



COLORADO
Department of Public
Health & Environment

Dedicated to protecting and improving the health and environment of the people of Colorado

To: Members of the State Board of Health

From: James Jarvis, Hazardous Materials and Waste Management Division
Jennifer Opila, Manager, Colorado Radiation Control Program

Through: Gary Baughman, Director, Hazardous Materials and Waste Management Division *JB*

Date: December 1, 2015

Subject: **Rulemaking Hearing**
Proposed Amendments to 6 CCR 1007-1, Part 18, Licensing Requirements for Uranium and Thorium Processing, for the rulemaking hearing to occur in December of 2015

The Division is proposing amendments to regulatory part 18, titled *Licensing Requirements for Uranium and Thorium Processing*.

The regulatory part is being amended to ensure consistency with the 2014 and 2015 changes to the enabling legislation (statute), the Colorado Radiation Control Act. The 2014 changes were initiated by parties external to the Department. Following a 2014 audit by the U.S. Nuclear Regulatory Commission (NRC), additional items were found to be incompatible in statute. The Department then initiated changes to the statute which were finalized and approved during the 2015 legislative session. Changes are also being proposed to address NRC comments and to ensure compatibility with federal rule.

The proposed changes to Part 18 specifically address the modification, deletion, and addition of several definitions consistent with state statute and federal rule; add clarifying language for requirements which are under federal jurisdiction and state jurisdiction; add language allowing receipt of non-processing materials; add language pertaining to financial surety; and add requirements for spill notification and expedited groundwater restoration.

In mid-July, 2015, approximately 1,100 stakeholders were notified of the proposed rule amendment and were provided the opportunity to comment over a 60 day period. Additionally, three stakeholder meetings were held in August, 2015 in Denver, Montrose, and Canon City, Colorado to present and discuss the proposed changes. The stakeholder comment period remained open through September 16. To date, the Division has received written comments from six stakeholders pertaining to proposed changes.

The rule originally proposed to stakeholders eliminated the section on hearing requirements (in 18.6) with the intent to defer to the Colorado Administrative Procedure Act (APA) for such hearing process requirements. This was proposed as past legal filings have indicated the potential for conflicts between the Part 18 rule, the APA, and standard court proceedings. Stakeholders expressed concerns with this approach and the lack of detail in the APA and that it would potentially limit the public involvement in the hearing process or otherwise necessitate having legal counsel to participate in the hearing process. The Department disagrees that the proposed deletion of Section 18.6 would leave the public unable to participate in the hearing process. However, as a result of stakeholder concerns, the section on hearings is retained. Clarifying language was added to the initial paragraph of this section

to indicate that where there are conflicts, and as applicable, the particular hearing forum (e.g., court) requirements will apply.

Stakeholders have also expressed concerns regarding proposed language which specifies that some public process requirements apply only to the facilities new, renewal, or amendment application pertaining to receipt of material. Some stakeholders have expressed concern that license amendments for some activities may require a more robust public involvement process, similar to those applicable to receipt of material. The language used in the proposed rule is equivalent to that found in the RCA. The Division will continue to receive feedback from stakeholders as to why and when public processes are needed, and incorporate that into Division decision-making.

Further details of the proposed changes are listed in a Statement of Basis and Purpose and Specific Statutory Authority for the proposed rule, which, along with a Regulatory Analysis and supporting information, is available at:

<https://www.colorado.gov/pacific/cdphe/regulations-development-parts-1318>

The Radiation Program requests that the Board of Health approve the rule at the rulemaking hearing on December 16 of 2015.

cc: Deborah Nelson, Administrator, State Board of Health

DRAFT

STATEMENT OF BASIS AND PURPOSE
AND SPECIFIC STATUTORY AUTHORITY
for Amendments to

6 CCR 1007-1, Part 18, Licensing Requirements for Uranium and Thorium Processing

Basis and Purpose.

The Colorado Radiation Control Act, Title 25, Article 11, Colorado Revised Statutes (the Act), requires the State Board of Health to formulate, adopt and promulgate rules and regulations pertaining to radiation control.

Section 25-11-103 of the Act requires the Colorado Department of Public Health and Environment (Department) to develop and conduct programs for evaluation and control of hazards associated with the use of sources of ionizing radiation. Under this authority the Department requires registration of sources of ionizing radiation such as radiation machines and licenses governing the use of radioactive materials.

Section 25-11-104 of the Act requires Colorado's radiation regulations to be consistent with U.S. Nuclear Regulatory Commission (NRC) requirements necessary to maintain compatibility (and status as an Agreement State); and the Suggested State Regulations for Control of Radiation (SSRCR) of the Conference of Radiation Control Program Directors, Inc., except when the Board of Health concludes, on the basis of detailed findings, that a substantial deviation from the SSRCR is warranted. In some instances, maintaining consistency with the SSRCR may not be possible due to the model regulation being out of date with NRC changes, where no model regulation exists, where there are specific programmatic needs that differ greatly from the SSRCR, or where possible conflicts exist between the SSRCR and state statute. Colorado's Part 18 - is partially based upon SSRCR Part "U" (2015).

The Department is proposing changes to Part 18 to maintain consistency with the 2014 and 2015 Colorado Radiation Control Act (statutory) changes. Additionally, changes are being made to address past comments of the NRC, and to address changes to federal rule since Part 18 was last amended in 2011 to ensure consistency and compatibility with current federal rule.

The specific proposed Part 18 changes address:

- (1) The removal of several definitions/terms (**active maintenance**; classified material; long term care; post closure; and surveillance) which were deleted from the Radiation Control Act (RCA) or otherwise did not fit with the national regulatory framework of regulating Uranium and Thorium facilities;
- (2) The addition of definitions (byproduct material; residual radioactive material, and uranium milling), and modification of an existing definition for consistency with the language in the RCA and federal rule;
- (3) As requested by the NRC, clarifying language is added to indicate the Division of Reclamation, Mining and Safety are not implementing any Atomic Energy Act regulatory authority as this is reserved to the Radiation Program.
- (4) Modification of the phrase "environmental report" to "environmental assessment", consistent with RCA use of the term;
- (5) Consistent with statutory changes, add language allowing receipt of certain non-processing radioactive materials;
- (6) Clarification, streamlining, and updating of the public process requirements, consistent with the 2014 and 2015 statutory changes;

- (7) The addition of language to clarify the hearing process when there are conflicts between Part 18 and other rules;
- (8) The addition of provisions that require financial surety (for decommissioning) to be in place prior to commencement of operations; and
- (9) Consistent with RCA changes, requirement added for expedited restoration of groundwater wells to historic use levels;
- (10) Consistent with RCA changes, requirement added for reporting of any spill or release of toxic or radioactive materials;
- (11) To correct a missing cross-reference and update consistent with federal rule, language is added pertaining to decommissioning completion documents; and
- (12) Correction of minor and cross-reference typographical errors throughout rule.

Following the Board of Health request for rulemaking on October 21, 2015 additional changes were made to the draft rule. The changes listed below (in order of occurrence) have been incorporated into Draft 2 of the rule. With the exception of formatting changes, per Board of Health request, changes are highlighted in the draft rule and where applicable, the supporting rule documents. Stakeholders were informed of the additional proposed changes via email on November 3.

