective action program and supporting rationale for Agency approval prior to putting the program into operation, unless otherwise directed by the Agency. The objective of the program is to return hazardous constituent concentration levels in ground water to the concentration limits set as standards. The licensee's proposed program shall address removing the hazardous constituents that have entered the ground water at the point of compliance or treating them in place. The program shall also address removing or treating in place any hazardous constituents that exceed concentration limits in ground water between the point of compliance and the down-gradient facility property boundary. The licensee shall continue corrective action measures to the extent necessary to achieve and maintain compliance with the ground water protection standard. The Agency will determine when the licensee may terminate corrective action measures based on data from the ground water monitoring program and other information that provide reasonable assurance that the ground water protection standard will not be exceeded.

Criterion 5E. In developing and conducting ground water protection programs, applicants and licensees shall also consider the following:

- (1) Installation of bottom liners (Where synthetic liners are used, a leakage detection system must be installed immediately below the liner to ensure major failures are detected if they occur. This is in addition to the ground water monitoring program conducted as provided in Criterion 7. Where clay liners are proposed or relatively thin, *in situ* clay soils are to be relied upon for seepage control. Tests must be conducted with representative tailings solutions and clay materials to confirm that no significant deterioration of permeability or stability properties will occur with continuous exposure of clay to tailings solutions. Tests must be run for a sufficient period of time to reveal any effects if they are going to occur (in some cases deterioration has been observed to occur rather rapidly after about nine months of exposure)).

- (2) Mill process designs which provide the maximum practicable recycle of solutions and conservation of water to reduce the net input of liquid to the tailings impoundment.
- (3) De-watering of tailings by process devices and/or *in situ* drainage systems (At new sites, tailings must be de-watered by a drainage system installed at the bottom of the impoundment to lower the phreatic surface and reduce the driving head of seepage, unless tests show tailings are not amenable to such a system. Where *in situ* de-watering is to be conducted, the impoundment bottom must be graded to assure that the drains are at a low point. The drains must be protected by suitable filter materials to assure that drains remain free running. The drainage system must also be adequately sized to assure good drainage).
- (4) Neutralization to promote immobilization of hazardous constituents.

Criterion 5F. Where ground water impacts are occurring at an existing site due to seepage, action must be taken to alleviate conditions that lead to excessive seepage impacts and restore ground water quality. The specific seepage control and ground water protection method, or combination of methods, to be used must be worked out on a site-specific basis. Technical specifications must be prepared to control installation of seepage control systems. A quality assurance, testing, and inspection program, which includes supervision by a qualified engineer or scientist, must be established to assure the specifications are met.

Criterion 5G. In support of a tailings disposal system proposal, the applicant/operator shall supply information concerning the following:

- (1) The chemical and radioactive characteristics of the waste solutions.
- (2) The characteristics of the underlying soil and geologic formations particularly as they will control transport of contaminants and solutions. This includes detailed information concerning extent, thickness, uniformity, shape, and orientation of underlying strata. Hydraulic gradients and conductivities of the various formations must be determined. This information must be gathered from borings and field survey methods taken within the proposed impoundment area and in surrounding areas where contaminants might migrate to ground water. The information gathered on bore-holes must include both geological and geophysical logs in sufficient number and degree of sophistication to allow determining significant discontinuities, fractures, and channeled deposits of high hydraulic conductivity. If field survey methods are used, they should be in addition to, and calibrated with, bore-hole logging. Hydrologic parameters such as permeability may not be determined on the basis of laboratory analysis of samples alone; a sufficient amount of field testing (e.g., pump tests) must be conducted to assure actual field properties are adequately understood. Testing must be conducted to allow estimating chemi-sorption attenuation properties of underlying soil and rock.
- (3) Location, extent, quality, capacity and current uses of any ground water at and near the site.

Criterion 5H. Steps must be taken during stockpiling of ore to minimize penetration of radionuclides into underlying soils; suitable methods include lining and/or compaction of ore storage areas.

Criterion 6.

- (1) In disposing of waste byproduct material, licensees shall place an earthen cover (or approved alternative) over tailings or wastes at the end of milling operations and shall close the waste disposal area in accordance with a design^{1/} which provides reasonable assurance of control of radiological hazards to (i) be effective for 1,000 years, to the extent reasonably achievable, and, in any case, for at least 200 years, and (ii) limit releases of radon-222 from uranium byproduct materials, and radon-220 from thorium byproduct materials, to the atmosphere so as not to exceed an average^{2/} release rate of 0.74 becquerel per square meter per second (20 pCi/m²s) to the extent practicable throughout the effective design life determined pursuant to (1)(i) of this criterion. In computing required tailings cover thicknesses, moisture in soils in excess of amounts found normally in similar soils in similar circumstances may not be considered. Direct gamma exposure from the tailings or wastes should be reduced to background levels. The effects of any thin synthetic layer may not be taken into account in determining the calculated radon exhalation level. If non-soil materials are proposed as cover materials, it must be demonstrated that these materials will not crack or degrade by differential settlement, weathering, or other mechanism, over long-term intervals.
- (2) As soon as reasonably achievable after emplacement of the final cover to limit releases of radon-222 from uranium byproduct material and prior to placement of erosion protection barriers or other features necessary for long-term control of the tailings, the licensee shall verify through appropriate testing and analysis that the design and construction of the final radon barrier is effective in limiting releases of radon-222 to a level not exceeding 0.74 becquerel per meter square per second (20 pCi/m²s) averaged over the entire pile or impoundment using the procedures described in 40 CFR Part 61, Appendix B, Method 115, or another method of verification approved by the Agency as being at least as effective in demonstrating the effectiveness of the final radon barrier.
- (3) When phased emplacement of the final radon barrier is included in the applicable reclamation plan, the verification of radon-222 release rates required in paragraph (2) of this Criterion must be conducted for each portion of the pile or impoundment as the final radon barrier for that portion is emplaced.
- (4) Within ninety days of the completion of all testing and analysis relevant to the required verification in paragraphs (2) and (3) of this Criterion, the uranium mill licensee shall report to the Agency the results detailing the actions taken to verify that levels of release of radon-222 do not exceed 0.74 becquerel per meter square per second (20 pCi/m²s) when averaged over the entire pile or impoundment. The licensee shall maintain records until termination of the license documenting the source of input parameters including the results of all measurements on which they are based, the calculations and/or analytical methods used to derive values for input parameters, and the procedure used to determine compliance. These records shall be kept in a form suitable for transfer to the custodial agency at the time of transfer of the site to the U.S. Department of Energy or a state for long-term care if requested.

^{1/} In the case of thorium byproduct materials, the standard applies only to design. Monitoring for radon emissions from thorium byproduct materials after installation of an appropriately designed cover is not required.

^{2/} This average applies to the entire surface of each disposal area over a period of a least one year, but a period short compared to 100 years. Radon will come from both byproduct materials and from covering materials. Radon emissions from covering materials should be estimated as part of developing a closure plan for each site. The standard, however, applies only the emissions from byproduct materials to the atmosphere.

- (5) Near surface cover materials (i.e., within the top three meters) may not include waste or rock that contains elevated levels of radium; soils used for near surface cover must be essentially the same, as far as radioactivity is concerned, as that of surrounding surface soils. This is to ensure that surface radon exhalation is not significantly above background because of the cover material itself.
- (6) The design requirements in this Criterion for longevity and control of radon releases apply to any portion of a licensed and/or disposal site unless such portion contains a concentration of radium in land, averaged over areas of 100 square meters, which as a result of byproduct material, does not exceed the background level by more than: (i) 0.18 becquerel per gram (5 pCi/g) of radium-226, or, in the case of thorium byproduct material, radium-228, averaged over the first 15 centimeters (cm) below the surface, and (ii) 0.56 becquerel per gram (15 pCi/g) of radium-226, or, in the case of thorium byproduct material, radium-228, averaged over 15-cm thick layers more than 15 cm below the surface.

Byproduct material containing concentrations of radionuclides other than radium in soil, and surface activity on remaining structures, must not result in a total effective dose equivalent (TEDE) exceeding the dose from cleanup of radium contaminated soil to the above standard (benchmark dose), and must be at levels which are as low as is reasonably achievable. If more than one residual radionuclide is present in the same 100 square-meter area, the sum of the ratios for each radionuclide of concentration present to the concentration limit will not exceed "1" (unity). A calculation of the potential peak annual TEDE within 1000 years to the average member of the critical group that would result from applying the radium standard (not including radon) on the site must be submitted for approval. The use of decommissioning plans with benchmark doses which exceed 1 millisievert per year (100 mrem/yr), before application of ALARA, requires the approval of the Agency. This requirement for dose criteria does not apply to sites that have decommissioning plans for soil and structures approved before [insert effective date].

- (7) The licensee shall also address the non-radiological hazards associated with the wastes in planning and implementing closure. The licensee shall ensure that disposal areas are closed in a manner that minimizes the need for further maintenance. To the extent necessary to prevent threats to human health and the environment, the licensee shall control, minimize, or eliminate post-closure escape of non-radiological hazardous constituents, leachate, contaminated rainwater, or waste decomposition products to the ground or surface waters or to the atmosphere.

Criterion 6A.

- (1) For impoundments containing uranium byproduct materials, the final radon barrier must be completed as expeditiously as practicable considering technological feasibility after the pile or impoundment ceases operation in accordance with a written, Agency-approved reclamation plan. (The term as expeditiously as practicable considering technological feasibility as specifically defined in U.3 includes factors beyond the control of the licensee). Deadlines for completion of the final radon barrier and, if applicable, the following interim milestones must be established as a condition of the individual license: windblown tailings retrieval and placement on the pile and interim stabilization including dewatering or the removal of freestanding liquids and recontouring. The placement of erosion protection barriers or other feature necessary for long-term control of the tailings must also be

completed in a timely manner in accordance with a written, Agency-approved reclamation plan.

- (2) The Agency may approve a licensee's request to extend the time for performance of milestones related to emplacement of the final radon barrier if, after providing an opportunity for public participation, the Agency finds that the licensee has adequately demonstrated in the manner required in paragraph (2) of Criterion 6 that releases of radon-222 do not exceed an average of 0.74 becquerel per meter square per second (20 pCi/m²s). If the delay is approved on the basis that the radon releases do not exceed 0.74 becquerel per meter square per second (20 pCi/m²s), a verification of radon levels, as required by paragraph (2) of Criterion 6, must be made annually during the period of delay. In addition, once the Agency has established the date in the reclamation plan for the milestone for completion of the final radon barrier, the Agency may extend that date based on cost if after providing an opportunity for public participation, the Agency finds that the licensee is making good faith efforts to emplace the final radon barrier, the delay is consistent with the definition of available technology, and the radon releases caused by the delay will not result in a significant incremental risk to the public health.
- (3) The Agency may authorize by license amendment, upon licensee ~~report~~request, a portion of the impoundment to accept uranium byproduct material or such materials that are similar in physical, chemical, and radiological characteristics to the uranium mill tailings and associated wastes already in the pile or impoundment from other sources, during the closure process. No such authorization will be made if it results in a delay or impediment to emplacement of the final radon barrier over the remainder of the impoundment in a manner that will achieve levels of radon-222 releases not exceeding 0.74 becquerel per meter square per second (20 pCi/m²s) averaged over the entire impoundment. The verification required in paragraph (2) of Criterion 6 may be completed with a portion of the impoundment being used for further disposal if the Agency makes a final finding that the impoundment will continue to achieve a level of radon-222 release not exceeding 0.74 becquerel per meter square per second (20 pCi/m²s) averaged over the entire impoundment. In this case, after the final radon barrier is complete except for the continuing disposal area, (a) only byproduct material will be authorized for disposal, (b) the disposal will be limited to the specified existing disposal area, and (c) this authorization will only be made after providing opportunity for public participation. Reclamation of the disposal area, as appropriate, must be completed in a timely manner after disposal operations cease in accordance with paragraph (1) of Criterion 6; however, these actions are not required to be complete as part of meeting the deadline for final radon barrier construction.

Criterion 7. The licensee shall establish a detection monitoring program needed for the Agency to set the site-specific ground water protection standards in paragraph 5B(1) of this appendix. For all monitoring under this paragraph, the licensee or applicant will propose for Agency approval as license conditions which constituents are to be monitored on a site-specific basis. A detection monitoring program has two purposes. The initial purpose of the program is to detect leakage of hazardous constituents from the disposal area so that the need to set ground water protection standards is monitored. If leakage is detected, the second purpose of the program is to generate data and information needed for the Agency to establish the standards under Criterion 5B. The data and information must provide a sufficient basis to identify those hazardous constituents which require concentration limit standards and to enable the Agency to set the limits for those constituents and the compliance period. They may also need to provide the basis for adjustments to the point of

compliance. The detection monitoring programs must be in place when specified by the Agency in orders or license conditions. Once ground water protection standards have been established pursuant to paragraph 5B(1), the licensee shall establish and implement a compliance monitoring program. The purpose of the compliance monitoring program is to determine that the hazardous constituent concentrations in ground water continue to comply with the standards set by the Agency. In conjunction with a corrective action program, the licensee shall establish and implement a corrective action monitoring program. The purpose of the corrective action monitoring program is to demonstrate the effectiveness of the corrective actions. Any monitoring program required by this paragraph may be based on existing monitoring programs to the extent the existing programs can meet the stated objective for the program.

Criterion 8. Milling operations must be conducted so that all airborne effluent releases are reduced to levels as low as is reasonably achievable. The primary means of accomplishing this must be by means of emission controls. Institutional controls, such as extending the site boundary and exclusion area, may be employed to ensure that offsite exposure limits are met, but only after all practicable measures have been taken to control emissions at the source. Notwithstanding the existence of individual dose standards, strict control of emissions is necessary to assure that population exposures are reduced to the maximum extent reasonably achievable and to avoid site contamination. The greatest potential sources of offsite radiation exposure (aside from radon exposure) are dusting from dry surfaces of the tailings disposal area not covered by tailings solution and emissions from yellowcake drying and packaging operations. During operations and prior to closure, radiation doses from radon emissions from surface impoundments of uranium or thorium byproduct materials must be kept as low as is reasonably achievable.

Checks must be made and logged hourly for all parameters (e.g., differential pressures and scrubber water flow rates) that determine the efficiency of yellowcake stack emission control equipment operation. The licensee shall retain each log as a record for three years after the last entry in the log is made. It must be determined whether or not conditions are within a range prescribed to ensure that the equipment is operating consistently near peak efficiency; corrective action must be taken when performance is outside of prescribed ranges. Effluent control devices must be operative at all times during drying and packaging operations and whenever air is exhausting from the yellowcake stack. Drying and packaging operations must terminate when controls are inoperative. When checks indicate the equipment is not operating within the range prescribed for peak efficiency, actions must be taken to restore parameters to the prescribed range. When this cannot be done without shutdown and repairs, drying and packaging operations must cease as soon as practicable. Operations may not be restarted after cessation due to off-normal performance until needed corrective actions have been identified and implemented. All these cessations, corrective actions, and restarts must be reported to the Agency as indicated in Criterion 8A, in writing, within ten days of the subsequent restart.

To control dusting from tailings, that portion not covered by standing liquids must be wetted or chemically stabilized to prevent or minimize blowing and dusting to the maximum extent reasonably achievable. This requirement may be relaxed if tailings are effectively sheltered from wind, such as may be the case where they are disposed of below grade and the tailings surface is not exposed to wind. Consideration must be given in planning tailings disposal programs to methods which would allow phased covering and reclamation of tailings impoundments because this will help in controlling particulate and radon emissions during operation. To control dusting from diffuse sources, such as tailings and ore pads where automatic controls do not apply, operators shall develop written operating procedures specifying the methods of control which will be utilized.