1. In 18.1, a new provision - 18.1.7 - was added, consistent with 10 CFR 40.3 and SSR U.2.d. The added provision clarifies that a person subject to Part 18 may not carry out certain activities with byproduct material or source material without a specific or general license. The informational side margin comment was added describing change;
2. In 18.2, the definition "Active maintenance" is deleted. This definition does not appear in NRC rule or in SSR U, but may have been present in a past version of Part U. Although not defined, the term is used one time in Appendix A of 10 CFR 40 and Appendix A of SSR U consistent with its use there. A side margin comment was added describing the change;
3. In 18.3, a reference to whole Part 3 is added, consistent with SSR U. A side margin comment was added describing the change;
4. In 18.3.1.2, 18.3.1.3, 18.3.2.1 - the alignment/formatting is corrected;
5. In 18.3.5.3(2), and (3), the word "releases" is changed to "effluents", as it technically more correct. A side margin comment was added describing change;
6. In 18.3.5.4(8)(d) a typographical correction is made - a space is added between "42" and "U.S.C.";
7. In 18.3.8.6(2) a typographical correction is made - the word "Section" is added before "24-4-105, C.R.S.";
8. In 18.3.8.10 a typographical correction is made - the word "section" is capitalized;
9. In 18.6.1.1, the word "separate" is added for clarification;
10. In 18.6.1.2(2) a typographical correction is made - the number "4" was placed in parenthesis;
11. In 18.7.1 a typographical correction is made - the word "Sections" is added;
12. In 18.7.3.4 a typographical correction is made - the word "Section" is added before "24-4-101";
13. In 18.9.1.2.2, the phrase "during operation" is added consistent with other wording in the subsection. Side margin comment added describing change;
14. In 18.9.5, language is divided between 18.9.5 and new provision 18.9.6. Subsections 18.9.6.1 and 18.9.6.2 are created. Language is added for consistency with 10 CFR 40.42(j) and SSR U.12.g;
15. Original 18.9.6 is renumbered to 18.9.7 due to renumbering of 18.9.5, and cross references are updated.

In addition to the above changes, the following changes were made and are reflected in the Draft being proposed for the final rulemaking hearing:

1. In 18.3.8, language is added which specifies when the statutorily required public process applies. A comment received in mid-November stated that the applicability of the public hearing procedures/process was unclear and requested that further detail be specified in the rule. The commenter suggested that the public process be required when an environmental assessment (from the applicant/licensee) is required. The Division believes that the statute does not authorize such a public process when an environmental assessment is required.

Additionally, the original language of 18.3.8 pertaining to notification of the public, Governor, and General Assembly and the language pertaining to the Department taking action on notices not accompanied by a fee are retained and relocated to (a reinstated) Section 18.3.9.

2. In 18.4.1 a cross-reference is corrected due to renumbering - the cross-reference is changed to 18.3.8.4.

Specific Statutory Authority.

These rules are promulgated pursuant to the following statutory provisions: 25-1.5-101(1)(k), 25-1.5-101(1)(l), 25-11-103, 25-11-104, and 25-1-108, C.R.S.

SUPPLEMENTAL QUESTIONS

Is this rulemaking due to a change in state statute?

Yes, the bill number is HB 15-1145 and SB 14-192 ;
rules are ___ authorized required.
 No

Is this rulemaking due to a federal statutory or regulatory change?

Yes
 No

Does this rule incorporate materials by reference?

Yes
 No

Does this rule create or modify fines or fees?

Yes
 No

DRAFT

REGULATORY ANALYSIS

for Amendments to

6 CCR 1007-1, Part 18, Licensing Requirements for Uranium and Thorium Processing

1. **A description of the classes of persons who will be affected by the proposed rule, including classes that will bear the costs of the proposed rule and classes that will benefit from the proposed rule.**

The Part 18 rule and proposed amendments pertain to and affect those facilities that are currently (or may in the future be) licensed by the Department to operate uranium and thorium processing facilities, including uranium mills. Uranium and thorium processing facilities licensed by the Department to process materials will bear the costs of the proposed amendments to the rule. Both the regulated entities (licensed facilities) and the Citizens of Colorado will benefit from the proposed rule changes by having rules and requirements that are aligned and consistent with state law and the national regulatory framework established for such regulated facilities. Having succinct and understandable requirements for the public processes, and the appeals to those processes will benefit the communities where licensed facilities may be located.

This rule would likely impact any facility operating to process uranium and thorium in the future, however, there are presently no such operating facilities in Colorado. Colorado has two former uranium processing licensees that have completed decommissioning, and are undergoing license termination. These two facilities will not be impacted by the proposed amendment. Colorado has one former uranium processing licensee that is currently undergoing decommissioning. New provisions for notification of spills and active restoration of groundwater wells will impact this licensee.

2. **To the extent practicable, a description of the probable quantitative and qualitative impact of the proposed rule, economic or otherwise, upon affected classes of persons.**

QUANTITATIVE IMPACTS

Many of the proposed changes are technical in nature and most are not expected to have a significant quantitative impact. The added, deleted, or modified definitions in the proposed rule will aid licensees by clarifying requirements and make them consistent with state statute and federal rule. Similarly, the added clarifying language throughout the rule is expected to enhance the understanding of the rule requirements.

The provision added to the proposed rule based on the 2014 RCA changes which mandates expedited and active restoration of wells affected by a contamination release from the facility may result in significant monetary expenses by impacted licensees. Systems for active treatment of groundwater tend to be highly variable in cost, are very site specific and depend upon the nature of the release, geologic characteristics of the area and the type of treatments used. Such systems can range in initial capital costs ranging from \$100,000 to \$1 million+ or more, plus additional annual maintenance costs which may be in the same cost range.

QUALITATIVE IMPACTS

The qualitative impact of the proposed changes is that the language and updated definitions will better align with the regulatory requirements contained in federal rule and those of other agreement states, making Colorado's requirements consistent -

notwithstanding differing statutory requirements - with the national regulatory framework.

3. The probable costs to the agency and to any other agency of the implementation and enforcement of the proposed rule and any anticipated effect on state revenues.

The rule requirements are enforced only by the Department. No other agency is expected to encounter costs as a result of the proposed changes.

The costs to the Department are not expected to change significantly as a result of the proposed changes. The added (statutorily driven) requirement for posting spill information on the website is expected to result in minimal effort and costs by the Department. Other rule changes which may require specific review by the Department would typically be recouped by the hourly fees charged.

4. A comparison of the probable costs and benefits of the proposed rule to the probable costs and benefits of inaction.

The anticipated/likely probable costs to the Department as a result of the proposed rule are those associated with posting of information pertaining to spills and releases. These costs are expected to require minimal effort that can be absorbed into the routine tasks of the radiation program. Less probable and unpredictable are the costs that licensees may encounter in implementing an active remediation system in the event of a groundwater release.

The benefits of amending the rule will be to address outstanding comments from the NRC and the alignment of terminology that is consistent with the national framework of regulating uranium and thorium processing facilities. The rule amendments will help ensure that Colorado's status as an agreement state is maintained. Additionally, the amended rule will bring the rule language and requirements into alignment with recent statutory changes.

Inaction on the proposed rule will result in potential conflict with statutory requirements and may jeopardize Colorado's agreement state status. Inaction would also limit Colorado's consistency with the national regulatory framework.

5. A determination of whether there are less costly methods or less intrusive methods for achieving the purpose of the proposed rule.

The purpose of the proposed rule changes is to align the requirements with recent statutory changes and to attain compatibility with federal rule. There are no less costly or less intrusive methods to achieve the purpose of the proposed changes, short of eliminating some provisions in the rule, which may result in conflict with statutory requirements.

6. Alternative Rules or Alternatives to Rulemaking Considered and Why Rejected.

The proposed rules are needed to achieve consistency with state statute and federal rules needed for compatibility as an agreement state. There are no alternate rules or alternatives to rulemaking that will achieve the goals and requirements.

7. **To the extent practicable, a quantification of the data used in the analysis; the analysis must take into account both short-term and long-term consequences.**

The short and long term consequences of not implementing the proposed requirements will be inconsistency with state law and continued incompatibility with federal rules and requirements needed to maintain status as an agreement state under NRCs program.