Milling operations producing or involving uranium and thorium byproduct materials must be conducted in such a manner as to provide reasonable assurance that the annual dose equivalent does not exceed 0.25 millisievert (25 mrem) to the whole body, 0.75 millisievert (75 mrem) to the thyroid, and 0.25 millisievert (25 mrem) to any other organ of any member of the public as a result of exposures to the planned discharge of radioactive material, radon and its progeny excepted, to the general environment.

Uranium and thorium byproduct materials must be managed so as to conform to the applicable provisions of Title 40 of the Code of Federal Regulations, Part 440, "Ore Mining and Dressing Point Source Category: Effluent Limitations Guidelines and New Source Performance Standards, Subpart C, Uranium, Radium, and Vanadium Ores Subcategory", as codified on January 1, 1983.

Criterion 8A. Inspections of tailings or waste retention systems must be conducted daily during operations, or at an alternate frequency approved by the Agency for other conditions. Such inspections shall be conducted by, or under the supervision of, a qualified engineer or scientist, and documented. The licensee shall retain the documentation for each inspection as a record for three years after the documentation is made. The Agency must be immediately notified of any failure in a tailings or waste retention system that results in a release of tailings or waste into unrestricted areas, or any unusual conditions (conditions not contemplated in the design of the retention system) that if not corrected could indicate the potential or lead to failure of the system and result in a release of tailings or waste into unrestricted areas.

Criterion 9 Financial surety arrangements must be established by each mill operator prior to the commencement of operations to assure that sufficient funds will be available to carry out the decontamination and decommissioning of the mill and site and for the reclamation of any tailings or waste disposal areas. The amount of funds to be ensured by such surety arrangements must be based on Agency-approved cost estimates in an Agency-approved plan for (1) decontamination and decommissioning of mill buildings and the milling site to levels which allow unrestricted use of these areas upon decommissioning, and (2) the reclamation of tailings and/or waste areas in accordance with technical criteria delineated in this Appendix. The licensee shall submit this plan in conjunction with an environmental report that addresses the expected environmental impacts of the milling operation, decommissioning and tailings reclamation, and evaluates alternatives for mitigating these impacts. The surety must also cover the payment of the charge for long-term surveillance and control required by Criterion 10. In establishing specific surety arrangements the licensee's cost estimates must take into account total costs that would be incurred if an independent contractor were hired to perform the decommissioning and reclamation work. In order to avoid unnecessary duplication and expense, the Agency may accept financial sureties that have been consolidated with financial or surety arrangements established to meet requirements of other Federal or state agencies and/or local governing bodies for such decommissioning, decontamination, reclamation, and long-term site surveillance and control, provided such arrangements are considered adequate to satisfy these requirements and that the portion of the surety which covers the decommissioning and reclamation of the mill, mill tailings site and associated areas, and the long-term funding charge is clearly identified and committed for use in accomplishing these activities. The licensee's surety mechanism will be reviewed annually by the Agency to assure that sufficient funds would be available for completion of the reclamation plan if the work had to be performed by an independent contractor. The amount of surety liability should be adjusted to recognize any increases or decreases resulting from inflation, changes in engineering plans, activities performed, and any other conditions affecting costs. Regardless of whether reclamation is phased through the

life of the operation or takes place at the end of operations, an appropriate portion of surety liability must be retained until final compliance with the reclamation plan is determined.

This will yield a surety that is at least sufficient at all times to cover the costs of decommissioning and reclamation of the areas that are expected to be disturbed before the next license renewal. The term of the surety mechanism must be open ended, unless it can be demonstrated that another arrangement would provide an equal level of assurance. This assurance would be provided with a surety instrument which is written for a specified period of time (e.g. 5 years) yet which must be automatically renewed unless the surety notifies the beneficiary (the Agency) and the principal (the licensee) some reasonable time (e.g. 90 days) prior to the renewal date of their intention not to renew. In such a situation the surety requirement still exists and the licensee would be required to submit an acceptable replacement surety within a brief period of time to allow at least 60 days for the Agency to collect.

Proof of forfeiture must not be necessary to collect the surety so that in the event that the licensee could not provide an acceptable replacement surety within the required time, the surety shall be automatically collected prior to its expiration. The conditions described above would have to be clearly stated on any surety instrument which is not open-ended, and must be agreed to by all parties. Financial surety arrangements generally acceptable to the Agency are:

- (1) Surety bonds;
- (2) Cash deposits;
- (3) Certificates of deposits;
- (4) Deposits of government securities;
- (5) Irrevocable letters or lines of credit; and
- (6) Combinations of the above or such other types of arrangements as may be approved by the Agency. However, self insurance, or any arrangement which essentially constitutes self insurance will not satisfy the surety requirement since this provides no additional assurance other than that which already exists through licensing requirements.

[A licensee who uses either a surety bond guaranteeing payment or performance, or a letter of credit must establish a standby trust. Under the terms of the mechanism, all payments made thereunder will be deposited by the issuer directly into the standby trust fund in accordance with instructions from the Director of the Agency.

Criterion 10 A minimum charge of \$250,000 (1978 dollars) to cover the costs of long-term surveillance shall be paid by each mill operator to the general treasury of the United States or to an appropriate State agency prior to the termination of a uranium or thorium mill license.

If site surveillance or control requirements at a particular site are determined, on the basis of a site specific evaluation, to require funding significantly greater than specified in this Criteria (e.g., if fencing is determined to be necessary), variance in funding requirements may be specified by the Agency. The total charge to cover the costs of long-term surveillance shall be such that, with an assumed one percent annual real interest rate, the collected funds will yield interest in an amount

sufficient to cover the annual costs of site surveillance. The charge will be adjusted annually prior to actual payments to recognize inflation. The inflation rate to be used is that indicated by the change in the consumer price index published by the United States Department of Labor, Bureau of Labor Statistics.

Criterion 11.

Criterion 11A. These criteria relating to ownership of tailings and their disposal sites became effective on November 8, 1981, and apply to all licenses terminated, issued, or renewed after that date.

Criterion 11B. Any uranium or thorium milling license or tailings license must contain such terms and conditions as the U.S. Nuclear Regulatory Commission and Agency determine necessary to assure that prior to termination of the license, the licensee will comply with ownership requirements of this criterion for sites used for tailings disposal.

Criterion 11C. Title to the byproduct material licensed under this Part U and land, including any interests therein (other than land owned by the United States or by a State), which is used for the disposal of any such byproduct material, or is essential to ensure the long-term stability of such disposal site, must be transferred to the United States or the State in which such land is located, at the option of such State. In view of the fact that physical isolation must be the primary means of long-term control, and Government land ownership is a desirable supplementary measure, ownership of certain severable subsurface interests (for example, mineral rights) may be determined to be unnecessary to protect the public health and safety and the environment. In any case, however, the applicant/operator must demonstrate a serious effort to obtain such subsurface rights, and must in the event that certain rights cannot be obtained, provide notification in local public land records of the fact that the land is being used for the disposal of radioactive material and is subject to either a U.S. Nuclear Regulatory Commission general or specific license prohibiting the disruption and disturbance of the tailings. In some rare cases, such as may occur with deep burial where no ongoing site surveillance will be required, surface land ownership transfer requirements may be waived with the approval of the U.S. Nuclear Regulatory Commission. For licenses issued before November 8, 1981, the U.S. Nuclear Regulatory Commission may take into account the status of the ownership of such land, and interests therein, and the ability of a licensee to transfer title and custody thereof to the United States or a State.

Criterion 11D. If the U.S. Nuclear Regulatory Commission, subsequent to title transfer determines that use of the surface or subsurface estates, or both, of the land transferred to the United States or to a State will not endanger the public health, safety, welfare, or environment, the U.S. Nuclear Regulatory Commission, may permit the use of the surface or subsurface estates, or both, of such and in a manner consistent with the provisions provided in these criteria. If the U.S. Nuclear Regulatory Commission, permits such use of such land, it will provide the person who transferred such land with the right of first refusal with respect to such use of such land.

Criterion 11E. Material and land transferred to the United States or the State in accordance with this Criterion must be transferred to the United States or the State without cost other than administrative or legal costs incurred in carrying out such transfer.

Criterion 11F. The provisions of this Part respecting transfer of title and custody to land and tailings and wastes do not apply in the case of lands held in trust by the United States for any Indian tribe or

lands owned by such Indian tribe subject to a restriction against alienation imposed by the United States. In the case of such lands which are used for the disposal of uranium or thorium byproduct material the licensee shall enter into arrangements with the U.S. Nuclear Regulatory Commission as may be appropriate to assure the long-term surveillance of such lands by the United States.

Criterion 12 Reserved

Criterion 13. Secondary ground water protection standards required by Criterion 5 of this Appendix are concentration limits for individual hazardous constituents. The following list of constituents identifies the constituents for which standards must be set and complied with if the specific constituent is reasonably expected to be in or derived from the byproduct material and has been detected in ground water. For purposes of this Appendix, the property of gross alpha activity will be treated as if it is a hazardous constituent. Thus, when setting standards under paragraph 5B(5) of Criterion 5, the Agency will also set a limit for gross alpha activity. The Agency does not consider the following list imposed by 40 CFR Part 192 to be exhaustive and may determine other constituents to be hazardous on a case-by-case basis, independent of those specified by the U.S. Environmental Protection Agency in Part 192.

APPENDIX A

HAZARDOUS CONSTITUENTS

- Acetonitrile (Ethanenitrile)
- Acetophenone (Ethanone, 1-phenyl)
- 3-(alpha-Acetylbenzyl)-4-hydroxycoumarin and salts (Warfarin)
- 2-Acetylaminofluorene (Acetamide, N-(9H-fluoren-2-yl)-)
- Acetyl chloride (Ethanoyl chloride)
- 1-Acetyl-2-thiourea (Acetamide, N-(aminothioxomethyl)-)
- Acrolein (2-Propenal)
- Acrylamide (2-Propenamide)
- Acrylonitrile (2-Propenenitrile)
- Aflatoxins
- Aldrin (1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a,8b-hexahydro-endo,exo-1,4:5,8-Dimethanonaphthalene)
- Allyl alcohol (2-Propen-1-ol)
- Aluminum phosphide
- 4-Aminobiphenyl ([1,1'-Biphenyl]-4-amine)
- 6-Amino-1,1a,2,8,8a,8b-hexahydro-8-(hydroxymethyl)-8a-methoxy-5-methyl-carbamate azirino [2',3'3,4] pyrrolo [1,2-a]indole-4,7-dione,(ester) (Mitomycin C) (Azirino[2'3'3,4]pyrrolo(1,2-a)indole-4,7-dione,6-amino-8-(((amino-carbonyl)oxy)methyl) - 1,1a,2,8,8a,8b-hexa-hydro-8a methoxy-5-methyl-)
- 5-(Aminomethyl)-3-isoxazolone (3(2H)-Isoxazolone, 5-(aminomethyl)-) 4-Aminopyridine (4-Pyridinamine)
- Amitrole (1H-1,2,4-Triazol-3-amine)
- Aniline (Benzenamine)
- Antimony and compounds, N.O.S.^{3/}
- Aramite (Sulfurous acid, 2-chloroethyl-,2- [4-(1,1-dimethylethyl)phenoxy] -1-methylethyl ester)
- Arsenic and compounds, N.O.S.
- Arsenic acid (Orthoarsenic acid)
- Arsenic pentoxide (Arsenic (V) oxide)
- Arsenic trioxide (Arsenic (III) oxide)
- Auramine (Benzenamine,4,4' -

^{3/} The abbreviation N.O.S. (not otherwise specified) signifies those members of the general class not specifically listed by name in this list

- Carbonimidoylbis[N,N-Dimethyl-,
monohydrochloride)
- Azaserine (L-Serine, diazoacetate (ester))
- Barium and compounds, N.O.S.
- Barium cyanide
- Benz [c]acridine (3,4-Benzacridine)
- Benz[a]anthracene (1,2-Benzanthracene)
- Benzene (Cyclohexatriene)
- Benzenearsonic acid (Arsonic acid, phenyl-)
- Benzene, dichloromethyl- (Benzal chloride)
- Benzenethiol (Thiophenol)
- Benzidine ([1,1'-Biphenyl]-4,4' diamine)
- Benzo[b]fluoranthene (2,3-
Benzofluoranthene)
- Benzo[j]fluoranthene (7,8-Benzofluoranthene)
- Benzo([a]pyrene (3,4-Benzopyrene)
- p-Benzoquinone (1,4-Cyclohexadienedione)
- Benzotrichloride (Benzene, Trichloromethyl)
- Benzyl chloride (Benzene, (chloromethyl)-)
- Beryllium and compounds, N.O.S.
- Bis(2-chloroethoxy)methane (Ethane, 1,1'-
[methylenebis(oxy)]bis[2-chloro-])
- Bis(2-chloroethyl) ether (Ethane, 1,1'-
oxybis [2-chloro-])
- N,N-Bis(2-chloroethyl)-2-naphthylamine
(Chlornaphazine)
- Bis(2-Chloroisopropyl) ether (Propane, 2,2'-
oxybis[2-chloro-])
- Bis(chloromethyl) ether (methane,
oxybis[chloro-])
- Bis(2-ethylhexyl) phthalate (1,2-
Benzenedicarboxylic acid, bis(2-
ethylhexyl) ester)
- Bromoacetone (2-Propanone, 1-bromo-)
- Bromomethane (Methyl bromide)
- 4-Bromophenyl phenyl ether (Benzene, 1-
bromo-4-phenoxy-)
- Brucine (Strychnidin-10-one, 2,3-dimethoxy-)
- 2-Butanone peroxide (Methyl ethyl ketone,
peroxide)
- Butyl benzyl phthalate (1,2-
Benzenedicarboxylic acid, butyl
phenylmethyl ester)
- 2-sec-Butyl-4,6-dinitrophenol (DNBP) (Phenol,
2,4-dinitro-6-(1-methylpropyl)-)
- Cadmium and compounds, N.O.S.
- Calcium chromate (Chromic acid, calcium salt)
- Calcium cyanide
- Carbon disulfide (Carbon bisulfide)

- Carbon oxyfluoride (Carbonyl fluoride)
- Chloral (Acetaldehyde, trichloro-)
- Chlorambucil (Butanoic acid, 4-([bis(2-chloroethyl)amino])benzene-)
- Chlordane (alpha and gamma isomers) 4,7-Methanoindan, 1,2,4,5,6,7,8,8-octachloro-3,4,7,7a-tetrahydro-) (alpha and gamma isomers)
- Chlorinated benzenes, N.O.S.
- Chlorinated ethane, N.O.S.
- Chlorinated fluorocarbons, N.O.S.
- Chlorinated naphthalene, N.O.S.
- Chlorinated phenol, N.O.S.
- Chloroacetaldehyde (Acetaldehyde, chloro-)
- Chloroalkyl ethers N.O.S.
- p-Chloroaniline (Benzenamine, 4-chloro-)
- Chlorobenzene (Benzene, chloro-)
- Chlorobenzilate (Benzeneacetic acid, 4-chloro-alpha-(4-chlorophenyl)-alpha-hydroxy-,ethyl ester)
- p-Chloro-m-cresol (Phenol, 4-chloro-3-methyl)
- 1-Chloro-2,3-epoxypropane (Oxirane, 2-(chloromethyl)-)
- 2-Chloroethyl vinyl ether (Ethene, (2-chloroethoxy)-)
- Chloroform (Methane, trichloro-)
- Chloromethane (Methyl chloride)
- Chloromethyl methyl ether (Methane, chloromethoxy-)
- 2-Chloronaphthalene (Naphthalene, betachloro-)
- 2-Chlorophenol (Phenol, o-chloro-)
- 1-(o-Chlorophenyl)thiourea (Thiourea, (2-chlorophenyl)-)
- 3-Chloropropionitrile (Propanenitrile, 3-chloro-)
- Chromium and compounds, N.O.S.
- Chrysene (1,2-Benzphenanthrene)
- Citrus red No. 2 (2-Naphthol, 1-[(2,5-dimethoxyphenyl)azo] -)
- Coal tars
- Copper cyanide
- Creosote (Creosote, wood)
- Cresols (Cresylic acid) (Phenol, methyl-)
- Crotonaldehyde (2-Butenal)
- Cyanides (soluble salts and complexes), N.O.S.
- Cyanogen (Ethanedinitrile)

- Cyanogen bromide (Bromine cyanide)
- Cyanogen chloride (Chlorine cyanide)
- Cycasin (beta-D-Glucopyranoside, (methyl-ONN-azoxy)methyl-)
- 2-Cyclohexyl-4,6-dinitrophenol (Phenol, 2-cyclohexyl-4,6-dinitro-)
- Cyclophosphamide (2H-1,3,2-Oxazaphosphorine, [bis(2-chloroethyl)amino] -tetrahydro-,2-oxide)
- Daunomycin (5,12-Naphthacenedione, (8S-cis)-8-acetyl-10-[(3-amino-2,3,6-trideoxy)-alpha-L-lyxo-hexopyranosyl)oxy]- 7,8,9,10-tetrahydro-6,8,11-trihydroxy-1-methoxy-)
- DDD (Dichlorodiphenyldichloroethane) (Ethane, 1,1-dichloro-2,2-bis(p-chlorophenyl)-)
- DDE (Ethylene, 1,1-dichloro-2,2-bis(4-chlorophenyl)-)
- DDT (Dichlorodiphenyltrichloroethane) (Ethane, 1,1,1-trichloro-2,2-bis (p-chlorophenyl)-)
- Diallylate (S-(2,3-dichloroallyl) Diisopropylthiocarbamate)
- Dibenz[a,h]acridine (1,2,5,6-Dibenzacridine)
- Dibenz[a,j]acridine (1,2,7,8-Dibenzacridine)
- Dibenz[a,h]anthracene (1,2,5,6-Dibenzanthracene)
- 7H-Dibenzo[c,g]carbazole (3,4,5,6-Dibenzcarbazole)
- Dibenzo[a,e]pyrene(1,2,4,5-Dibenzpyrene)
- Dibenzo[a,h]pyrene(1,2,5,6-Dibenzpyrene)
- Dibenzo[a,i]pyrene(1,2,7,8-Dibenzpyrene)
- 1,2-Dibromo-3-chloropropane (Propane, 1,2-dibromo-3-chloro-)
- 1,2-Dibromoethane (Ethylene dibromide)
- Dibromomethane (Methylene bromide)
- Di-n-butyl phthalate (1,2-Benzenedicarboxylic acid, dibutyl ester)
- o-Dichlorobenzene (Benzene, 1,2-dichloro-)
- m-Dichlorobenzene (Benzene, 1,3-dichloro-)
- p-Dichlorobenzene (Benzene, 1,4-dichloro-)
- Dichlorobenzene, N.O.S. (Benzene, dichloro-, N.O.S.)
- 3,3'-Dichlorobenzidine ([1,1' Biphenyl]-4,4'-diamine, 3,3'-dichloro-)
- 1,4-Dichloro-2-butene (2-Butene, 1,4-dichloro-)
- Dichlorodifluoromethane (Methane, dichlorodifluoro-)
- 1,1 Dichloroethane (Ethylidene dichloride)

- 1,2 Dichloroethane (Ethylene dichloride)
- trans-1,2-Dichloroethene (1,2-Dichloroethylene)
- Dichloroethylene, N.O.S. (Ethene, dichloro-, N.O.S.)
- 1,1-Dichloroethylene (Ethene, 1,1-dichloro-)
- Dichloromethane (Methylene chloride)
- 2,4-Dichlorophenol (Phenol, 2,4-dichloro-)
- 2,6-Dichlorophenol (Phenol, 2,6-dichloro-)
- 2,4-Dichlorophenoxyacetic acid (2,4-D), salts and esters (Acetic acid, 2,4-dichlorophenoxy-, salts and esters)
- Dichlorophenylarsine (Phenyl dichloroarsine)
- Dichloropropane, N.O.S. (Propane, dichloro-N.O.S.)
- 1,2-Dichloropropane (Propylene dichloride)
- Dichloropropanol, N.O.S. (Propanol, dichloro-N.O.S.)
- Dichloropropene, N.O.S. (Propene, dichloro-N.O.S.)
- 1,3-Dichloropropene (1-Propene, 1,3-dichloro-)
- Dieldin (1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octa-hydro-endo,exo-1,4:5,8-Dimethanonaphthalene)
- 1,2:3,4-Diepoxybutane (2,2' -Bioxirane)
- Diethylarsine (Arsine, diethyl-)
- N,N-Diethylhydrazine (Hydrazine, 1,2-diethyl)
- O,O-Diethyl S-methyl ester of phosphorodithioic acid (Phosphorodithioic acid, O,O-diethyl S-methyl ester)
- O,O-Diethylphosphoric acid, O-p-nitrophenyl ester (Phosphoric acid, diethyl p-nitrophenyl ester)
- Diethyl phthalate (1,2-Benzenedicarboxylic acid, diethyl ester)
- O,O-Diethyl O-2-pyrazinyl phosphorothioate (Phosphorothioic acid, O,O-diethyl O-pyrazinyl ester)
- Diethylstilbesterol (4,4'-Stilbenediol, alpha, alpha-diethyl, bis(dihydrogen phosphate, (E)-)
- Dihydrosafrole (Benzene, 1,2-methylenedioxy-4-propyl-)
- 3,4-Dihydroxy-alpha-(methylamino)methyl benzyl alcohol (1,2-Benzenediol, 4-[1-hydroxy-2 (methylamino)ethyl])
- Dilsopropylfluorophosphate (DFP) (Phosphorofluoridic acid, bis(1-

- methylethyl) ester)
- Dimethoate (Phosphorodithioic acid, O,O-dimethyl S-[2-(methylamino)-2-oxoethyl] ester)
- 3,3'-Dimethoxybenzidine ([1,1',-Biphenyl] -4,4'-diamine, 3-3',-dimethoxy-)
- p-Dimethylaminoazobenzene (Benzenamine, N,N-dimethyl-4-(phenylazo)-)
- 7,12-Dimethylbenz[a]anthracene (1,2-Benzanthracene, 7,12-dimethyl-)
- 3,3'-Dimethylbenzidine ([1,1-Biphenyl] -4,4'-diamine, 3,3'-dimethyl-)
- Dimethylcarbamoyl chloride (Carbamoyl chloride, dimethyl-)
- 1,1 Dimethylhydrazine (Hydrazine, 1,1-dimethyl-)
- 1,2-Dimethylhydrazine (Hydrazine, 1,2-dimethyl-)
- 3,3-Dimethyl-1-(methylthio)-2-butanone, O-[(methylamino) carbonyl] oxime (Thiofanox)
- alpha,alpha-Dimethylphenethylamine (Ethanamine, 1,1-dimethyl-2-phenyl-)
- 2,4-Dimethylphenol (Phenol, 2,4-dimethyl-)
- Dimethyl phthalate (1,2-Benzenedicarboxylic acid, dimethyl ester)
- Dimethyl sulfate (Sulfuric acid, dimethyl ester)
- Dinitrobenzene, N.O.S. (Benzene, dinitro-N.O.S.)
- 4,6-Dinitro-o-cresol and salts (Phenol, 2,4-dinitro-6-methyl-, and salts)
- 2,4-Dinitrophenol (Phenol, 2,4-dinitro-)
- 2,4-Dinitrotoluene (Benzene, 1-methyl-2,4-dinitro-)
- 2,6-Dinitrotoluene (Benzene, 1-methyl 2,6-dinitro-)
- Di-n-octyl phthalate (1,2-Benzenedicarboxylic acid, dioctyl ester)
- 1,4-Dioxane (1,4-Diethylene oxide)
- Diphenylamine (Benzenamine, N-phenyl-)
- 1,2-Diphenylhydrazine (Hydrazine, 1,2-diphenyl-)
- Di-n-propylnitrosamine (N-Nitroso-di-n-propylamine)
- Disulfoton (O,O-diethyl S-[2-(ethylthio)ethyl] phosphorodithioate)
- 2,4-Dithiobiuret (Thiomidodicarbonic diamide)

- Endosulfan (5-Norbornene, 2,3-dimethanol, 1,4,5,6,7,7-hexachloro-cyclic sulfite)
- Endrin and metabolites (1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-endo, endo-1,4,5,8-dimethanonaphthalene, and metabolites)
- Ethyl carbamate (Urethan) (Carbamic acid, ethyl ester)
- Ethyl cyanide (propanenitrile)
- Ethylenebisdithiocarbamic acid, salts, and esters (1,2-Ethanediy-biscarbamodithioic acid, salts and esters)
- Ethyleneimine (Aziridine)
- Ethylene oxide (Oxirane)
- Ethylenethiourea (2-Imidazolidinethione)
- Ethyl methacrylate (2-Propenoic acid, 2-methyl-, ethyl ester)
- Ethyl methanesulfonate (Methanesulfonic acid, ethyl ester)
- Fluoranthene (Benzo[j,k]fluorene)
- Fluorine
- 2-Fluoroacetamide (Acetamide, 2-fluoro-)
- Fluoroacetic acid, sodium salt (Acetic acid, fluoro-sodium salt)
- Formaldehyde (Methylene oxide)
- Formic acid (Methanoic acid)
- Glycidylaldehyde (1-Propanol-2,3 epoxy)
- Halomethane, N.O.S.
- Heptachlor (4,7-Methano-1H-indene, 1,4,5,6,7,8,8-heptachloro-3a,4,7,7a-tetrahydro-)
- Heptachlor epoxide (alpha, beta, and gamma isomers) (4,7-Methano-1H-indene, 1,4,5,6,7,8,8-heptachloro-2,3-epoxy-3a,4,7,7-tetrahydro-,alpha, beta, and gamma isomers)
- Hexachlorobenzene (Benzene, hexachloro-)
- Hexachlorobutadiene (1,3-Butadiene, 1,1,2,3,4,4-hexachloro-)
- Hexachlorocyclohexane (all isomers) (Lindane and isomers)
- Hexachlorocyclopentadiene (1,3-Cyclopentadiene, 1,2,3,4,5,5-hexachloro-)
- Hexachloroethane (Ethane, 1,1,1,2,2,2-hexachloro-)
- 1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a-hexahydro-1,4,5,8-endo,endo-dimethanonaphthalene (Hexachlorohexahydro-endo,endo-dimethanonaphthalene)
- Hexachlorophene (2,2',-Methylenebis(3,4,6-

- trichlorophenol)
- Hexachloropropene(1-Propene, 1,1,2,3,3,3-hexachloro-)
- Hexaethyl tetraphosphate (Tetraphosphoric acid, hexaethyl ester)
- Hydrazine (Diamine)
- Hydrocyanic acid (Hydrogen cyanide)
- Hydrofluoric acid (Hydrogen fluoride)
- Hydrogen sulfide (Sulfur hydride)
- Hydroxydimethylarsine oxide (Cacodylic acid)
- Indeno (1,2,3-cd)pyrene (1,10-(1,2-phenylene)pyrene)
- Iodomethane (Methyl iodide)
- Iron dextran (Ferric dextran)
- Isocyanic acid, methyl ester (Methyl isocyanate)
- Isobutyl alcohol (1-Propanol, 2-methyl-)
- Isosafrole (Benzene, 1,2-methylenedioxy-4-allyl-)
- Kepone (decachlorooctahydro-1,3,4-Methano-2H-cyclobuta[cd]pentalen-2-one)
- Lasiocarpine (2-Butenoic acid, 2-methyl-, 7-[(2,3-dihydroxy-2-(1-methoxyethyl)-3-methyl-1-oxobutoxy)methyl]2,3,5,7a-tetrahydro-1H-pyrrolizin-1-yl-ester)
- Lead and compounds, N.O.S.
- Lead acetate (Acetic acid, lead salt)
- Lead phosphate (Phosphoric acid, lead salt)
- Lead subacetate (Lead, bis(acetato-0)tetrahydroxytri-)
- Maleic anhydride (2,5-Furandione)
- Maleic hydrazide (1,2-Dihydro-3,6-pyridazinedione)
- Malononitrile (Propanedinitrile)
- Melphalan (Alanine, 3-[p-bis(2-chloroethyl)amino] phenyl-L-)
- Mercury fulminate (Fulminic acid, mercury salt)
- Mercury and compounds, N.O.S.
- Methacrylonitrile (2-Propenenitrile, 2-methyl-)
- Methanethiol (Thiomethanol)
- Methapyrilene (Pyridine, 2-[(2-dimethylamino)ethyl]-2-thenylamino-)
- Metholmyl (Acetimidic acid, N-[(methylcarbamoyl)oxy]thio-,methyl ester)
- Methoxychlor (Ethane, 1,1,1-trichloro-2,2,-bis(p-methoxyphenyl)-)

- 2-Methylaziridine (1,2-Propylenimine)
- 3-Methylcholanthrene (Benz[j]aceanthrylene, 1,2-dihydro-3-methyl-)
- Methyl chlorcarbonate (Carbonochloridic acid, methyl ester)
- 4,4-Methylenebis(2-chloroaniline)
Benzenamine, 4,4-methylenebis-(2-chloro-)
- Methyl ethyl ketone (MEK) (2-Butanone)
- Methyl hydrazine (Hydrazine methyl-)
- 2-Methylactonitrile (Propanenitrile 2-hydroxy-2-methyl-)
- Methyl methacrylate (2-Propenoic acid, 2-methyl-, methyl ester)
- Methyl methanesulfonate Methanesulfonic acid, methyl ester)
- 2-Methyl-2-(methylthio)propionaldehyde-o-(methylcarbonyl) oxime (Propanal, 2-methyl-2(methylthio-0-[(methylamino)carbonyl]oxime)
- N-Methyl-N,-nitro-N-nitrosoguanidine (Guanidine, N-nitroso-N-methyl-N,-nitro-)
- Methyl parathion (0,0-dimethyl 0-(40 nitrophenyl) phosphorothioate)
- Methylthiouracil (4-IH-Pyrimidinone, 2,3-dihydro-6-methyl-2-thioxo-)
- Molybdenum and compounds, N.O.S.
- Mustard gas (Sulfide, bis(2-chloroethyl)-)
- Naphthalene
- 1,4-Naphthoquinone (1,4-Naphthalenedione)
- 1-Naphthylamine (alpha-Naphthylamine)
- 2-Naphthylamine (beta-Naphthylamine)
- 1-Naphthyl-2-thiourea (Thiourea, 1-naphthalenyl-)
- Nickel and compounds, N.O.S.
- Nickel carbonyl (Nickel tetracarbonyl)
- Nickel cyanide (Nickel (II) cyanide)
- Nicotine and salts (Pyridine, (S)-3-(1-methyl-2-pyrrolidinyl)-, and salts)
- Nitric oxide (Nitrogen (II) oxide)
- p-Nitroaniline (Benzenamine, 4-nitro-)
- Nitrobenzine (Benzene, nitro-)
- Nitrogen dioxide (Nitrogen (IV) oxide)
- Nitrogen mustard and hydrochloride salt (Ethanamine, 2-chloro-,N-(2-chloroethyl)-N-methyl-, and hydrochloride salt)
- Nitrogen mustard N-Oxide and hydrochloride salt (Ethanamine, 2-chloro,N-(2-chloroethyl)-N-methyl-and hydrochloride salt)