DRAFT

STAKEHOLDER COMMENTS

for Amendments to

6 CCR 1007-1, Part 18, Licensing Requirements for Uranium and Thorium Processing

The following individuals and/or entities were included in the development of these proposed rules:

On July 17, 2015, approximately 1,100 stakeholders were notified of the opportunity to comment on the proposed draft rule over a 60 day period. The entities notified represented:

- Approximately 550+ Stakeholders who have previously participated in stakeholder processes associated with uranium facilities, and Technologically Enhanced Naturally Occurring Radioactive Material (TENORM) groups;
- Approximately 300+ radioactive materials licensees;
- Approximately 278+ “other stakeholders” representing individuals who have specifically signed up to receive notification of proposed radiation regulation changes and who represent a wide variety of interests. These stakeholder entities include: x-ray registrants, radioactive materials licensees; private citizens; private companies; professional organizations; and special interest groups.

Stakeholder meetings were also held mid-way through the comment period in Denver, Montrose, and Canon City, providing stakeholders the opportunity to ask questions and provide comments on the proposed rule changes.

This rulemaking includes a state mandate on Boards of County Commissioners. A local Board of County Commissioners participates in licensing processes and activities associated with certain licensing actions. Board of County Commissioner participation is mandated by Section 25-11-203, C.R.S. This mandate exists in current rule. The proposal does not include a new local government mandate or an increase in the level of service. The proposed rule does include: the statutory language that a Board of County Commissioners may be reimbursed by the applicant for any costs the board incurs to respond to the application and the statutory language that the applicant is responsible for the costs associated with the meetings held to receive public comment on the application.

The following individuals and/or entities were notified that this rule-making was proposed for consideration by the Board of Health:

In addition to the notice of opportunity to comment on the proposed rule discussed above, stakeholders were provided with the anticipated rulemaking schedule for both the request for rulemaking and the rulemaking hearing dates. This rulemaking timeline information is also posted on the Department website area specific to the rule changes. A formal notice of rulemaking will be issued upon initial approval by the Board of Health during a request for rulemaking hearing.

On November 9-10, 2015 approximately ~1,100 stakeholders were provided notice that this rule-making was proposed for consideration by the Board of Health. The stakeholders comprised the same group of entities as during the initial stakeholder outreach as described above.

Summarize Major Factual and Policy Issues Encountered and the Stakeholder Feedback Received. If there is a lack of consensus regarding the proposed rule, please also identify the Department’s efforts to address stakeholder feedback or why the Department was unable to accommodate the request.

Stakeholders have expressed some concern over the original rule proposal to defer to the Colorado Administrative Procedure Act (APA) for requirements specific to the hearing process and the proposed elimination of more explicit requirements found in the current rule. Since some individual courts have their own written procedures for hearings, the original concept was to avoid conflict between these existing court procedures and the rule. Additionally, past legal filings have indicated the potential for conflicts between the current Part 18, the APA, and standard court proceedings. As a result of stakeholder concerns, the section on hearings is retained. Additional language is added to clarify that where available and applicable, the procedures of the particular hearing forum would apply rather than the Part 18 hearing requirements.

Stakeholders have also expressed concerns regarding proposed language which specifies that some public process requirements apply only to the facilities new, renewal, or amendment application pertaining to receipt of material. The concern is that license amendments for some activities may require a more robust public involvement process, similar to those applicable to receipt of material. The language used in the proposed rule is equivalent to that found in the RCA which specifies that the more robust public processes apply to the facilities receipt of material. It should be recognized that the Division will consider stakeholder feedback when determining the level of public process needed.

The table below outlines the specific comments received during the stakeholder **comment period**, and the Department’s response to those comments. Due to the parallel rulemaking of this regulatory part with other regulatory parts, and the overlapping nature of certain proposed provisions or topics, some information may overlap and also appear in other rule part documents.

The following table is an outline of the comments received during the stakeholder comment period and the response to those comments.

#	Rule Part(s)	Topic	Summary of Comment(s)	Department Response
18A	Parts 1,3,18	Rules deviate from Conference of Radiation Control Program Directors (CRCPD) Suggested State Regulations for Control of Radiation (SSRs)	CDPHE proposes deviation from the model rules but there is no explanation as to what the substantial deviation is for in this rulemaking. A description of what is in the model regulation followed by a description of the deviation is required.	Section 25-11-104 of the Act requires Colorado’s radiation regulations to be consistent with U.S. Nuclear Regulatory Commission (NRC) requirements necessary to maintain compatibility (and status as an Agreement State); and the Suggested State Regulations for Control of Radiation (SSRCR) of the Conference of Radiation Control Program Directors, Inc., except when the Board of Health concludes, on the basis of detailed findings, that a substantial deviation from the SSRCR is warranted. In some instances, maintaining consistency with the SSRCR may not be feasible due to the model regulation being out of date with NRC changes, where possible conflicts exist between

				<p>the SSRCR and state statute, where no model regulation exists, where there are specific programmatic elements or business processes that differ greatly from the SSRCR.</p> <p>The Radiation Control Act (RCA) does not require the Department to indicate each deviation from the SSRCR, however in some cases, where staff has found it would be helpful, notes have been provided in the side margins of the proposed revised regulations.</p>
18B	Part 18	Procedural rules pertaining to licensing hearing process	<p>Several stakeholders representing different public interest/stakeholder groups are opposed to the proposed elimination of section 18.6 of Part 18 pertaining to the public hearing process.</p> <p>The proposal to eliminate the rule section pertaining to license hearings is not justified and should be withdrawn. Elimination of the hearing section will result in confusion leaving the public unable to participate in the hearing process.</p>	<p>The Department is committed to having an open and fair public process that is consistent with federal law, state law, and Colorado's agreement with NRC. Although the Department disagrees that the deletion of Section 18.6 would leave the public unable to participate in the hearing process, In response to these comments, the Department has retained the hearing procedure provisions of Section 18.6 (now 18.7) of the Regulations. Additionally, the Department has added language to Section 18.7.1 to clarify that in the event of a conflict between the procedures of an administrative court and 18.7, the procedures of the court will be followed.</p> <p>A commenter cited the public process requirements specified in the regulations of some other Boards and Commissions involved in oversight of or regulatory development processes of the Department. In review of the Board specific regulations applicable to some Department activities, it is clear that these other Boards/Commissions have specific authority that goes beyond rulemaking and covers some activities or decisions made by the applicable division. While the Board of Health provides for the rulemaking process over radiation regulations, it does not have authority over facility specific activities of the radiation program, such as licensing or</p>

				<p>registration related activities. The Radiation Control Act does not specify a specific board or commission for adjudicatory hearings for radiation matters; the RCA instead defers to the APA for hearing matters.</p>
18C	Part 18	<p>Applicant environmental assessment for reclamation plans, and hearings for reclamation and decommissioning plans</p>	<p>All major license amendments should be subject to a meaningful public hearing process. The proposed regulations eliminate the opportunity for a hearing for significant changes such as reclamation and decommissioning plans for a licensed facility.</p> <p>Missing from the list of actions that require an applicant’s environmental assessment is reclamation plans.</p> <p>A commenter also cited the requirements of a 1991 NRC, EPA, and Agreement State Memorandum of Understanding (MOU) as it related to public processes and reclamation plans.</p>	<p>The proposed requirements for environmental assessments, public meetings and hearings are consistent with the Radiation Control Act. As such, the requirements for public meetings outlined in section 18.3.8 are required for new or renewal applications for source material milling, amendments pertaining to the receipt of material or an amendment that would result in significant changes as outlined in 18.3.5.3. The language pertaining to the threshold at which an applicant’s environmental assessment is consistent with the language of the suggested state regulations Part U.</p> <p>It is not necessary or practical for all license amendments to be subject to a rigorous public process as some amendments are minor in nature such as approval of a new authorized user. That being said, the Department routinely conducts public meetings outside of the requirements of part 18.3.8 when it is considering an application that may have a significant impact on stakeholders. For example, the Department conducted a series of public meetings when considering approval of the decommissioning funding plan for the Energy Fuels Uranium Mill in 2013.</p> <p>Additionally, the requirements of section 3.8.8. require the applicant to prepare an environmental assessment for any application for the conduct of any activity which will affect the quality of the human environment by reason of exposure to radiation. A change to the decommissioning and reclamation plan most likely would meet this requirement, depending on the extent of the change.</p>