- Nitroglycerine (1,2,3-Propanetriol, trinitrate)
- 4-Nitrophenol (Phenol, 4-nitro)
- 4-Nitroquinoline-1-oxide (Quinoline,4-nitro-1-oxide-)
- Nitrosamine, N.O.S.
- N-Nitrosodi-n-butylamine (1-Butanamine,N-butyl-N-nitroso-)
- N-Nitrosodiethanolamine (Ethanol, 2,2-(nitrosoimino)bis-)
- N-Nitrosodiethylamine (Ethanamine, N-ethyl-N-nitroso-)
- N-Nitrosodimethylamine (Dimethylnitrosamine)
- N-Nitroso-N-ethylurea (Carbamide, N-ethyl-N-nitroso-)
- N-Nitrosomethylethylamine (Ethanamine, N-methyl-N-nitroso-)
- N-Nitroso-N-methylurea (Carbamide, N-methyl-N-nitroso-)
- N-Nitroso-N-methylurethane (Carbamic acid, methylnitroso-, ethyl ester)
- N-Nitrosomethylvinylamine (Ethenamine,N-methyl-N-nitroso-)
- N-Nitrosomorpholine (Morpholine,-N-nitroso-)
- N-Nitrosornicotine (Nicotinic acid,-N-nitroso-)
- N-Nitrosopiperidine (Piperidine, hexahydro-,N-nitroso-)
- Nitrosopyrrolidine (Pyrrole, tetrahydro-N-nitroso-)
- N-Nitrososarcosine (Sarcosine,-N-nitroso-)
- 5-Nitro-o-toluidine (Benzenamine, 2-methyl-5-nitro-)
- Octamethylpyrophosphoramidate (Diphosphoramidate, octamethyl-)
- Osmium tetroxide (Osmium(VIII) oxide)
- 7-Oxabicyclo[2,2,1]heptane-2,3-dicarboxylic acid (Endothal)
- Paraldehyde (1,3,5-Trioxane, 2,4,6-trimethyl-)
- Parathion (Phosphorothioic acid O,O-diethyl O-(p-nitrophenyl)ester)
- Pentachlorobenzene (Benzene, pentachloro-)
- Pentachloroethane (Ethane, pentachloro-)
- Pentachloronitrobenzene (PCNB) (Benzene, Pentachloronitro-)
- Pentachlorophenol (Phenol, pentachloro-)
- Phenacetin (Acetamide, N-(4-ethoxyphenyl)-)
- Phenol (Benzene, hydroxy-)
- Phenylenediamine (Benzenediamine)

- Phenylmercury acetate (Mercury acetatophenyl-)
- N-Phenylthiourea (Thiourea, phenyl-)
- Phosgene (Carbonyl chloride)
- Phosphine (Hydrogen phosphide)
- Phosphorodithioic acid, O,O-diethyl S-[(ethylthio)methyl]ester (Phorate)
- Phosphorothioic acid, O,O-dimethyl O-]p-[(dimethylamino)sulfonyl]phenyl]ester (Famphur)
- Phthalic acid esters, N.O.S. (Benzene, 1,2-dicarboxylic acid, esters, N.O.S.)
- Phthalic anhydride (1,2-Benzenedicarboxylic acid anhydride)
- 2-Picoline (Pyridine, 2-methyl-)
- Polychlorinated biphenyl, N.O.S.
- Potassium cyanide
- Potassium silver cyanide (Argentate(1-), dicyano-,potassium)
- Pronamide (3,5-Dichloro-N-(1,1-dimethyl-2-propynyl)benzamide)
- 1,3 Propane sultone (1,2-Oxathiolane, 2,2-dioxide)
- n-Propylamine (1-Propanamine)
- Propylthiouracil (Undecamethylenediamine, N,N'-bis(2-chlorobenzyl-),dihydrochloride)
- 2-Propyn-1-ol(Propargyl alcohol)
- Pyridine
- Radium-226 and -228
- Reserpine (Yohimban-16-carboxylic acid, 11,17-dimethoxy-18-[3,4,5-trimethoxybenzoyl]oxy]-,methyl ester)
- Resorcinol (1,3-Benzenediol)
- Saccharin and salts (1,2-Benzoisothiazolin-3-one, 1,1-dioxide, and salts)
- Safrele (Benzene, 1,2-methylenedioxy-4-allyl-)
- Selenious acid (Selenium dioxide)
- Selenium and compounds, N.O.S.
- Selenium sulfide (Sulfur selenide)
- Selenourea (Carbamimidoseleoic acid)
- Silver and compounds, N.O.S.
- Silver cyanide
- Sodium cyanide
- Streptozotocin (D-Glucopyranose, 2-deoxy-2-(3-methyl-3-nitrosoureido)-)
- Strontium sulfide
- Strychnine and salts (Strychnidin-10-one, and salts)

- 1,2,4,5-Tetrachlorobenzene (Benzene,1,2,4,5-tetrachloro-)
- 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) (Dibenzo-p-dioxin, 2,3,7,8-tetrachloro-)
- Tetrachloroethane, N.O.S. (Ethane, tetrachloro-N.O.S.)
- 1,1,1,2-Tetrachlorethane (Ethane, 1,1,1,2-tetrachloro-)
- 1,1,2,2-Tetrachlorethane (Ethane 1,1,2,2-tetrachloro-)
- Tetrachlorethane (Ethene, 1,1,2,2-tetrachloro-)
- Tetrachloromethane (Carbon tetrachloride)
- 2,3,4,6-Tetrachlorophenol (Phenol 2,3,4,6-tetrachloro-)
- Tetraethyldithiopyrophosphate (Dithiopyrophosphoric acid, tetraethyl-ester)
- Tetraethyl lead (Plumbane, tetraethyl-)
- Tetraethylpyrophosphate (Pyrophosphoric acide, tetraethyl ester)
- Tetranitromethane (Methane, tetranitro-)
- Thallium and compounds, N.O.S.
- Thallic oxide (Thallium (III) oxide)
- Thallium (I) acetate (Acetic acid, thallium (I) salt)
- Thallium (I) carbonate (Carbonic acid dithallium (I) salt)
- Thallium (I) chloride
- Thallium (I) nitrate (Nitric acid, thallium (I) salt)
- Thallium selenite
- Thallium (I) sulfate (Sulfuric acid, thallium (I) salt)
- Thioacetamide (Ethanethioamide)
- Thiosemicarbazide (Hydrazinecarbothioamide)
- Thiourea (Carbamide thio-)
- Thiuram (Bis(dimethylthiocarbamoyl) disulfide)
- Thorium and compounds, N.O.S. when producing thorium byproduct material
- Toluene (Benzene, methyl-)
- Toluenediamine (Diaminotoluene)
- o-Toluidine hydrochloride (Benzenamine, 2-methyl-,hydrochloride)
- Tolylene diisocyanate (Benzene, 1,3-diisocyanatomethyl-)
- Toxaphene (Camphene, octachloro-)

- Tribromomethane (Bromoform)
- 1,2,4-Trichlorobenzene (Benzene, 1,2,4-trichloro-)
- 1,1,1-Trichloroethane (Methyl chloroform)
- 1,1,2-Trichloroethane (Ethane, 1,1,2-trichloro-)
- Trichloroethene (Trichloroethylene)
- Trichloromethanethiol (Methanethiol, trichloro-)
- Trichloromonofluoromethane (Methane, trichlorofluoro-)
- 2,4,5-Trichlorophenol (Phenol, 2,4,5-trichloro-)
- 2,4,6-Trichlorophenol (Phenol, 2,4,6-trichloro-)
- 2,4,5-Trichlorophenoxyacetic acid (2,4,5-T) (Acetic acid, 2,4,5-trichlorophenoxy-)
- 2,4,5-Trichlorophenoxypropionic acid (2,4,5-TP) (Silvex) (Propionic acid, 2-(2,4,5-trichlorophenoxy)-)
- Trichloropropane, N.O.S. (Propane, trichloro-, N.O.S.)
- 1,2,3-Trichloropropane (Propane, 1,2,3-trichloro-)
- O,O,O-Triethyl phosphorothioate (Phosphorothioic acid, O,O,O-triethyl ester)
- sym-Trinitrobenzene (Benzene, 1,3,5-trinitro-)
- Tris(1-aziridinyl) phosphine sulfide (Phosphine sulfide, tris(1-aziridinyl)-)
- Tris(2,3-dibromopropyl) phosphate (1-Propanol, 2,3-dibromo-, phosphate)
- Trypan blue (2,7-Naphthalenedisulfonic acid, 3,3',-((3,3',-dimethyl (1,1',-biphenyl)-4,4',-diyl)bis(azo))bis(5-amino-4-hydroxy-tetrasodium salt)
- Uracil mustard (Uracil-5-[bis(2-chloroethyl)amino]-)
- Uranium and compounds, N.O.S.
- Vanadic acid, ammonium salt (ammonium vanadate)
- Vanadium pentoxide (Vanadium (V) oxide)
- Vinyl chloride (Ethene, chloro-)
- Zinc cyanide
- Zinc phosphide

**2012
RATIONALE**

PART U

LICENSING REQUIREMENTS FOR URANIUM AND THORIUM PROCESSING

Introduction

U.S. Nuclear Regulatory Commission (NRC) regulations in 10 CFR Part 40 governing source material processing were promulgated in the early 1980s. Subsequent amendments have incorporated ground water and air quality protections and controls. The title of this section has been modified to uranium and thorium processing to encompass the major activities regulated by Agreement States: source material milling and *in situ* leaching.

On April 12, 1999, the NRC published a final rule in the Federal Register [64 FR 17506] to amend 10 CFR Part 40 of its regulations "Radiological Criteria for License Termination of Uranium Recovery Facilities". The criteria were added to Part U, Appendix A, Criterion 6, (6).

Specific Provisions

Sec. U.1 and U.2 - Purpose and Scope.

Part U contains the special licensing requirements for natural uranium and natural thorium processing and disposal.

The purpose is kept brief and is modified from U.S. Nuclear Regulatory Commission 10 CFR 40.1. The Nuclear Regulatory Commission's more lengthy wording is shortened somewhat.

The scope is condensed from 10 CFR 40.2 and the introduction to 10 CFR Part 40, Appendix A. In the "specific technical requirements" phrase of U.2a., "construction, " "monitoring, and financial assurance" are added.

U.2d. was added that is consistent with 10 CFR 40.3.

Sec. U.3 - Definitions.

The definitions of "aquifer", "as expeditiously as practicable considering technological feasibility", "available radon barrier technology", "byproduct material," "closure", "closure plan", "compliance period", "dike", "disposal area", "existing portion", "factors beyond the control of the licensee", "final radon barrier", "ground water", "leachate", "licensed site", "liner", "milestone", "operation", "point of compliance", "reclamation plan", "surface impoundment", and "uppermost aquifer" are from the introduction to 10 CFR Part 40, Appendix A.

The definitions of "commencement of construction", "decommission", "principal activities", "residual radioactive material", "source material", are adopted from 10 CFR 40.4. Source material milling replaces the comparable Part 40 definition of "uranium milling."

Sec. U.4 - Special Requirements for Issuance of Specific Licenses For Source Material Milling.

The basic or general requirements for specific licenses are in Part C of these regulations. Part U contains the special requirements for issuance of a source material processing license. The applicant submittals to the Agency must be complete and accurate, as in the requirement in 10 CFR 40.9a. Failure to clearly demonstrate how the requirements and objectives of Part U, in particular Appendix A, is a ground for refusing to accept an application. The application must describe (1) the proposed project or action, (2) site characteristics including geology, topography, hydrology and meteorology, (3) radiological and non-radiological impacts of the proposed project or action, including waterway and groundwater impacts, (4) environmental effects of accidents, (5) tailings disposal and decommissioning, and (6) site and project alternatives.

Sec. U.4b. requires the applicant, analogous to the requirement in 10 CFR 40.31(h), to provide "written specifications describing the means employed to meet" requirements during the operational phase of any project. U.4b.i., U.4b.ii. and U.4b.iii. are brought forward from Appendix A, Criterion 8, for emphasis. U.4c. is brought forward from the introduction to Criterion 7 of 10 CFR Part 40, Appendix A. At least one full year (prior to any major site construction) of baseline monitoring data on a source material processing site and its surroundings is required. U.4b.iii. provides options for "environment" instead of "unrestricted areas" to be more proactive in preventing future legacy sites. U.4c. also makes clear that the specifications to be included in the application are to provide for an operational monitoring program to measure or evaluate compliance with applicable standards and regulations, to evaluate performance of control systems and procedures, to evaluate environmental impacts of operation, and to detect potential long-term effects. U.4d., makes clear that the application must also include detailed proposed specifications relating to the source material processing operations and the disposition of tailings or wastes resulting from such milling activities to achieve the requirements and objectives set forth in the criteria listed in Appendix A to this Part U.

Sec. U.5 - Pre-licensing Construction.

Unless an exemption is sought and granted, no construction is to be commenced until the license has been issued. The application is to be filed with the Agency at least nine months prior to the anticipated commencement of construction of the plant and is to be accompanied by the environmental report required by U.6.

Sec. U.6 - Applicant's Environmental Report.

An environmental report meeting requirements like those of 10 CFR 51.45 is required for the types of action listed in U.6c. It is to include all information needed by the Agency to evaluate the short-term and long-range environmental impact of the project and activity, so that the Agency may weigh environmental, economic, technical, and other benefits against environmental costs, while considering available alternatives. The actions outlined in U.6c. (2-4) requiring an environmental report are adapted from 51.22(c)(9).

Sec. U.6d. allows a supplement to applicant's environmental report, as provided by 10 CFR 51.60(a)

(62 FR 26730). The applicant may incorporate a prior environmental report by reference or by updating or supplementing the information previously submitted to reflect any significant environmental change, including any significant environmental change resulting from operational experience or a change in operations or proposed decommissioning activities. By Sec. U.6e., an applicant who can demonstrate that no significant environmental impact will result from the licensed activity can be granted an exemption of the requirement to submit an additional environmental report or supplement.

Sec. U.7 - Transmittal of Applicant's Environmental Report for Review and Comment.

The Agency is required to transmit the applicant's environmental report for review and comment to federal, state, and local agencies having expertise in and jurisdiction over the proposed project and activity. Sec. U.7 also requires that written comments and reports of reviewing agencies be considered by the Agency in its decision-making review process on the license application request, as well as any available federal environmental impact statement (EIS). Sec. U.7b. provides that in reviewing the application and applicant's environmental report, the Agency shall consider applicable regulations and permits of federal, state, and local regulatory agencies.

Sec. U.8 - Environmental Impact Analysis.

The Udall compromise during passage of the Uranium Mill Tailings Radiation Control Act of 1978 required, although Agreement States are not required to follow federal EIS procedures, the licensing Agency must prepare a written analysis of the impact of the licensed activity on the environment. The written analysis is to be available to the public at the time of public notice of hearing. The analysis is to include (1) an assessment of the radiological and non-radiological impacts to the public health, (2) an assessment of any impact on any waterway and ground water, (3) consideration of alternatives to the activities to be conducted, and (4) consideration of the long-term impacts of the licensed activities.

Sec. U.8c. makes clear that the independent environmental impact analysis, or any part of it, is to be prepared directly by, or under supervision of, the Agency.

Sec. U.9 - Financial Assurance Arrangements.

Part U references the financial assurance requirements found in 10 CFR Part 40, Appendix A, Criterion 9 for reclamation and closure and in Criterion 10 for long term care. Prior to issuance of the license, the operator must establish financial assurance arrangements to (1) ensure decontamination and decommissioning of the facility and (2) provide a fund adequate to cover the payment of the cost for long-term care and monitoring. A requirement to provide the financial assurance prior to commencement of operations was included. Each state should ensure that they not only have authority to receive and hold financial assurances, but also to execute them, spend the money if necessary, or give back the money if not needed. If the legislation clearly differentiates between the two types of funds, (decontamination and decommissioning versus long-term care), then it may not be possible to combine the two types of financial assurances. [State specific requirements can be included as a license condition.]

Sec. U.10 - Operational Requirements.

Enhanced from but consistent with the U.S. Nuclear Regulatory Commission's 10 CFR Part 40, Appendix A, Part U explicitly requires each licensee authorized to receive, possess and use source material for milling or byproduct material to operate in accordance with the procedures required by U.4b., monitoring required by U.4c., and the technical requirements and objectives of Appendix A to this Part U.

Sec. U.10b. makes explicit the NRC requirement that each licensee submit a report to the Agency within 60 days after January 1 and July 1 of each year, specifying the quantity of each of the radioactive materials released to unrestricted areas in liquid and in gaseous effluents during the previous six months of operation, and such other information as the Agency may require to estimate maximum potential annual radiation doses to the public resulting from effluent releases. If quantities of radioactive materials released during the reporting period are significantly above the licensee's design objectives previously reviewed as part of the licensing action, the report shall cover this specifically.

Sec. U.11 - Decommissioning Requirements.

Consistent with other decommissioning planning requirements of these regulations, a plan for completion of decommissioning is required to describe (1) planned decommissioning activities, (2) methods used to assure protection of workers and the environment against radiation hazards during decommissioning, (3) the planned final radiation survey; and (4) the details of costs for decommissioning, including comparison of the cost estimate with present funds set aside for decommissioning and provisions to ensure adequate funds are available. The timely decommissioning requirements found in 10 CFR 40.36 have been included here.

APPENDIX A: CRITERIA RELATING TO THE OPERATION OF MILLS AND THE DISPOSITION OF RADIOACTIVE TAILINGS OR WASTES

These technical criteria, as required by U.4b., establish technical, ownership, and long-term site surveillance criteria relating to the siting, operation, decontamination, decommissioning, and reclamation of mills and tailings or waste systems and sites at which such mills and systems are located. The term "financial assurance" was added to the topics the regulations cover for completeness.

Criterion 1 states the broad objective of siting and design decisions--permanent isolation of tailings and associated contaminants by minimizing disturbance and dispersion by natural forces, and to do so without ongoing "active maintenance". Criterion 2 addresses avoidance of the proliferation of small waste disposal sites. By Criterion 3, the "prime option" for disposal of tailings is placement below grade, either in mines or specially excavated pits. Criterion 4 specifies the site and design criteria that must be adhered to whether tailings or wastes are disposed of above or below grade.

Criteria 5, 7 and 13, including the Table of Hazardous Constituents appended as secondary ground-water protection standards to Criterion 13, provide for ground water protection. Criteria 6 and 8 specify radiological and other criteria applicable to site and disposal operation and reclamation. Criterion 9 and 10 address financial assurance requirements. An optional requirement for a standby trust was added to Criterion 9 for states that do not have the ability to hold defaulted money, (for example, the money goes into a general fund for the state). Criterion 11 specifies how long term

custody and ownership requirements will be governed, including both surface and subsurface ownership. The requirements in Criterion 11C through 11F are reserved to the NRC for implementation and are included in Part U for completeness, but that the States do not play a regulatory role in implementing these Criteria. In the text, we deleted all references to "Agency" since this is NRC only. Criterion 12 is "reserved" as these requirements only apply to the U. S. Nuclear Regulatory Commission as the licensing agency. [The long-term surveillance requirement is found in Criterion 1D.]

In paragraph 5 of the introduction, it is necessary to add the sentence: "Proposed alternatives to specific regulations in this Part U require notice and opportunity for hearing before the U. S. Nuclear Regulatory Commission." Elsewhere throughout Appendix A, where 10 CFR Part 40 refers to "the Commission" or "NRC", Part U refers to the "Agency". Where 10 CFR Part 40 uses "must", Part U prefers "shall."

MATTERS FOR FUTURE CONSIDERATION

The Nuclear Regulatory Commission is currently developing a rulemaking for regulatory requirements for groundwater protection for in-situ leach operations (RIN: 3150-AI40). The EPA is considering revising 10 CFR 192 in 2012 with respect to groundwater protection. NRC has published changes to decommissioning planning and financial assurance requirements (Federal Register, January 22, 2008) that will impact uranium and thorium recovery and Part U. The Final Decommissioning Planning Rule was published in the Federal Register on June 17, 2011^{1/}. The Rule will become effective on December 17, 2012.

CRCPD and OAS representatives have been on the NRC's Staff Level Working Group Rule Making Team in order to ensure consistency between Part U and NRC revised regulations, as well as commenting on draft and draft final rules. Other benefits will be timely production of the parallel Suggested State Regulation and the contributions of state experience.

^{1/} <http://www.gpo.gov/fdsys/pkg/FR-2011-06-17/pdf/2011-14267.pdf>

PART Z
MEDICAL CREDENTIALING

Sec. Z.1 - Purpose and Scope.

This Part provides for the credentialing of individuals in medical radiation technology. Unless specifically exempt in accordance with Z.3, an individual may not legally perform medical radiation technology without valid accreditation, or without the expressed written approval of the Agency during such time as an application may be pending.

The provisions of this Part are in addition to, and not in substitution for, other applicable provisions of these regulations.

Sec. Z.2 - Definitions.

"Accreditation" means the process by which the Agency grants permission to persons meeting the requirements of the Act and the Agency's rules and regulations to engage in the practice of administering radiation to human beings.

"ACRRT" means the American Chiropractic Registry of Radiologic Technologists, 52 W Colfax Street, Palatine, IL 60067, Phone (847) 705-1178, web site: www.acrrt.com.

"Act" means (cite State Radiation Control Act or other appropriate enabling legislation here).

"Advanced practice nurse" means a person who practices in accordance with the provisions set forth in the Nurse Practice Act of 2007 (cite appropriate reference).

"Agency" means (cite appropriate state Agency).

"Applies ionizing radiation" means the acts of using ionizing radiation for diagnostic or therapeutic purposes. Specifically included are those tasks that have a direct impact on the radiation burden of the patient, which if performed improperly would result in the re-administration of radiation.

"Approved program" means a formal education program in the respective discipline of radiography, nuclear medicine technology or radiation therapy that is accredited by one or more of the following:

- (1) Joint Review Committee on Education in Radiologic Technology;
- (2) Joint Review Committee on Educational Programs in Nuclear Medicine Technology;
- (3) Regional Institutional Accrediting Agencies;
- (4) Conjoint Secretariat of the Canadian Medical Association;

(5) Australian Institute of Radiography.

"ARRT" means the American Registry of Radiologic Technologists, 1255 Northland Drive, St. Paul, MN 55120, Phone (651) 687-0048, web site: www.rrrt.org.

"Authorized user" means a licensed practitioner who is identified as an authorized user on a license or equivalent permit issued by the Agency, Nuclear Regulatory Commission or Agreement State that is authorized to permit the medical use of radioactive material.

"Board" means (cite appropriate state advisory board or committee).

"Bone densitometry" means the science and art of applying x-radiation to human beings for determination of site specific bone density.

"CBRPA" means the Certification Board for Radiology Practitioner Assistants, 225 DuPont St, PO Box 1626, Lander, WY 82520, Phone (307) 335-5201, web site: www.cbrpa.org.

"Chiropractic radiography" means the science and art of applying x-radiation to human beings for diagnostic evaluation of skeletal anatomy.

"Chiropractic radiographer" means a person other than a licensed practitioner who performs medical radiation procedures and applies x-radiation to the human body for diagnostic evaluation of skeletal anatomy, while under the general supervision of a licensed chiropractor.

"Computed tomography" means the production of a tomogram by the acquisition and computer processing of x-ray transmission data.

"Continuing education activity" means a learning activity that is planned, organized and administered to enhance the professional knowledge and skills underlying professional performance that a technologist uses to provide services for patients, the public or the medical profession. In order to qualify as continuing education, the activity must be planned, be organized and provide sufficient depth and scope of a subject area.

"Continuing education credit" or "CE credit" means a unit of measurement for continuing education activities. One continuing education credit is awarded for one contact hour (50 minutes). Activities longer than one hour are assigned whole or partial credits based on the 50-minute hour. Activities less than 30 minutes receive no credit.

"Credentialing" means any process whereby a State government or non-governmental agency or association grants recognition to an individual who meets certain predetermined qualifications.

"CT" (See "Computed tomography").

"Director" means (cite the title of the Agency's responsible individual).

"Ionizing radiation" means gamma rays, x-rays, alpha and beta particles, high speed electrons, neutrons, protons and other nuclear particles; but not sound of radio waves, or visible, infrared or ultraviolet light (see definition in Act).

"In vitro" means isolated from the living organism.

"In vivo" means occurring within the living organism.

"Licensed practitioner" means a person licensed or otherwise authorized by law to practice medicine, dentistry, osteopathy, chiropractic or podiatry.

"Limited diagnostic radiographer" means a person, other than a licensed practitioner, who, while under the general supervision of a licensed practitioner, applies x-radiation for diagnostic purposes. Radiographic procedures are limited to one or more of the following anatomical regions: chest, extremities, skull/sinus, spine or foot/ankle. Specific radiographic examinations appropriate to each type of limited radiography accreditation may be found in Appendix A of this Part. However, a limited diagnostic radiographer may not perform any radiographic exams for a portable x-ray service provider.

"Medical radiation technology" means the science and art of performing medical radiation procedures involving the application of ionizing radiation to human beings for diagnostic and therapeutic purposes. The specialized disciplines of medical radiation technology are medical radiography, nuclear medicine technology, radiation therapy technology, chiropractic radiography, limited diagnostic radiography and radiologist assistant.

"Medical radiographer" means a person, other than a licensed practitioner, who, while under the general supervision of a licensed practitioner, applies x-radiation to any part of the human body and who, in conjunction with radiation studies, may administer contrast agents and related drugs for diagnostic purposes.

"Medical radiography" means the science and art of applying x-radiation to human beings for diagnostic purposes.

"NMTCB" means the Nuclear Medicine Technology Certification Board, 3558 Habersham at Northlake, Bldg. I, Tucker, GA 30084-4009, Phone (404) 315-1739, web site: www.nmtcb.org.

"Nuclear medicine advanced associate" means a person, other than a licensed practitioner, who as a nuclear medicine technologist with advanced training and certification, performs a variety of activities under the direct, general or personal supervision of a licensed practitioner, who is also an authorized user of radioactive material, in the areas of patient care, patient management, clinical imaging and invasive or therapeutic procedures. The nuclear medicine advanced associate may not interpret images, make diagnoses or prescribe medications or therapies.

"Nuclear medicine technologist" means a person, other than a licensed practitioner, who administers radiopharmaceuticals and related drugs to human beings for diagnostic purposes, performs in vivo and in vitro detection and measurement of radioactivity and administers radiopharmaceuticals to

human beings for therapeutic purposes. A nuclear medicine technologist may perform such procedures only while under the general supervision of a licensed practitioner who is licensed to possess and use the radiopharmaceuticals involved.

"Nuclear medicine technology" means the science and art of in vivo and in vitro detection and measurement of radioactivity and the administration of radiopharmaceuticals to human beings for diagnostic and therapeutic purposes.

"PET" (See "Positron emission tomography").

"Physician assistant" means a person who practices in accordance with the provisions set forth in the Physician Assistant Practice Act of 1987 (cite appropriate reference).

"Podiatric" means radiographic examination of the toes, foot, ankle, calcaneus, distal tibia/fibula, but does not include the knee joint.

"Portable x-ray service provider" means a registrant who, under a physician's authorization, provides diagnostic x-ray procedures with hand-held or mobile radiographic equipment in a patient's place of residence.

"Positron emission tomography" means a nuclear medicine imaging technique which produces a three-dimensional image of functional processes in the body by detecting pairs of gamma rays emitted indirectly by a positron-emitting radionuclide.

"Radiation therapist" means a person, other than a licensed practitioner, who performs procedures and applies ionizing radiation emitted from x-ray machines, particle accelerators, or sealed radioactive sources to human beings for therapeutic purposes while under the general supervision of a licensed practitioner who is licensed, as required, to possess and use radioactive materials.

"Radiation therapy technology" means the science and art of applying ionizing radiation emitted from x-ray machines, particle accelerators and sealed radioactive sources to human beings for therapeutic purposes.

"Radiologist assistant" means a person, other than a licensed practitioner, who as a medical radiographer with advanced-level training and certification, performs a variety of activities under the direct, general or personal supervision of a radiologist, certified by the American Board of Radiology or the American Osteopathic Board of Radiology, in the areas of patient care, patient management, clinical imaging and interventional procedures. The radiologist assistant may not interpret images, make diagnoses or prescribe medications or therapies.

"Radiology" means the branch of medicine that deals with the study and application of imaging technology to diagnosis and treat disease.

"Recognized Continuing Education Evaluation Mechanism" or "RCEEM" means a mechanism for evaluating the content, quality and integrity of an educational activity. The evaluation shall include a review of education objectives, content selection, faculty qualifications, and educational methods and materials. Among the requirements for qualification as a RCEEM, an organization shall be

national in scope, non-profit, radiology based and willing to evaluate CE activity developed by any technologist within a given discipline. Organizations with current RCEEM status include:

- (1) American College of Radiology
- (2) American Healthcare Radiology Administrators
- (3) American Institute of Ultrasound in Medicine
- (4) American Roentgen Ray Society
- (5) American Society of Nuclear Cardiology
- (6) American Society of Radiologic Technologists
- (7) Association of Vascular and Interventional Radiographers
- (8) Canadian Association of Medical Radiation Technologists
- (9) Medical Dosimetrist Certification Board
- (10) Radiological Society of North America
- (11) Society of Diagnostic Medical Sonography
- (12) Section for Magnetic Resonance Technologist of the International Society for Magnetic Resonance in Medicine
- (13) Society of Nuclear Medicine Technologist Section
- (14) Society of Vascular Ultrasound.

"Single photon emission computed tomography" means a nuclear medicine tomographic imaging technique using gamma rays.

"SPECT" (See "Single photon emission computed tomography").