				<p>Most licensing decisions are subject to appeal under the Administrative Procedures Act.</p> <p>The 1991 MOU was an agreement signed by applicable federal and state agencies and pertained to the closure of former uranium milling sites and the establishment of radon caps to limit exposure/releases within a specific timeline. The MOU did require for these specific applications, a public process. However, the actions under the MOU were completed and the MOU is no longer in effect. The Department believes that the intent of the MOU was to put forth certain requirements - including those for public notification - only until the required actions were completed and not to be applied for all time periods in the future. No change to the proposed rule was made as a result of this comment.</p>
18D	Part 18	Contents of Licensee's Environmental Assessment	<p>To be consistent with Federal Law, the requirement for content of the applicant's environmental report in the revised section 18.3.5.4 should include:</p> <ol style="list-style-type: none"> 1. An evaluation of alternatives, including alternative sites and engineering methods, to the proposed licensing activities. 2. An analysis of the long-term impacts, including decommissioning, decontamination, and reclamation impacts, including the management of any byproduct material. 	<p>The content in revised section 18.3.5.4 has not changed with this revision and is consistent with Section 25-11-203(1)(b)(III)(2)(c). The topics suggested by the comment to be added are evaluated in the Department's Environmental Impact Analysis as required by Section 18.4.1.3 and 18.4.1.4. No change to the proposed rule was made as a result of this comment.</p>
18E	Part 18	Contents of Department's Environmental Impact Analysis	<p>Sections 18.4.1.1 to 18.4.1.4 should be revised to be more consistent with Federal Law.</p>	<p>Sections 18.4.1.1 to 18.4.1.4 have not been changed with this revision and are essentially the same as the wording suggested by the comment. No change to the proposed rule was made as a result of this comment.</p>

18F	1, 18	<p>Definitions of “source material milling” and “uranium milling”</p> <p>[^a existing Part 1 definition; ^b proposed Part 18 definition]</p>	<p>The definitions in the radiation regulations regarding possession, processing, and disposal of mined uranium ore and its waste are ambiguous, somewhat contradictory both internally as well as with federal law, duplicative, or incomplete.</p> <p>The proposed definition of “uranium milling” (Part 18) is functionally equivalent to the existing definition of “source material milling”. If source material milling refers to other activities rather than the processing of uranium and thorium ore source material, this should be clarified.</p> <p>The commenter stated that the NRC general counsel has found the uranium milling definition confusing and that they have proposed an alternative working definition.</p>	<p>The proposed definition (for uranium milling) was requested to be added to Part 18 by NRC as a matter of compatibility and is specific to Part 18 which provides requirements specific to uranium and thorium processing facilities. The regulations of Part 3 - where the term source material milling is used most often - is a more broad regulation encompassing licensing activities that include but go beyond uranium milling. As the commenter indicated, the definitions are functionally similar. However, NRC has specifically directed Colorado to incorporate the uranium milling definition into its Part 18 rule. The Department agrees that the terms are somewhat redundant, however does not see how this redundancy will hamper implementation. No change to the proposed rule was made as a result of this comment.</p>
18G	1, 18	<p>Definition for “byproduct material”</p>	<p>The language used in the definition of “byproduct material” appears clearly understandable and unambiguous, but it opens many questions as to its meaning.</p>	<p>The definition of byproduct material as used in Part 18 defers to a specific, applicable portion of the definition found in Part 1. The full definition found in Part 1 is based upon the language of state statute and is consistent with the federal rule definition of NRC.</p> <p>The commenter identified further detailed definitional information pertaining to the term “beneficiation” through reference to EPA rule 40 CFR 261.4(b)(7). While this requirement applies under EPA jurisdiction, NRC has not incorporated this definition into its rules.</p> <p>The Department is bound by state law, which includes definitions for “ore” and “byproduct material”, and the requirements, including definitions, of NRC necessary to maintain compatibility. No change to the proposed rule was made as</p>

				a result of this comment.
18H	18	Part 12 schedule of fees	The description and license fee schedule for radioactive material licensees found in Appendix 2.A2 of Part 12, Source Material, does not include non-conventional milling activities that meet the proposed Part 18 definition of uranium milling	This comment is outside of the scope of this rulemaking. No change to the proposed rule was made as a result of this comment.
18I	18	Applicability of Part 18 standards	Recently proposed non-conventional processes do produce waste meeting the definition of byproduct material -- for example, Impact Ablation and Underground BoreHole Mining -- and must be held to the same standards and criteria as conventional mills and tailings storage facilities as described in Appendix A of Part 18	This comment refers to the implementation of the regulations and is outside the scope of this rulemaking. No change to the proposed rule was made as a result of this comment.
18J	Non-regulation		A commenter provided numerous documents pertaining to specific facilities in Colorado as well as facilities outside Colorado many of which are not regulated by the Department.	The information provided did not clearly address any specific changes to the proposed rules. No change to the proposed rules was made as a result of the information submitted.

Please identify health equity and environmental justice (HEEJ) impacts. Does this proposal impact Coloradoans equally or equitably? Does this proposal provide an opportunity to advance HEEJ? Are there other factors that influenced these rules?

The proposed rule changes impact Coloradoans equally and equitably. The proposed rule

amendments are primarily technical in nature and do not provide specific opportunities to advance HEEJ, although inherent in the rules are certain requirements for protection of the environment and public health and safety. The proposed rule changes are based upon the 2014 and 2015 statutory changes, and changes to federal rule.



COLORADO
Department of Public
Health & Environment

Dedicated to protecting and improving the health and environment of the people of Colorado

December 1, 2015

The Colorado Radiation Advisory Committee would like to express support for the proposed regulatory changes to 6 CCR 1007, Part 1 (*General Provisions*), Part 3 (*Licensing of Radioactive Material*), and Part 18 (*Licensing Requirements for Uranium and Thorium Processing*). The Committee has reviewed and discussed the proposed changes during the August and October 2015 meetings and believes the changes are reasonable and appropriate. The proposed rule changes are complex due to the varying requirements driven by statutory and federal rule changes. We believe the Radiation Program has done an exemplary job in navigating these complexities.

There is consensus from the Radiation Advisory Committee that the proposed changes are reasonable and consistent with recent federal and statutory rule changes. We recognize the value of the Colorado Radiation Program in promoting the safe use of radioactive materials and radiation sources through regulation, and acknowledge the commitment of the staff and Department in developing and promoting safe, reasonable, and scientific and risk based regulatory requirements wherever possible.

In summary, we encourage the State Board of Health to approve the proposed changes to the rules during the rulemaking hearing in December 2015.

With Regards,

Thomas E. Johnson, PhD, CHP, Chair
Colorado Radiation Advisory Committee

Created by the Colorado Radiation Control Act (25-11-105, CRS), the nine-member Radiation Advisory Committee advises the Colorado Department of Public Health and Environment's Radiation Program on radiation safety matters and reviews proposed changes to regulations. The current Committee represents past and present radiation safety personnel and users of radiation sources at state and federally regulated entities associated with institutions of higher learning, medical facilities, industry and consulting.



November 10, 2015

Jennifer T. Opila, MPA
Program Manager
Radiation Program
Department of Public Health & Environment
4300 Cherry Creek Dr. So.
Denver, CO 80246

Dear Ms. Opila,

We realize we are well past the deadline for official comment on changes to the Radiation Control Act, but still want to pass along a few thoughts.

Western Colorado Congress' Uranium Committee wishes to thank you, Mr. Smith and Mr. Jarvis for your very informative presentation in Montrose on the proposed changes to the RCA. And we also wish to thank you for making Montrose one of your presentations sites. This greatly facilitated our committee members being able to attend your presentation.

Our committee was very pleased to find out that you had reduced the long-term care warranty interest rate for cleanups and reclamations from 6 percent to 1 percent under Section 3.9.5.15. This will definitely help protect the taxpayers of Colorado from the long-term financial liabilities caused by uranium facilities.

The committee was also pleased with the groundwater protections added to the RCA with respect to uranium and thorium processing, especially the requirements for restoration of groundwater to historic use levels, expedited remediation of groundwater contamination and the reporting of any spill of toxic or radioactive materials.

Our committee members were also pleased that a visual narrative timeline was included in your presentation and on your website for new licenses, renewals or amendments for receipt of material. This will be very helpful to the general public in following the steps and time limits that need to be taken in these processes.

It was also very helpful to find out that all hearings are now following the requirements of the Administrative Procedures Act. And finally, thank you for producing a clean non-redlined version of 6 CCR 1007-1 Parts 01, 03 and 18 and placing it on your website.

Again, thank you for coming to Montrose and making such a well-prepared presentation,


Jennifer Parker, Chair
WCC Uranium Committee

1 **DRAFT 2 11/02/15**

2 **DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT**

3 **Hazardous Materials and Waste Management Division**

4 **RADIATION CONTROL - LICENSING REQUIREMENTS FOR URANIUM AND THORIUM**
5 **PROCESSING**

6 **6 CCR 1007-1 Part 18**

7 **Adopted by the Board of Health December 16, 2015**

8 *[Editor's Notes follow the text of the rules at the end of this CCR Document.]*

10 **PART 18: LICENSING REQUIREMENTS FOR URANIUM AND THORIUM PROCESSING**

11 **18.1 Purpose and Scope.**

12 18.1.1 The regulations in this part establish criteria, terms and conditions upon which the Department
13 issues licenses to receive title to, receive, possess, use, transfer, or deliver source and byproduct
14 materials **as defined in this part**, to operate uranium and thorium processing facilities and for the
15 disposition of the resulting byproduct material. The requirements of this part are in addition to,
16 and not in substitution for, other applicable requirements of these regulations.

17 18.1.2 This part establishes performance objectives and procedural requirements applicable to any
18 uranium or thorium material processing operation, to waste systems for byproduct material **as**
19 **defined in this part as in definition (2) of 1.2.2**, and to related activities concerning uranium-
20 bearing and thorium-bearing materials. It establishes specific technical and financial requirements
21 for ~~siting~~siting, construction, operation, and decontamination, reclamation and ultimate
22 stabilization, as well as requirements for license transfer and termination, long-term site
23 monitoring and surveillance, and ownership and ultimate custody of source material milling
24 facilities and byproduct material impoundments.

25 18.1.3 The requirements of this part apply to byproduct material **as defined in this part**, that is located
26 at a site where milling operations are no longer active, if such site is not covered by the remedial
27 action program of Title I of the Uranium Mill Tailings Radiation Control Act (UMTRCA) OF 1978
28 (92 STAT. 3021; 42 U.S.C. 7901). The regulations in this part do not establish procedures and
29 criteria for the issuance of licenses for materials covered under Title I of the Uranium Mill Tailings
30 Radiation Control Act of 1978 (92 Stat. 3021) ~~unless that program fails to accomplish remedial~~
31 ~~action~~. Disposal at a uranium or thorium processing site of radioactive material which is not type 2
32 byproduct material must not inhibit reclamation of the tailings impoundment or the ability of the
33 U.S. Government to take title to the impoundment as long-term custodian.

34 ~~18.1.4~~ Nothing in this Part ~~applies~~~~shall apply~~ to, **includes, or affects** the following naturally occurring
35 radioactive materials (NORM) or technologically enhanced naturally occurring radioactive
36 materials (TENORM):

37 18.1.4.1 ~~Residuals or sludges from the treatment of drinking water by aluminum, ferric chloride,~~
38 ~~or similar processes; except that the material may not contain hazardous substances~~
39 ~~that otherwise would preclude receipt;~~

40 18.1.4.2 Sludges, soils, or pipe scale in or on equipment from oil and gas exploration, production,
41 or development operations or drinking water or wastewater treatment operations; except
42 that the material may not contain hazardous substances that otherwise would preclude
43 receipt;

Comment [JJ1]: EDITORIAL NOTE 1: ALL COMMENTS (SUCH AS THIS ONE) SHOWN IN THE RIGHT SIDE MARGIN OF THIS DOCUMENT ARE FOR INFORMATION PURPOSES ONLY TO PROVIDE ADDITIONAL INFORMATION AND TO AID THE READER IN UNDERSTANDING THE PROPOSED RULE DURING THE DRAFT REVIEW PROCESS.

THESE COMMENTS ARE **NOT** PART OF THE RULE AND ALL COMMENTS WILL BE DELETED PRIOR TO FINAL SUBMISSION.

Comment [JJ2]: This reflects the date of anticipated approval by the Colorado Board of Health. The effective date is approximately 60 days beyond this date, pending additional review and approvals.

This date is subject to change as determined by the Board of Health. Changes to this date will be properly reflected in the rule, as applicable.

Comment [JJ3]: Due to the added definition for "byproduct material" in 18.2 appearing subsequently in the rule, the wording here is clarified.

Similar changes are made in the rule up to the definition section 18.2.

Comment [JJ4]: This and three additional occurrences of this spelling error are corrected in the rule.

Comment [JJ5]: Proposed change deletes requirements which are no longer applicable. Based on Nuclear Regulatory Commission (NRC) comments - under the 274b Agreement, the State of Colorado does not have jurisdiction over Title I facilities.

Discussion with CDPHE remediation program staff indicated that this may have been initiated in the past due to uncertainty with UMTRCA process at the time.

Change made based on NRC letter dated 10/13/11 (# 18).

10 CFR 40.2a(b)
[Compatibility=A]
NRC Compatibility information can be found at: <https://scp.nrc.gov/regresources.html>

Comment [JJ6]: Language modified for consistency with 2015 statutory changes (Colorado Radiation Control Act) via House Bill 15-1145.

44 18.1.4.3 Materials from or activities related to construction material mining regulated under article
45 32.5 of title 34, CRS.

46 18.1.4.4 The treatment, storage, management, processing, or disposal of solid waste, which may
47 include NORM and TENORM, either pursuant to issuance of a certificate of designation
48 or considered approved or otherwise deemed to satisfy the requirement for a certificate of
49 designation.

50 18.1.5 The regulation of uranium in situ leach mining (in situ recovery), as defined in Section 34-32-103,
51 CRS., involves the Department of Natural Resources, Division of Reclamation, Mining and Safety
52 or their successor. The requirements of that agency may, due to the use of terms-of-art and other
53 technical words, phrases and definitions, be interpreted inconsistently or be held in conflict with
54 the Department's requirements. The Department will coordinate with that agency to the maximum
55 extent practicable to resolve any such conflicts or inconsistencies. An applicant or licensee that
56 identifies such inconsistency or conflict shall provide that information to both agencies for
57 resolution. **The Department of Natural Resources, Division of Reclamation, Mining and
58 Safety or their successor, is not implementing any Atomic Energy Act regulatory authority
59 under the Articles of Agreement, Section 274, of the Atomic Energy Act of 1954, as
60 amended.**

62 **18.1.6** License amendments for the receipt of **classified-radioactive** material at a facility are subject to
63 sections 18.3 and 18.4 except when the material is from an approved source and **suchthe**
64 amendment would not result in a change in ownership, design, or operation of the facility. License
65 amendments not subject to 18.3 and 18.4 of this part are subject to 18.5 of this section.