"Supervision" means responsibility for and control of, quality, radiation safety and protection, and technical aspects of the application of ionizing radiation to human beings for diagnostic and/or therapeutic purposes. For the purposes of this Part, supervision shall consist of one of the following:

- (1) Personal - the required individual must be in attendance in the room during the performance of the procedure.
- (2) Direct - the required individual must be present in at least an adjacent area and immediately available to furnish assistance and direction throughout the procedure.

- (3) General - the procedure is furnished under the overall direction and control of a licensed practitioner whose presence is not required during the performance of the procedure.

Sec. Z.3 - Exemptions.

- a. Nothing in this Part shall be construed to limit or affect in any respect, the practice of persons properly licensed under other statutes or regulations with respect to their professions.
- b. The Agency shall, upon application therefore or upon its own initiative, grant such exemptions or exceptions from the requirements of this Part as it determines are authorized by law and will not result in a hazard to public health and safety.
- c. Exemptions to this Part shall include:
 - i. A student enrolled in an approved program applicable to his/her profession who, as a part of his/her course of study, applies ionizing radiation to human beings while under the direct supervision of a licensed practitioner or medical radiation technologist who holds an active license or accreditation with the Agency.
 - ii. A licensed practitioner who is licensed or otherwise authorized by law to practice medicine, osteopathy, dentistry, chiropractic or podiatry.
 - iii. A licensed physician assistant or advanced practice nurse who, under the direct or personal supervision of a responsible physician, performs delegated interventional fluoroscopic procedures.
 - iv. An accredited nuclear medicine technologist or radiation therapist who, certified in CT by the ARRT, performs CT radiographic exams.
 - v. An accredited nuclear medicine technologist who performs CT radiographic exams as part of a PET/CT or SPECT/CT combination exam.
 - vi. A person employed as a dental assistant or dental hygienist who performs radiography under the general supervision of a licensed dentist.
 - vii. A nurse, technician or other assistant who, under the general supervision of a licensed podiatrist, performs radiographic exams of the foot or ankle.
 - viii. A nurse, technician or other assistant who, under the general supervision of a licensed practitioner, performs bone densitometry.

Sec. Z.4 - Categories and Types of Accreditation.

- a. The Agency shall accredit individuals in the practice of Medical Radiation Technology in one or more of the following specific categories:

- i. Medical Radiography;
 - ii. Nuclear Medicine Technology;
 - iii. Radiation Therapy Technology;
 - iv. Radiologist Assistant;
 - v. Nuclear Medicine Advanced Associate;
 - vi. Chiropractic Radiography; and
 - vii. Limited Diagnostic Radiography.
- b. The Agency shall issue and recognize the following types of accreditation:
- i. Active Status Accreditation - for persons who have passed an examination as indicated in Z.5.
 - ii. Temporary Accreditation - for persons who have completed an approved program in medical radiography, nuclear medicine technology or radiation therapy technology and are eligible for the examination specified in Z.5. Temporary Accreditation shall convey the same rights as Active Status Accreditation.
 - iii. Conditional (grandfathered) Accreditation Type I - for persons who were employed in medical radiation technology for 24 months prior to (effective date of the rule), and who otherwise did not meet the qualifications of accreditation. Issuance shall be contingent upon submission of a written Statement of Assurance that the person is competent to apply ionizing radiation to human beings. A Statement of Assurance submitted to the Agency in accordance with this Section shall specify the nature of the equipment and procedures the individual is competent to utilize. The Statement of Assurance shall be provided by a licensed practitioner under whose general supervision the individual is employed or has been employed. Conditional Accreditation Type I issued pursuant to this Section shall be specific to the procedures and equipment indicated in the Statement of Assurance. The Agency shall not issue Conditional Accreditation Type I as provided for in this Section after (cite a specific date in which grandfathering will be closed, usually 2 or 3 years after the effective date of the rule). However, Conditional Accreditation Type I issued on or before (cite date grandfathering closed) is renewable in accordance with Z.8.
 - iv. Conditional (community hardship) Accreditation Type II - for persons for whom it has been determined that a community hardship exists. When making such a determination the Agency will consult placement services or County or Local Health Departments, and evaluate the availability of alternative radiology services and trained personnel. In addition, the Agency will require the employer or perspective employer to demonstrate that recruitment of qualified personnel, at competitive

compensation, has been attempted and unsuccessful. Conditional Accreditation Type II will only be issued, if based on information submitted and obtained the Agency determines that qualified personnel cannot be recruited, and that the people in the locality would be denied adequate health care because of the unavailability of appropriately accredited individuals.

- v. Limited Diagnostic Radiography Accreditation - for persons who have passed examinations as indicated in Z.5g.

Sec. Z.5 - Examination Requirements. Persons who seek active or limited accreditation in medical radiation technology shall pass the appropriate examination as specified below:

- a. Medical Radiography. The American Registry of Radiologic Technologists (R) (ARRT).
- b. Nuclear Medicine Technology.
 - i. The American Registry of Radiologic Technologists (N) (ARRT).
 - ii. The Nuclear Medicine Technology Certification Board (NMTCB).
 - iii. The American Society of Clinical Pathologists (NM) (ASCP).
- c. Radiation Therapy Technology. The American Registry of Radiologic Technologists (T) (ARRT).
- d. Radiologist Assistant.
 - i. The American Registry of Radiologic Technologists (RRA) (ARRT).
 - ii. Certification Board for Radiology Practitioner Assistants (RPA) (CBRPA).
- e. Nuclear Medicine Advance Associate. The Nuclear Medicine Technology Certification Board (NMAA) (NMTCB).
- f. Chiropractic Radiography. The American Chiropractic Registry of Radiologic Technologists (ACRRT).
- g. Limited Diagnostic Radiography. The American Registry of Radiologic Technologists (ARRT) Examination for the Limited Scope of Practice in Radiography.
 - i. The exam will cover general radiography topics and, depending on the type of limited radiography sought, specific questions related to radiography of the chest, extremities, skull/sinus, spine, or podiatric applications.
 - ii. All exams will be scheduled through the Agency.
 - iii. The passing score shall be 65 percent for any combination of sections of the exam.

Sec. Z.6 - Application for Accreditation.

- a. Any person applying to the Agency for initial accreditation or renewal of accreditation in medical radiation technology shall:
 - i. Submit a complete and legible application form;
 - ii. Pay the appropriate application fee in accordance with Z.12a; and
 - iii. Provide evidence that he/she has met the requirements for the given category and status of accreditation that is sought.
- b. Persons applying for Active Status Accreditation shall submit evidence of registration, Board certification, or other examination as appropriate pursuant to Z.5.
- c. Persons applying for accreditation in Limited Diagnostic Radiography (i.e., limited chest, extremities, skull/sinus, spine or podiatry) shall submit evidence that they have passed the required examinations specified in Z.5g.
- d. Persons applying for Temporary Accreditation shall submit evidence of graduation from an approved program.
- e. Persons applying for accreditation as a radiologist assistant shall submit a letter of agreement/delegation from a radiologist certified by the American Board of Radiology or the American Osteopathic Board of Radiology. An example letter may be found in Appendix B of this Part.
- f. Persons applying for accreditation as a nuclear medicine advanced associate shall submit a letter of agreement/delegation from a licensed practitioner who is also an authorized user. An example letter may be found in Appendix C of this Part.
- g. The duration of issuance of Active Status, Temporary (which is non renewable), Conditional Type I, Conditional Type II or Limited Diagnostic Radiography Accreditation shall be 2 years, and shall entitle the individual to privileges consistent with the category and status of accreditation indicated unless the accreditation is suspended or revoked in accordance with Z.11.
- h. [The Agency shall refuse to issue or renew accreditation to any individual if the Agency has evidence that the applicant is delinquent in the repayment of an educational loan guaranteed by the (cite State Student Assistance Commission, and legal citation of Act)].
- i. [The Agency shall refuse to issue or renew accreditation to any individual if the Agency has evidence that the applicant is delinquent in the payment of child support orders pursuant to the provisions and procedures set forth in (cite Act)].

Sec. Z.7 - Notification of Address / Name Changes.

- a. All persons who have received accreditation from the Agency shall promptly notify the Agency of any change in their designated mailing address and of any change in name due to marriage or any other reason. Notification to the Agency shall be made in writing, by telephone or fax, or through the Agency's Internet Web Site (if applicable).
- b. Failure to forward such information to the Agency shall not be considered to be a valid cause for delaying any subsequent administrative proceedings involving the individual or excuse the individual from complying with any other rules or regulations administered by the Agency.

Sec. Z.8 - Requirements for Renewal of Accreditation.

- a. An individual shall make application for renewal of accreditation on or before the expiration date of accreditation. Accreditation shall lapse if not renewed within this time period.
- b. The expiration date of a renewed accreditation that has been renewed on or before the expiration date of the previous accreditation shall be 2 years from the expiration date of the previous accreditation. For renewal of accreditation that has lapsed, the expiration shall be 2 years from the last day of the month in which the application for renewal is processed.
- c. Each applicant shall submit a complete and legible application with the fee for renewal of accreditation in accordance with Z.12. The submission of a timely and sufficient application for renewal shall hold the prior accreditation valid until such time as the Agency acts to grant or deny renewal of accreditation. The Agency will grant or deny renewal of accreditation within 90 days after receipt of an application for renewal or the expiration date of the current accreditation, whichever is later.
- d. Renewal of Conditional Accreditation Type I (grandfathering) shall be specific to the equipment and procedures indicated in the most recent Statement of Assurance that has been presented to the Agency.
- e. Renewal of Conditional Accreditation Type II (community hardship) shall be based on a re-evaluation by the Agency of a condition of community hardship.
- f. All applicants for renewal shall meet the requirements for continuing education as specified in Z.9.

Sec. Z.9 - Continuing Education Requirements for Renewal.

- a. The required effort in continuing education credits for each category of medical radiation technology is as follows:
 - i. Medical Radiography - 24 CE credits
 - ii. Nuclear Medicine Technology - 24 CE credits

- | | | | |
|------|-------------------------------------|---|---------------|
| iii. | Radiation Therapy Technology | - | 24 CE credits |
| iv. | Radiologist Assistant | - | 50 CE credits |
| v. | Nuclear Medicine Advanced Associate | - | 48 CE credits |
| vi. | Chiropractic Radiology | - | 24 CE credits |
| vii. | Limited Diagnostic Radiography | - | 12 CE credits |
- b. The options for meeting CE requirements are:
- i. Activities approved by a RCEEM.
 - ii. Approved academic courses offered by a post-secondary educational institution that are relevant to the radiologic sciences and/or patient care. Courses in the biologic sciences, physical sciences, communication (verbal and written), and mathematics, computers, management or education methodology are considered relevant. Credit will be awarded at the rate of 12 CE credits for each academic quarter or 16 CE credits for each academic semester credit.
 - iii. Advanced CPR certification (Advanced Life Support, Instructor or Instructor Trainer) through the Red Cross, the Heart Association or the American Safety and Health Institute will be awarded 6 CE credits.
 - iv. Technologists may also meet CE requirements (24 credits) by passing an additional primary or post-primary (advance level) exam, approved or acceptable to the ARRT or NMTCB. A listing of approved or acceptable exams is available from the ARRT, NMTCB or the Agency.
- c. All technologists accredited by the Agency are required to maintain proof of participation in CE activities. This proof may be in the form of a certificate or an itemized list from an ARRT approved record keeping mechanism. All documentation shall include:
- i. Name of participant,
 - ii. Dates of attendance,
 - iii. Title and content of the activity,
 - iv. Number of contact hours for the activity,
 - v. Name of the sponsor,
 - vi. Signature of the instructor or an authorized representative of the sponsor issuing the

documentation, and

- vii. A reference number and the identification of the RCEEM that approved it.
- d. Technologists seeking renewal will be required to attest that they have acquired the required number of CE credits. Within 30 days after receipt of this attestation, the Agency may perform an audit in which the individual will be asked to provide copies of documentation of CE. Failure to respond to the Agency's audit request and/or failure to provide acceptable documentation may result in a refusal to renew accreditation as provided in Z.11.
- e. Technologists who are registered with ARRT, NMTCB, or CBRPA and who are in compliance with CE requirements or on CE probation at the time of renewal with the Agency will be considered in compliance with the CE requirements of this Part.

Sec. Z.10 - Non Renewal of Accreditation.

- a. The Agency shall not renew an individual's accreditation if he/she fails to present satisfactory evidence that he/she possesses the necessary qualifications for accreditation, and that he/she has participated in an approved continuing education program in accordance with Z.9.
- b. If the Agency does not find satisfactory evidence that the individual meets these requirements, the Agency shall, within 90 days after receipt of the application for renewal of accreditation or the expiration date of the current accreditation, whichever is later, send the individual a Notice of Intent Not to Renew Accreditation. This notice shall include the areas of deficiency and the individual's rights as set forth in this Section.
- c. The individual, at any time while an application is pending, may submit additional information to the Agency in order to establish that the identified areas of deficiency have been met or corrected. If the applicant does not provide additional information to the Agency within the time frame specified in the Notice of Intent Not to Renew Accreditation, the Agency shall issue a Notice of Accreditation Denied.
- d. An individual's current credential shall be invalid as of the date of his/her receipt of a Notice of Accreditation Denied. After the Agency has sent the Notice of Accreditation Denied, the individual may request a hearing within 30 days in accordance with [cite the appropriate provision of the Agency's Administrative Procedure Rule]. The individual shall have the burden of proof.
- e. If an individual's accreditation is not renewed, he/she shall have the right at any time to submit an application for renewal of accreditation. The application shall be reviewed and processed in accordance with the requirements of this Section, except that an individual may not legally apply ionizing radiation to human beings until and unless the Agency has acted to grant the application for renewal of accreditation.

Sec. Z.11 - Suspension, Revocation and Denial of Accreditation.