66 **18.1.7** **A person subject to the regulations in this Part may not receive title to, own, receive,
67 possess, use, transfer, provide for long-term care, deliver or dispose of byproduct material
68 as defined in this Part, or any source material after removal from its place of deposit in
69 nature, unless authorized in a specific license issued by the Department under the
70 regulations in this Part or general license issued by the Department under Part 3, Section
71 3.5 of these regulations.**

72 **18.2 As used in this regulation:**

73 **"Active maintenance" means any significant activity needed during the period of long term care including
74 ongoing activities such as the pumping and treatment of water from a site or one-time measures such as
75 replacement of a disposal site's cover. Active maintenance does not include custodial activities such as
76 repair of fencing, repair or replacement of monitoring equipment, revegetation, minor additions to soil
77 cover, minor repair of disposal site cover, and general disposal site upkeep such as mowing grass.**

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

- 81 (1) hydraulically interconnected to a natural aquifer;
- 82 (2) capable of discharge to surface water; or
- 83 (3) reasonably accessible because of migration beyond the vertical projection of the
84 boundary of the land transferred for long-term government ownership and care in
85 accordance with Criterion 9 of Appendix A to this Part 18.

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

Comment [JJ7]:
Statement is added to clarify that the Department of Natural Resources (DNR) does not have regulatory authority over radioactive materials under the Atomic Energy Act and the Articles of Agreement between the Atomic Energy Commission (now NRC) and the State of Colorado Radiation Program.

In a letter dated October 13, 2011 (Item 17), and as reaffirmed in a letter dated June 28, 2012 (item 17), the U.S. Nuclear Regulatory Commission (NRC) requested that the regulatory authority in relation to the Atomic Energy Act be clarified.

10 CFR 40.2
NRC Regulations can be found at:
<http://www.nrc.gov/reading-rm/doc-collections/cfr/>

Comment [JJ8]: Wording change consistent with 2015 statutory Radiation Control Act (RCA) changes via House Bill 15-1145.

CRS 25-11-203(1)(b)(III)

Comment [jsj9]:
A provision is added for consistency with 10 CFR 40.3 and SSR CR U.2.d.

NRC Compatibility = C

Comment [jsj10]: The definition "Active maintenance" is removed from Part 18, consistent with NRC rule and SSR CR U. The definition. The term is used only one time in Part 18 (App A, Criterion 1D) and its use there is consistent with NRC (App A, Criterion 1) and SSR CR U (App A, Criterion 1D).

NRC previously requested that the definition for "long-term care" be removed from the Part 18 rule as proposed in the past and current draft of Part 18. NRC subsequently requested that the use of the term "long-term care" also be removed from (within) the definition for "active maintenance". Rather than create an alternate term for long-term care for use in the "active maintenance" definition - which may pose conflicts with federal rule - the definition "active maintenance" is deleted in its entirety.

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

Comment [JJ11]:

The words "radon barrier" is deleted from this definition to be consistent with Appendix A of 10 CFR Part 40 wording. The original full definition language (including the words "radon barrier") are not used in Part 18, so no additional changes are necessary. The revised definition is currently used in Part 18 and those uses are consistent with 10 CFR Part 40.

NRC Compatibility = A
 NRC letters dated 06/28/12 (#26); 10/13/11 (#26).

101 **"Byproduct Material" is the same as in definition (2) of 1.2.2 and means the tailings or wastes**
 102 **produced by the extraction or concentration of uranium or thorium from any ore processed**
 103 **primarily for its source material content, including discrete surface wastes resulting from uranium**
 104 **solution extraction processes. Underground ore bodies depleted by such solution extraction**
 105 **operations do not constitute "byproduct material" within this definition.**

Comment [JJ12]:

Consistent with the approach used in 10 CFR Part 40, the definition for byproduct material is added. This approach eliminates the need to refer back to Part 1 for the definition throughout Part 18. As a result of this added definition, some current references to the Part 1 definition will be deleted.

The specific sub-definition of byproduct material is appropriate for uranium and thorium processing facilities regulated under Part 18.

NRC Compatibility = C
 NRC Letter 01/14/14

106 "Certificate of designation" means the approval pursuant to article 20 of title 30, CRS., or section 25-15-
 107 204 (6).

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

110 "Closure plan" means the Department approved plan to accomplish closure.

111 "Compliance period" begins when the Department sets secondary ground-water protection standards and
 112 ends when the owner or operator's license is terminated and the site is transferred to the State or Federal
 113 agency for long-term care.

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

116 "Disposal area" means the area containing byproduct materials to which the requirements of Criterion 6 of
 117 Appendix A to this Part 18 apply.

118 "Disposal site" means all land that is subject to transfer to a government agency after termination of the
 119 license.

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

122 "Facility" in this part means the physical location at one site or address and under the same administrative
 123 control at which:

- 124 (1) the possession, use, processing or storage of uranium-bearing and thorium-bearing
 125 radioactive material is or was authorized by license pursuant to this part; or
- 126 (2) uranium and thorium is milled, or otherwise processed and the resulting byproduct
 127 material is dispositioned.

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

- 132 (1) physical conditions at the site;
- 133 (2) inclement weather or climatic conditions;
- 134 (3) an act of god;

- 135 (4) an act of war;
- 136 (5) a judicial or administrative order or decision, or change to the statutory, regulatory, or
137 other legal requirements applicable to the licensee's facility that would preclude or delay
138 the performance of activities required for compliance;
- 139 (6) labor disturbances;
- 140 (7) any modifications, cessation or delay ordered by state, federal, or local agencies;
141
- 142 (8) delays beyond the time reasonably required in obtaining necessary government permits,
143 licenses, approvals, or consent for activities described in the reclamation plan proposed
144 by the licensee that result from agency failure to take final action after the licensee has
145 made a good faith, timely effort to submit legally sufficient applications, responses to
146 requests (including relevant data requested by the agencies), or other information,
147 including approval of the reclamation plan; and
- 148 (9) an act or omission of any third party over whom the licensee has no control.

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

151 "Ground water" means water below the land surface in a zone of saturation. For purposes of Appendix A
152 to this Part 18, ground water is the water contained within an aquifer as defined above.

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

155 "Licensed site" means the area contained within the boundary of a location under the control of persons
156 generating or storing radioactive materials under a Department license.

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

160 ~~"Long term care" means the observation and maintenance of a site following the post closure period and
161 termination of the license.~~

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

163 "Monitoring" means observing and making measurements to provide data to evaluate the performance
164 and characteristics of a site.

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

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

171 ~~"Post closure" means the period of time from completion of the site closure plan for decontamination,
172 reclamation, and stabilization of the site and disposal area and prior to the termination of the license.~~

173 "Reclamation plan", for the purposes of Criterion 6A of Appendix A of this Part 18, means the plan
174 detailing activities to accomplish reclamation of the tailings or waste disposal area in accordance with the
175 technical criteria of Appendix A of this Part. The reclamation plan must include a schedule for reclamation
176 milestones that are key to the completion of the final radon barrier including as appropriate, but not limited to,
177 windblown tailings retrieval and placement on the pile, interim stabilization (including dewatering or the

Comment [JJ13]:

NRC has requested this definition be deleted from Part 18. Although the term is used in 10 CFR Part 40, NRC does not define the term. Retaining the definition in Colorado rules may result in non-compatibility with NRC requirements.

This term is used in 18.2, 18.6.1.2, and Criterion 6 of Part 18.

[NOTE: Although not defined in 10 CFR Part 40, the words "long term care" are used multiple times in 10 CFR 40 in 40.1, 40.2a, 40.3, 40.20, 40.27, 40.28, and Appendix A.]

NRC letters dated 06/28/12 (#20); 10/13/11 (#20).
10 CFR 40.4

Comment [JJ14]:

NRC has requested that the definition "post closure" be deleted from Part 18 since it is not defined in NRC's equivalent part (10 CFR 40). According to NRC, retaining the definition may result in conflicts with 10 CFR Part 40.