- a. The Agency may act to suspend or revoke an individual's accreditation, or refuse to issue or renew accreditation, for any one or a combination of the following causes:
- i. Knowingly causing a material misstatement or misrepresentation to be made in the application for initial accreditation or renewal of accreditation if such misstatement or misrepresentation would impair the Agency's ability to assess and evaluate the applicant's qualifications for accreditation under this Part;
 - ii. Knowingly making a false material statement to an Agency employee during the course of official Agency business;
 - iii. Willfully evading the statute or regulations pertaining to accreditation, or willfully aiding another person in evading such statute or regulations pertaining to accreditation;
 - iv. Performing procedures under or representing as valid to any person either a certificate of accreditation not issued by the Agency, or a certificate of accreditation containing on its face unauthorized alterations or changes that are inconsistent with Agency records regarding the issuance of such certificate;
 - v. Having been convicted of a crime that is a felony under the laws of this State or conviction of a felony in a federal court, unless such individual demonstrates to the Agency that he/she has been sufficiently rehabilitated to warrant the public trust;
 - vi. Exhibiting significant or repeated incompetence in the performance of professional duties;
 - vii. Having a physical or mental illness or disability that results in the individual's inability to perform professional duties with reasonable judgment, skill and safety;
 - viii. Having an actual or potential inability to practice medical radiation technology with reasonable skill and safety on patients or other individuals due to the use of alcohol, narcotics or stimulants;
 - ix. Applying ionizing radiation to a human being when not operating in each particular case under the direction of a duly licensed practitioner or to any person or part of the human body other than specified in the law under which the practitioner is licensed;
 - x. Interpreting a diagnostic image for a physician, patient, the patient's family or the public;
 - xi. Performing in a way that deviates from accepted professional conduct;
 - xii. Having had a similar credential by another state or the District of Columbia suspended or revoked if the grounds for that suspension or revocation are the same or equivalent to one or more grounds for suspension or revocation set forth in this Section;

- xiii. Failing to repay an educational loan guaranteed by [if applicable, cite appropriate Student Loan Commission and statute];
 - xiv. Failing to meet child support orders as provided in [if applicable, cite appropriate statute]. The action will be based solely upon the certification of delinquency made by [note appropriate State Agency], or the certification of violation made by the court. Further process, hearing, or re-determination of the delinquency or violation by the Agency shall not be required [if applicable, cite appropriate statute];
 - xv. Failing to respond to an audit request by the Agency for documentation of continuing education; and
 - xvi. Failing to pay a fee or civil penalty properly assessed by the Agency.
- b. If, based upon any of the grounds in subsection (a) of this Section, the Agency determines that action to suspend or revoke accreditation, or refusal to issue or renew accreditation, is warranted, the Agency shall notify the individual and shall provide an opportunity for a hearing in accordance with [cite appropriate Administrative Proceedings rule]. An opportunity for a hearing shall be provided before the Agency takes action to suspend or revoke an individual's accreditation unless the Agency finds that an immediate suspension is required to protect against immediate danger to the public health or safety [cite immediate danger provision of Act or Statute], in which case the Agency shall suspend an individual's accreditation pending a hearing.
 - c. If the Agency finds that revocation or refusal to issue or renew accreditation is warranted, the usual action shall be suspension or denial of accreditation for up to one year. The term of suspension or denial may be reduced by the (Agency Director), based upon evidence presented, if the conditions leading to the Suspension Order can be cured in less than one year. However, if the Agency finds that the causes are of a serious or continuous nature, such as past actions that posed an immediate threat to public health or safety, deficiencies that cannot be cured within one year or frequent child support arrearages (if applicable), the Agency shall revoke the individual's accreditation or deny the application.
 - d. When an individual's accreditation is suspended or revoked, the individual shall surrender his/her credential to the Agency until the termination of the suspension period or until re-issuance of the accreditation.
 - e. An individual whose accreditation has been revoked may seek reinstatement of accreditation by filing a petition for reinstatement with the Agency one year or more after the beginning of the revocation period. The individual shall be afforded a hearing in accordance with [cite appropriate Administrative Proceedings rule] and shall bear the burden of proof of establishing that the accreditation should be reinstated due to rehabilitation or other just cause.

Sec. Z.12 - Fees.

- a. The fees for initial or renewal of accreditation in all categories, Active, Conditional, Temporary or Limited Status shall be "[cite schedule of fees]" per application and shall be non-refundable.
- b. The examination fee for Limited Diagnostic Radiography Accreditation shall be "[cite schedule of fees]" for the categories of Chest, Extremities, Spine, Skull and Sinuses, Podiatric or any combination thereof.
- c. The appropriate application fees must accompany the application when filing with the Agency. An application is filed on the date it is received and stamped by the Agency.

Sec. Z.13 - Civil Penalties.

- a. The Agency shall assess civil penalties, in accordance with subsections (c) and (d) of this Section against any registrant or licensee who allows an individual to perform medical radiation procedures without valid accreditation, unless the individual performing the medical radiation procedures is specifically exempt from accreditation requirements as specified in Z.3.
- b. Prior to assessing civil penalties, the Agency shall confirm the violation of the accreditation requirements by:
 - i. Observation of the violation;
 - ii. Obtaining records, documents, or other physical evidence;
 - iii. Obtaining statements from either the employer, or the employee which confirm the existence of the violation; or
 - iv. Obtaining statements from third parties, e.g., patients or co-workers that corroborate the allegation that a violation has occurred.
- c. Civil penalties shall be assessed against any registrant or licensee who allows an individual to perform medical radiation procedures without valid accreditation as follows:
 - i. First violation by an individual who is fully qualified for accreditation but has failed to apply for initial or renewal of accreditation at the time the violation is discovered:

(1)	In violation 30 days or less	\$200
(2)	In violation 31 through 90 days	\$300
(3)	In violation greater than 90 days	\$500
 - ii. First violation by a person who is not qualified for accreditation at the time the violation is discovered is \$1000.

- iii. Second and subsequent violations shall be assessed civil penalties using the factors set forth in [cite Agency's rule for the assessment of civil penalties, not specifically specified above].
- d. Civil penalties shall be assessed against any individual involved in presenting falsified accreditation certificates or any other documents used to meet accreditation qualifications using the factors set forth in [cite Agency's rule for the assessment of civil penalties, not specifically specified above].
- e. The Agency may commence administrative proceedings for the assessment and collection of civil penalties by sending a Notice of Violation. The Notice shall give the registrant, licensee or individual an opportunity to pay the penalty without further action from the Agency.
- f. Failure to abate an accreditation violation or to pay the civil penalty as directed shall cause the Agency to issue an Order [cite appropriate Administrative Proceedings rule]. The Order may contain a provision prohibiting the use of any source of radiation at the facility of the registrant or licensee until such time as the violation has been abated and all assessed civil penalties have been paid.

PART Z**APPENDIX A****LIMITED DIAGNOSTIC PROCEDURES BY TYPE OF LIMITED ACCREDITATION**

- | | | | |
|----|--|-------------------|--------------|
| a. | Limited Diagnostic - Chest | | |
| | PA Upright | Lateral Upright | AP Lordotic |
| | AP Supine | Lateral Decubitus | Obliques |
| b. | Limited Diagnostic Radiography - Extremities | | |
| | Fingers | Hand | Wrist |
| | Forearm | Elbow | Humerus |
| | Shoulder | Clavicle | Scapula |
| | Toes | Foot | Ankle |
| | Tibia / Fibula | Knee | Patella |
| | Femur | | |
| c. | Limited Diagnostic Radiography - Spine | | |
| | Cervical Spine | Thoracic Spine | Lumbar Spine |
| | Sacroiliac Joints | Sacrum | Coccyx |
| d. | Limited Diagnostic Radiography - Skull and Sinuses | | |
| | Skull | Paranasal Sinuses | Mandible |
| | Facial Bones | | |
| e. | Limited Diagnostic Radiography - Podiatric | | |
| | Foot | Ankle | |

PART Z

APPENDIX B

EXAMPLE LETTER OF AGREEMENT FOR RADIOLOGIST ASSISTANT

(Date)

Name of State Program Manager, Title
Technology Accreditation Program
State Agency
Street Address
City, State Zip

Re: (Name of Applicant)

Dear:

This letter is to serve as acknowledgement that (insert full name of applicant) will be employed by (Name of Radiology Group or Facility) under my supervision. (Insert name of applicant) will, as a radiologist assistant, perform a variety of activities in the areas of patient care, patient management, clinical imaging and interventional procedures. It is also recognized that (he/she) may not interpret images, make diagnosis or prescribe medications or therapies.

I am a radiologist, licensed by the State of () as a physician, and certified by the American Board of Radiology or the American Osteopathic Board of Radiology (select the appropriate Board).

Sincerely,

Physician's Name (Typed)

PART Z

APPENDIX C

EXAMPLE LETTER OF AGREEMENT FOR NUCLEAR MEDICINE

ADVANCED ASSOCIATE

(Date)

Name of State Program Manager, Title
Technology Accreditation Program
State Agency
Street Address
City, State Zip

Re: (Name of Applicant)

Dear:

This letter is to serve as acknowledgement that (insert full name of applicant) will be employed by (Name of Physician Group or Facility) under my supervision. (Insert name of applicant) will, as a nuclear medicine advance associate, perform a variety of activities in the areas of patient care, patient management, clinical imaging and invasive or therapeutic procedures. It is also recognized that (he/she) may not interpret images, make diagnosis or prescribe medications or therapies.

I am a physician, licensed by the State of (), whose name appears as an authorized user on a license (insert license#/name) issued by (Agency/NRC) that permits the medical use of radioactive material.

Sincerely,

Physician's Name (Typed)

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RATIONAL**

PART Z

MEDICAL CREDENTIALING

Background and History

Medical radiologic technologists are medical personnel who perform diagnostic imaging examinations with x-ray and radioactive pharmaceuticals, and administer radiation therapy treatments. Individuals performing imaging examinations are responsible for accurately positioning patients and ensuring that a quality diagnostic image is produced, with minimal radiation exposure. These individuals work closely with physicians who interpret medical images to either diagnose or rule out disease or injury. For the images to be interpreted correctly, the imaging exam must be performed properly. Radiologic technologists who perform radiation therapy procedures deliver high doses of radiation to treat cancer and other diseases.

The need for regulation of these individuals to ensure some acceptable level of education or competency is universally recognized. However, current laws regulating medical radiation technologists vary widely from state to state. Eight states (Alabama, Alaska, Georgia, Idaho, Missouri, North Carolina, Oklahoma, South Dakota) and the District of Columbia have no regulations, and five states (Colorado, Michigan, Nevada, New Hampshire, and Wisconsin) have partial regulations which only pertain to specific modalities such as mammography, therapy or CT. Efforts at the state level to provide for legislative authority to initiate medical credentialing or upgrade existing regulations vary.

In order to achieve some type of nationwide uniformity of basic educational and credentialing standards, the American Society of Radiologic Technologists (ASRT) introduced legislation in the 1999 Congressional session. The legislation, now known as the Consistency, Accuracy, Responsibility and Excellence in Medical Imaging and Radiation Therapy (CARE) bill would apply to all 50 states, and is envisioned to ensure that patients undergoing all types of radiologic procedures have the same assurance of quality as those receiving mammograms under the provisions of the Mammography Quality Standards Act. However, despite the best efforts of the ASRT, and the Alliance for Quality Medical Imaging and Radiation Therapy, a group of 20 radiologic science organizations representing more than 750,000 imaging technologists, radiation therapists and medical physicists, the legislation has not yet been enacted.

Regulation of medical radiologic technologists has long been the responsibility of the states. This Part is intended to assist any state in initiating, expanding or standardizing their regulatory efforts in this area.

Specific Provisions

Sec.Z.2 - Definitions.

Accreditation - states will need to determine a specific name for their credentialing process, accreditation, credentialing, certification, licensure, etc., for which this definition can be interchangeable.

Act - appropriate enabling legislation will be required for enactment of this Part.

Applies ionizing radiation - Care needs to be given with to what extent this definition will be applied, or whether specific tasks, such as positioning the patient or film are included. A liberal interpretation could result in limiting the activities of the medical dosimetrist or physicist, or even service engineers or darkroom techs. This is unnecessary. Applies ionizing radiation means energizing the x-ray beam, and who ever does so takes full responsibility for the exposure.

Approved program - is defined as a formal education program accredited by one of the mechanisms listed in the definition. Since states can count on the integrity of this process, there is no further need to review or approve any of these programs.

Board - enabling legislation will create an advisory board or committee to assist the state program in promulgating or revising its regulations. Typically, members will consist of physicians and technologists who practice in the fields of diagnostic radiography, nuclear medicine and therapy, additional physicians who do not specialize in radiology, a chiropractic physician, medical physicist, and anyone else deemed appropriate.

Limited diagnostic radiographer - the statement at the end of this definition prohibits these individuals from performing any radiographic exam for a portable x-ray service provider (also defined). Such companies are Medicare certified and provide portable x-ray services, primarily to nursing homes. Part 486.104(a) of the Medicare Standard for Portable X-ray Machine Service Providers requires that the x-ray machine operator basically have an educational background that would allow them to be eligible for the ARRT radiography exam (additional standards for individuals whose training was completed prior to 1960 or 1966 are no longer considered relevant). However, this particular prohibition, as worded, will disallow the use of any accredited limited diagnostic radiographer (even those with the documented education) to be employed as such by a portable x-ray service provider. This was done with the additional realization that the high ethical standards of conduct required of all ARRT radiographers would severely restrict the opportunities for fraud and abuse that have been documented among some of these providers.

Sec.Z.3 - Exemptions.

Dentists - the vast majority of the x-ray units in these offices are rather simple, with low radiation output and small beam sizes. Although a few of the Cone Beam CT (CBCT) units are beginning to appear in these offices, they are small and compact, with exposure levels significantly lower than that of a regular CT unit (approximately twice the exposure of a panoramic procedure for a typical full field view). As such, even with the occasional CBCT unit, an exemption of this group is appropriate, included in the proposed CARE bill and well established among the various regulatory programs. As such, any attempt to do otherwise will be strongly opposed.

Podiatrist - these individuals may also lobby to have operators of their units exempt. Like dental x-ray units, they are of low output, and confined to radiographs of the foot and ankle. Any fluoroscopic applications in a podiatric office would be performed by the practitioner. If desired, exemption language is included in Z.3.

Physician assistants / advanced practice nurses - state laws grant physicians the authority to delegate a broad range of tasks to these individuals. However, state laws and regulations governing other professions or areas of health care may contradict this legal authority. This then results in these individuals being either exempted from operator or accreditation requirements (similar to licensed practitioners) to prohibitions against their use of any x-ray or fluoroscopic equipment. The purpose of Part Z is to protect the public from individuals who are not adequately trained to use ionizing radiation safely. However, one must also recognize and acknowledge a supervising physician's ability to plan for the proper utilization of these individuals in a manner that is consistent with their training and experience, the physician's delegatory decision process, the policies of applicable facilities and the needs of the patients seen in the practice. As such, it appears reasonable to consider and include a specific exemption, for interventional fluoroscopic procedures performed under the direct or personal supervision of a responsible physician, for these individuals. This particular position is also supported by ACR Technical Standard For Management of the Use of Radiation in Fluoroscopic Procedures (Revised 2008, Resolution 6), and in particular Section III (E) which states: "Other ancillary personnel who are qualified and duly licensed or certified under applicable state law may, under the supervision of a radiologist or other qualified physician, perform specific interventional fluoroscopic or other image guided procedures. Supervision by a radiologist or other qualified physician must be direct or personal, and must comply with local, state, and federal regulations." The support of the ACR in this matter will effectively mute any objections from other professional societies. However, if adequate radiation safety training becomes an issue of concern, (the ACR notes that the individual should have received formal training in radiation management) regulatory language should then be considered to allow physician assistants and advanced practice nurses authorization to perform interventional fluoroscopic procedures upon completion of a radiation safety course that can reasonably be completed by a working medical professional.

In June, 2011 the Committee received an email for the ARRT's Director of Government Affairs noting that the ARRT, ACR, ASRT and the American Association of Physician Assistants are in agreement that anyone operating a fluoroscope should be properly educated and that should include 40 hours of didactic and 40 hours of clinical training in addition to passing a valid fluoroscopy exam. However, in reviewing this matter the Committee still believes that any additional training/education or exam requirement is unnecessary for the following reasons: the exemption is limited to interventional fluoroscopic procedures while under the personal (in the room) or direct (immediately available) supervision of the responsible physician. As such, if the physician is present during the procedure, why would the individual's training or competency become in issue? If it is, and brought to the attention of the radiology manager, who is that individual going to contact to correct the matter, the hospital's medical physicist and radiology staff or the state regulatory agency?

Nuclear medicine and therapy technologist (CT) - Nuclear medicine and therapy technologists are now being allowed (with appropriate education, training and clinical experience) to sit for the ARRT CT certification exam. Successful applicants are now requesting a regulatory change (must be

radiographers) in order to perform these examinations. Since they have passed the CT exam one cannot argue that they are unqualified. As such, Part Z needed to be modified in order to accommodate them. This was done by proposing an exemption (from the radiography requirement) for these individuals, which will also eliminate the need for a separate accreditation category (and fee). Although the vast majority of radiographers, who may represent around 85% of all technologists, and the professional societies representing them will not be enamored with this proposal, it cannot be successfully challenged on a health or safety basis (they're qualified). However, this expected reaction of the radiographers can also be tempered by every ones realization that the decision to allow non-radiographers to sit for the CT certification exam was made by the ARRT, with the concurrence of the ASRT.

PET/CT and SPEC/CT - this section is also proposing an exemption (from the radiography requirement) for an accredited nuclear medicine technologist to operate the CT component of a PET/CT or SPEC/CT unit when used in the dual combination mode, without any additional education or certification requirements. This position does not appear to pose any health or safety concerns and will again eliminate the need for an additional accreditation category (fusion imaging specialist) and fee. If necessary, consideration can be given to requiring these individuals to also complete a typical manufacturer's training course for new CT operators. Such courses are usually 15 hours in length, and include equipment operation, contrast media, sectional anatomy and CT radiation protection. Any requirement that the CT portion of the exam must be performed by an accredited radiographer is impractical and unwarranted.

Bone densitometry - this section also proposes an exemption for individuals, who under the general supervision of a licensed practitioner perform bone densitometry. In examining this issue there appears to be universal agreement that the radiation exposure to the operator and patient is minimal, and that the operator has little control over the overall quality of the exam. Although proper positioning may be an issue, especially with repeat or follow-up exams, it is a matter that can be easily addressed by the responsible physician. As such regulating the operator does not appear to be a health or safety issue, and may in fact limit its availability. The ASRT has taken a position that individuals performing bone densitometry exams should be credentialed. However, in order to effectively challenge this exemption, one would have to demonstrate to the regulatory agency that an operator exemption for bone densitometry would result in undue hazard to public health and safety, which appears unlikely.

Sec. Z.5 - Examination Requirements.

Radiologist assistant - two separate certification pathways exist for the radiologist assistant, the Registered Radiology Assistant (R.R.A.) through the ARRT, and the Radiology Practitioner Assistant (RPA) through the CBRBA. The American College of Radiology has expressed concerns over the recognition of the CBRPA certification, specifically, the lack of oversight from national organizations and scope of practice issues. The ASRT and the ACR are also continuing with efforts at the state level to pass legislation which will exclude the RPA pathway, even in states in which no RPAs are employed or reside. They were successful in doing so in Oklahoma, even though this state has no legislation addressing overall medical credentialing. The CPRPA apparently intends to challenge the laws in each state that does so.

Presently, the ACR, ASRT, CPRPA and the Society of Radiology Physician Extenders (SPRE), which is composed of both R.R.A. and RPA members, are cooperating to pass legislation in the U.S. Congress that would recognize an RA as either an R.R.A. certified by the ARRT, or an RPA certified by the CBRPA. Once passed, this bill would then allow Medicare reimbursement for RA procedures and supervision levels that are defined in existing state law. Again, all groups involved, ACR, ASRT, ARRT, CBRPA and the SPRE are presently supporting this legislative effort.

A number of states have already recognized the dual certification pathway and the number of CBRPA certified individuals greatly outnumber those certified by the ARRT, of which the majority are RPAs who completed the R.R.A. exam. Since the CBRPA is established and viable, in this regulatory approach the dual certification pathway is recommended, unless existing state statute specifically excludes.

In this regulatory approach the required supervising board certified radiologist will have complete control of the individual's duties and responsibilities. Additionally, the facility's credentialing committee and/or medical staff and the board certified radiologist will also determine the role delineation of each individual and the level of supervision required, which will be formalized in a letter of delegation or agreement with the Agency. The ACR continues to strongly disagree with this particular approach, and has requested that the scope of practice and supervision requirement be specified by rule. However, in an ARRT document reflecting entry-level clinical activities (role delineation) for radiologist assistants (RRA), the ARRT notes that any exclusion of a procedure is not intended to limit the procedures performed by a radiologist assistant, provided that appropriate education, training, and competence assessment has been documented. The document further notes that the actual level of radiologist supervision for the radiologist assistant in practice will depend on the individual's experience as well as state, insurer, institutional, and employer requirements. This further complicates any desire by a regulatory body to specify by rule the procedures which can be performed and the level of supervision required, especially for a field in which the number and types of procedures are rapidly expanding. However, professional standards (ASRT Practice Standards and the CBRPA Standards of Practice) for these individuals will keep pace with this evolution. States referencing such national standards rather than a list of specific procedures will build flexibility into their regulatory mechanism. Due to the training and knowledge of the board certified radiologist involved, it is unlikely that any individual would be allowed to perform a radiological procedure without adequate supervision or appropriate training or competence assessment. As such any additional regulatory efforts in further controlling or defining this specific relationship with the radiologist assistant, and the exams which can be performed, appear unwarranted.

Chiropractic radiography - individuals performing radiographic exams in a chiropractor's office must be either a radiographer, chiropractic radiographer or an appropriately accredited limited diagnostic radiographer (usually spine, extremity).

Limited diagnostic radiography exam - this particular exam was developed and is administered by the ARRT. It is a computer based exam, which is available at some 200 test centers throughout the United States. The exam consists of a core module containing 100 questions on radiation protection, equipment operation and quality control, image production and evaluation and patient care and education. There are also specific questions (20) relating to radiography of the chest, extremities (25), skull/sinuses (20), spine (25), and podiatric region (20). The passing score requirements vary widely from state to state. However, in a December 1994 publication, the ARRT recommended to

all licensing states that, for simplicity and consistency (and ease in reciprocity), they adopt a single passing score of 65% for any combination of the exam. This recommendation has been adopted, and results in the passing criteria noted below:

Chest	CH (20) + Core (100) ≥ 78
Extremity	EX (25) + Core (100) ≥ 81
Skull/Sinuses	SK (20) + Core (100) ≥ 78
Spine	SP (25) + Core (100) ≥ 81
Podiatric	PD (20) + Core (100) ≥ 78

States should recognize that the 65 percent combo passing criteria will generate numerous comments from various groups and individuals noting that this proposed passing criteria is either too high or too low. Various scoring scenarios will also be raised, and in particular the possibility that a test applicant could score an 81 on the core section, and miss all of the questions in the specific groups. In such a scenario, the state will still issue a full, limited accreditation (it appears inconceivable that one could score so highly on the core section and miss all other questions). Nevertheless, it should be noted that the ARRT is no doubt familiar with all these various exam scenarios, and still stands by its recommendation.

Additionally, recommendations will be made that these individuals must first complete a training program, specified by rule, before being eligible to sit for the exam. Although there is no consistency in the education provided to limited exam applicants, and training requirements vary greatly from state to state, the ARRT took this into consideration when they established the minimum passing score necessary for a borderline candidate to demonstrate competency. As such, one's educational background or experience should be irrelevant, and one only needs to demonstrate the required competency by passing the exam.

In summary, there will be two main issues associated with this discussion. The health and safety issue as to whether the 65 combo score is an acceptable passing score, and the issue as to whether as a regulatory agency, one wishes to make it more difficult for limited applicants to enter into this field. Based on the organization's experience and reputation, it is unlikely that anyone will question the validity of the ARRT exam. Implementing the ARRT recommended scoring criteria should also make the state's position in this matter beyond reproach.

Podiatric radiographers - unless exempted, individuals performing radiographic exams in a podiatrist's office will need to be either a radiographer or an appropriately accredited limited diagnostic radiographer (having passed the podiatric or extremity exam). In order to utilize the limited exam, states will need to enter into a contract with the ARRT.

Sec.Z.6 - Application for Accreditation.

Many states are now refusing to issue or renew licenses or accreditations if applicants are delinquent in the repayment of an educational loan or child support. If applicable, the appropriate rule and citation should be noted in this section.

Persons applying for active status accreditation as a radiographer, nuclear medicine technologist, therapist, radiologist assistant, nuclear medicine advance associate or chiropractic radiographer must

submit evidence of registration, certification, etc., from the appropriate organization. This will demonstrate that at some point, they were eligible to sit for and then passed the required exam. However, they are not required to maintain their registry or certification at the time of initial application or renewal. Although this is often a job requirement, and few individuals may choose not to, it cannot be a regulatory requirement. Despite its desirability, states have not been able to require membership in professional societies or organizations as a condition for the issuance of accreditation.

Sec. Z.7 - Initial Issuance of Accreditation.

Individuals may not legally perform medical radiation technology without valid accreditation, or without the expressed written approval of the Agency during such time as an application may be pending (receipt of completed application, documentation of qualifications, the required fee and no other outstanding issues). This written approval can be issued by e-mail or fax to the individual's supervisor and is good for a period of 10 days, which is sufficient for the Agency to process, print and mail the required certificate of accreditation.

Conditional Accreditation Type I (grandfathering) - any state that wishes to initiate a program for the credentialing of medical radiation technologist will not be successful in doing so without a grandfathering provision for those presently working in the field, for the last 24 months, before the rule became effective. This grandfathering period (which is negotiable) would then be open for perhaps 2 or 3 years, before closing. However, once issued, it will be renewable, in accordance with Sec.Z.8. Attempts to require any type of documented training program or competency exam for these individuals will only provide additional fodder for opponents of medical credentialing (its not grandfathering), and will not be successful.

As proposed, numerous potentially unqualified individuals may be credentialed simply upon receipt of a statement from a licensed practitioner that they are competent, and have worked in the field for the past two years. However, there will be no implied guarantee to any of these individuals that they would be able to work anywhere within the state, as "conditions of employment" (ARRT registered, etc) will still apply.

As regulators and stakeholders it is sometimes necessary to look at an issue with a bigger lens (where do we wish to be in 20 to 30 years). This is almost impossible to do, but necessary. Illinois required credentialing of medical radiation technologist in 1984, with a grandfathering provision which was inserted in the enabling legislation (it would not have passed without). Grandfathering closed in Illinois in 1990. Since the program's inception, Illinois has issued a total of 1402 grandfathered credentials. However, as of September 2011, out of 14,200 active accreditations there are now only 128.

It is important for new credentialing states to recognize that this grandfathering feature will be a very contentious and unsettling issue for thousands of their technologists who are qualified by virtue of education and certification to perform these procedures. Their understanding and support of this item is crucial and required (they will later become the program's strongest supporters). They and all other stakeholders must also come to recognize that without this feature, efforts to accomplish initial credentialing of medical radiation technologists will continue to fail.

Conditional Accreditation Type II (community hardship) - if necessary, new credentialing states may also wish to consider and utilize this particular type of accreditation if conditions within their state appear applicable (Alaska) and to counter arguments from opponents of credentialing that the unavailability of qualified individuals will have a detrimental effect on the health care in a given locality, which is already isolated and underserved. Effective resistance to this feature can be muted by the state's adherence to a strict, structured determination criterion as specified in Z.7a.v.

Sec. Z.9 - Requirements for Renewal of Accreditation.

The requirements for renewal are specific in this section (completed application and fee). It also contains a requirement for continuing education (CE), which is specified in Section Z.9.

CE is a mandatory requirement for any individual who wishes to renew or reinstate their professional registry (ARRT) or certification (NMTCB/CBRPA). As such, the vast majority of the technologists in any given state will be complying with this requirement. Its rationale is that with advancing technology and changing job duties, technologists need to continually update their knowledge and skills to remain competent and prevent professional obsolescence. These are worthy goals for professional societies. However, from a regulatory position, CE will not assure competency, nor is one's failure to obtain the required CE a health or safety issue (one cannot argue that a technologist is a hazard to their patient if that have not completed the required hours of CE for renewal). As such, states will need to decide as to whether CE should be a regulatory requirement for renewal of accreditation.

If CE is required, a record keeping mechanism to ensure compliance for each individual is strongly discouraged. Per Z.9d, technologists seeking renewal will attest on the renewal application that they have the required number of CE credits. Within 30 days of receipt of these attestations the Agency would then randomly select 10 percent of the respondents for a CE audit, and ask the individuals selected to provide copies of their CE documentation (failure to respond to this audit request or provide acceptable documentation may result in a refusal to renew, as noted in Z.11xv). Technologists registered/certified with the ARRT, NMTCB or CBRPA, who are in compliance with CE requirements or on CE probation need not be required to produce CE documentation if they are selected for the CE audit (each of these individuals is already subject to a 10% random CE audit by their respective certification bodies).

In addition, if CE is required, please note that the registry's CE biennium is based on the technologist's birth month, whereas the state's accreditation period will be based on when the individual first applied. These two periods will rarely overlap, but is rectified by the inclusion of Section Z.9e.

Sec. Z.11 - Suspension, Revocation and Denial of Accreditation.

This section, as well as the Z.13 (civil penalties) must contain the standard due process provisions that vary somewhat from state to state (right to a hearing, appeal mechanisms, etc).

Sec. Z.13 - Civil Penalties.

Not all states have implemented civil penalties, and some other states may choose not to apply civil penalties to accreditation violations. In either case, the assessment of civil penalties against registrants or licensees who allow individuals to perform medical radiation procedures without valid accreditation will act as a strong deterrent, and should be seriously considered. However, for violations of 30 days or less, by policy, states may wish to cite the violation, without assessing a civil penalty.

Appendix A - Radiographic Procedures by Type of Limited Accreditation.

States should note that the projections listed in the Appendix are anatomic structures which are specifically covered on the ARRT Limited Scope of Practice in Radiography examination. In adding any additional projections (ribs, hips, pelvic, etc), states will need to realize that these will not be specifically covered in the exam. However, there are presently 20 questions on the chest exam and 25 each for the extremity and spine exam. If the ARRT agreed to cover any additional projection, it might only add one specific question to the total. As such, if a limited exam applicant passes the core, chest, extremity and/or spine sections, arguments might be made that they could adequately perform a rib or perhaps a pelvic exam (neither of which is listed in Appendix A), without a health or safety concern. Adding any additional projections is a matter that needs to be thoroughly discussed with the state's Advisory Committee, as well as the consequences of not doing so (a limited chest radiographer who performs a rib exam).

Medical Dosimetrists.

The Committee was asked to consider a credentialing mechanism which would allow any board certified medical dosimetrist to perform brachytherapy. After discussions with members of the American Association of Medical Dosimetrist (AAMD), which included how they define brachytherapy therapy, the following response was obtained:

For a certified medical dosimetrist, brachytherapy includes, but is not limited to, the following activities: treatment planning associated calculations, source assay, and source inventory and source preparation.

As such it is the Task Group's consensus that the certified medical dosimetrist is considered qualified to do all of the above listed tasks, with the exception of administrating ionizing radiation to a patient. However, it is also recognized that presently, unless specifically prohibited by state statute or rule, NRC regulations allow other individuals to administer ionizing radiation to patients provided it is done so under the supervision of an authorized user.

Although this issue may need to be revisited at a later date, Part Z as currently proposed will specifically prohibit any individual who is not a physician or accredited medical radiation therapist from applying ionizing radiation to a patient.

Matters for Future Consideration.

As currently proposed, the radiologist assistant can only work under the supervision and authorization of a board certified radiologist. However, a number of other specialty physicians (orthopedic, urology and cardiology) are beginning to inquire about the possibility of utilizing these

individuals in a manner similar to that of a radiologist. At some point this option may need to be further explored.