[NOTE: The term is used in Appendix A to 10 CFR Part 40 in Criterion 6 (7), but does not define it.]

Part 18 uses this term in Criterion 6(7) in a manner equivalent to Appendix A of 10 CFR Part 40.

NRC letter dated 06/28/12 (#21); 10/13/11 (#21).

178 removal of freestanding liquids and recontouring), and final radon barrier construction. (Reclamation of
179 tailings must also be addressed in the closure plan; the detailed reclamation plan may be incorporated
180 into the closure plan.)

181 **“Residual radioactive material” means:**

182 **(1) Waste (which the Secretary of Energy determines to be radioactive) in the form of**
183 **tailings resulting from the processing of ores for the extraction of uranium and other**
184 **valuable constituents of the ores; and**

185 **(2) Other waste (which the Secretary of Energy determines to be radioactive) at a**
186 **processing site which relates to such processing, including any residual stock of**
187 **unprocessed ores or low-grade materials.**

188 **The term residual radioactive material is used only with respect to materials at sites**
189 **subject to remediation under title I of the Uranium Mill Tailings Radiation control Act of**
190 **1978, as amended.**

Comment [JJ15]:

NRC has commented that the definition for “residual radioactive material” was omitted from Part 18 of the Colorado regulations. Continued omission of the definition may result in incompatibility with NRC regulations.

[The term is used in Part 3, 3.16.2.6 in a manner similar to use in the Conference of Radiation Control Program Directors (CRCPD) Suggested State Regulations for Radiation Control (SSRCR) Part C.32. The term is not currently used/found in Part 1 or in Part 18.]

NRC letter dated 06/28/12 (#22); 10/13/11 (#22)
NRC Compatibility = A

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

194

195

196 ~~"Surveillance" means the observation of the site for the purposes of visual detection of the need for~~
197 ~~maintenance, custodial care, evidence of unauthorized access, and compliance with other license and~~
198 ~~regulatory requirements.~~

Comment [JJ16]:

At the request of NRC, the specific definition for surveillance is deleted. NRC has stated that the Colorado definition is too narrow as it implies only “visual” types of surveillance. [The word is used in 18.1.2; Appendix A-criterion 2, 9C, and 9F].

The word “surveillance” is not defined in 10 CFR Part 40, although the word is used in several areas of Part 40 in a broad sense. NRC has stated that surveillance may include other activities besides visual observation, including monitoring and sampling.

NRC letters 06/28/12 (#23); 10/13/11 (#23).

199 "Third-party contractor" or "Third-party agreement" means a legal or contractual mechanism whereby an
200 applicant or licensee voluntarily agrees to pay for the services, solely selected and supervised by the
201 Department, of qualified persons not Department staff nor under contract directly to the Department.

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

205 **“Uranium milling” means any activity that results in the production of byproduct material as**
206 **defined in Part 18.**

Comment [JJ17]:

As required by NRC for compatibility, a definition for “uranium milling” is added. The definition is based on that found in 10 CFR Part 40.4.

NRC letters: 01/14/14 (#3); 06/28/2012 (#24);
10/13/11 (#24)

NRC Compatibility = A

209 **18.3 Special Requirements for Issuance of Specific Licenses For Source Material Milling.**

210 In addition to the requirements set forth in **3.8 and 3.9 Part 3**, a specific license for source material milling
211 will be issued if the applicant submits to the Department a complete and accurate **written** application that
212 clearly demonstrates how objectives and requirements of this Part are met. Failure to clearly so
213 demonstrate shall be grounds for refusing to accept an application. Any person desiring to have a facility
214 or site referred to in this Part shall apply to the Department for approval of such facility or site. The
215 application shall contain such information as the Department requires and shall be accompanied by an
216 application fee determined by the Board pursuant to the provisions of Part 12 of these regulations.

Comment [jsj18]:

Reference to Part 3 rather than subsections is added consistent with SSRCR U.

217 18.3.1 An application for a license or to amend or renew an existing license to receive, possess, and use
218 source material for milling or byproduct material ~~as in definition (2) of 1.2.2~~ shall include all
219 information required under these regulations and such other information as the Department may
220 deem necessary, and shall address the following:

- 221 18.3.1.1 Description of the proposed project or action;
- 222 18.3.1.2 Area/site characteristics including geology, topography, hydrology and
223 meteorology;
- 224 18.3.1.3 Radiological and nonradiological impacts of the proposed project or action,
225 including waterway and groundwater impacts;
- 226 18.3.1.4 Environmental effects of accidents;
- 227 18.3.1.5 Tailings disposal and decommissioning;
- 228 18.3.1.6 Site and project alternatives.
- 229 18.3.2 The applicant shall provide procedures describing the means employed to meet the following
230 requirements during the operational phase of any project.
- 231 18.3.2.1 Milling operations shall be conducted so that all releases are reduced to as low
232 as is reasonably achievable below the limits of Part 4.
- 233 18.3.2.2 The mill operator shall conduct at least daily inspection of any tailings or waste
234 retention systems. The inspection shall be performed by a person who is
235 qualified and approved by the Department. Records of such inspections shall be
236 maintained for review by the Department.
- 237 18.3.2.3 The mill operator shall immediately notify the Department of the following:
- 238 18.3.2.3.1 Any failure in a tailings or waste retention system which results in a
239 release of tailings or waste into uncontrolled areas; and
- 240 18.3.2.3.2 Any unusual conditions which are not contemplated in the design of the
241 retention system and which if not corrected could lead to failure of the
242 system and result in a release of tailings or waste into uncontrolled
243 areas.
- 244 18.3.3 During any one full year prior to submittal of a new application or amendment expanding the
245 facility the applicant/licensee shall conduct a preoperational monitoring program to provide
246 complete baseline data on a milling site and its environs. Throughout the construction and
247 operating phases of the mill, the applicant/licensee shall conduct an operational monitoring
248 program to measure or evaluate compliance with applicable standards and regulations, to
249 evaluate performance of control systems and procedures, to evaluate environmental impacts of
250 operation, and to detect potential long-term effects.
- 251 18.3.4 The environmental **reportassessment** required by 3.8.8 shall contain all information deemed
252 necessary by the agency to assist the agency in the evaluation of the short-term and long-range
253 environmental impact of the project and activity so that the agency may weigh environmental,
254 economic, technical, and other benefits against environmental costs, while considering available
255 alternatives. The environmental **reportassessment** shall be submitted with the license application
256 or amendment request, unless an exemption as provided by 3.8.7.1 has been obtained from the
257 Department.
- 258 18.3.5 The following types of actions require an applicant's environmental **reportassessment**:
- 259 18.3.5.1 Issuance ~~or of a new or~~ renewal ~~of a~~ source material milling license;
- 260 **18.3.5.2 Each new, renewal or amendment application pertaining to the facility's receipt of**
261 **material;**
- 262 18.3.5.3 Issuance of an amendment that would authorize or result in:

Comment [JJ19]: Wording is modified here and in subsequent sections, to be consistent with the language used in the Colorado Radiation Control Act for the document(s) submitted by the applicant which pertains to environmental concerns.

The term environmental assessment is changed to environmental report. The environmental report is the document submitted by the applicant or licensee.

Comment [JJ20]: Language modified for clarity.

Comment [JJ21]:
This requirement has been relocated from 18.3.9, and 18.3.9.2 and language merged.

- 263 (1) A significant expansion of a site;
- 264 (2) A significant change in the types of **releaseseffluents**;
- 265 (3) A significant increase in the amounts of **releaseseffluents**;
- 266 (4) A significant increase in individual or cumulative occupational radiation exposure;
- 267 or
- 268 (5) A significant increase in the potential for or consequences from radiological
- 269 accidents.
- 270 18.3.5.43. ~~T~~The environmental assessment shall contain all information deemed necessary
- 271 by the department, and shall include, at a minimum:
- 272 (1) The identification of the types of **classified** material to be received, stored,
- 273 processed, or disposed of;
- 274 (2) A representative presentation of the physical, chemical, and radiological
- 275 properties of the type of **classified** material to be received, stored, processed, or
- 276 disposed of;
- 277 (3) An evaluation of the short-term and long-range environmental impacts of such
- 278 receipt, storage, processing, or disposal;
- 279 (4) An assessment of the radiological and nonradiological impacts to the public
- 280 health from the proposed activities;
- 281 (5) Any facility-related impact on any waterway and ground water from the proposed
- 282 activities;
- 283 (6) An analysis of the environmental, economic, social, technical, and other benefits
- 284 of the proposed activities against environmental costs and social effects while
- 285 considering available alternatives;
- 286 (7) ~~A~~a list of all material violations of local, state, or federal law at the facility since
- 287 the submittal date of the previous license application or license renewal
- 288 application;
- 289 (8) ~~F~~or an application for a license or license amendment pertaining to the facility's
- 290 receipt of **classified** material for storage, processing, or disposal at the facility, a
- 291 demonstration that:
- 292 (a) ~~T~~here are no outstanding material violations of any state or federal
- 293 statutes, compliance orders, or court orders applicable to the facility, and
- 294 any releases giving rise to any such violation have been remediated;
- 295 (b) ~~T~~he operator, after a good faith review of the facility and its operations,
- 296 is not aware of any current license violation at the facility;
- 297 (c) ~~T~~here are no current releases to the air, ground, surface water, or
- 298 groundwater that exceed permitted limits; and
- 299 (d) ~~N~~o conditions exist at the facility that would prevent the Department of
- 300 Energy's receipt of title to the facility pursuant to the federal "Atomic
- 301 Energy Act of 1954", 42 U.S.C. sec. 2113;
- 302 (9) ~~A~~a list of all necessary permits and any changes to local land use ordinances
- 303 that are needed to construct or operate the facility; and

Comment [jsj22]: The term "releases" is changed to "effluents" consistent with SSRCR U.6.c.ii.(2) as derived from 10 CFR 51. The term "releases" usually refers to something that is not within the control of the licensee, versus effluents which are typically a controlled type of release and which have specific limits.

304 (10) For sites or facilities placed on the National Priority List pursuant to the federal
 305 "Comprehensive Environmental Response, Compensation, and Liability Act", 42
 306 U.S.C. sec. 9605, a copy of the most recent five-year review and any associated
 307 updates that have been issued by the United States Environmental Protection
 308 Agency.

309 18.3.6 An application for a license to receive, possess and use source material for milling or byproduct
 310 material ~~as in definition (2) of 1.2.2~~ shall contain proposed specifications relating to the milling
 311 operations and the disposition of tailings or wastes resulting from such milling activities to achieve
 312 the requirements and objectives set forth in the criteria listed in Appendix A to this Part 18. Each
 313 application for a new license or for license renewal must clearly demonstrate how the
 314 requirements and objectives set forth in Appendix A to this Part 18 have been addressed. Failure
 315 to clearly demonstrate how the requirements and objectives in Appendix A to this Part 18 have
 316 been addressed shall be grounds for refusing to accept an application.

A facility shall not dispose of or receive for storage incident to disposal or processing at the facility radioactive material, except for nonprocessing operational purposes such as radioactive standards, samples for analysis, or materials contained in fixed or portable gauges, unless the facility has received a license, a five-year license renewal, or license amendment pertaining to the facilities receipt of radioactive material, in accordance with the Administrative Procedures Act, for such receipt, storage, processing, or disposal of radioactive material and the license, license renewal, or license amendment approves the type of activity.

Comment [JJ23]: Paragraph added consistent with the 2015 changes to the RCA. The provision allows for a facility to receive non-processing related radioactive materials provided the license authorizes the material and activity.

RCA: 25-11-203(1)(b)(I)

Comment [JJ24]: Wording change consistent with 2015 statutory (RCA) changes via House Bill 15-1145.

C.R.S. 25-11(1)(b)(II)

Comment [JJ25]: Editorial adjustment - number is added for clarity/consistency with other formatting in Part 18.

325 18.3.7 Nothing in **section 18.3** ~~shall apply~~**applies** to a contract for the storage, processing, or disposal
 326 of less than the sum of one hundred ten ~~(110)~~ tons of ~~classified radioactive~~ material per source
 327 or to a contract for a bench-scale or a pilot-scale testing project or a contract for less than a de
 328 minimis amount of ~~classified radioactive~~ material as determined by the department for storage,
 329 processing, or disposal.

Comment [JJ26]: Wording change to "radioactive" consistent with 2015 statutory (RCA) changes via House Bill 15-1145.

330 **18.3.8** Upon receipt of an application or notice as provided in this section 18.3, the Department shall
 331 notify the public and forward a copy of the application or notice to the Governor and the General
 332 Assembly, as appropriate. ~~The Department will take no further formal action on notices that~~
 333 ~~are not accompanied by the proper application and application fee.~~ In addition to the
 334 requirements in this Section 18.3, the following requirements apply to each proposed new
 335 license, five-year license renewal, or license amendment pertaining to the facility's receipt
 336 of radioactive material.

Comment [JJ27]: Language is modified in order to clarify when the specified public process is required consistent with statutory (RCA) requirements.

18.3.8.1 ~~the Department shall publish a determination as to whether an application submitted pursuant to paragraph (b) of subsection (2) of this section is substantially complete within forty-five days after receipt of the application. Within forty-five (45) days after receipt of an application, the Department shall publish a determination as to whether the application submitted is substantially complete.~~

The requirement pertaining to notification of the public, and providing copies to the Governor, and General Assembly, and the provision pertaining to the Department taking formal action without receipt of a fee is retained and relocated to Section 18.3.9.

Comment [JJ28]: The original language of 18.3.8.1 (shown in ~~strikeout~~) makes reference to "paragraph (b) of subsection (2)". Paragraph (b) of subsection (2) does not currently exist within Part 18. During a prior revision to Part 18, this reference was incorporated in Part 18 in error. The "paragraph (b)" phrase refers to a section in the Colorado Radiation Control Act (2010) (rather than Part 18).

18.3.8.2 ~~an initial public meeting or hearing shall be convened within forty-five days after publication of the determination that the application is substantially complete. A second such public meeting shall be convened within thirty days after the first public meeting. Within forty-five (45) days after publication its determination that the application required by 18.3.8.1 is substantially complete, an initial public meeting shall be convened. The meeting shall, at a minimum require:~~

Comment [JJ29]: This paragraph incorporates the requirements of 18.3.9.1 relating to the application being substantially complete prior to holding an initial meeting.

(1) At least two weeks' written notice before the meeting;

Comment [JJ30]: Relocated from 18.3.9.1(1).

(2) The meeting to be hosted and presided over by a person selected upon agreement by the Department, the local Board of County Commissioners and the applicant;

Comment [JJ31]: Relocated from 18.3.9.1.

(3) The licensee or applicant to provide a summary of the facility's application to receive, store, process, or dispose of material and the nature of the material;

Comment [JJ32]: Relocated from 18.3.9.1(2).

354
355
356
357
358
359
360
361
362
363
364
365
366
367
368
369
370
371
372
373
374
375
376
377
378
379
380
381
382
383
384
385
386
387
388
389
390
391
392
393
394

(4) An opportunity for the public to comment and be heard;

Comment [JJ33]: Relocated from 18.3.9.1(2).

(5) The licensee or applicant to provide transcripts of the meeting, which:

Comment [JJ34]: Relocated from 18.3.9.1(3).

(a) Allows the public to make copies of a transcript of the meeting; and

(b) Shall be provided to the Department in an electronic format in a manner that allows posting on the Department's website within ten (10) days after receipt from the transcription service.

~~18.3.8.3 the Department shall approve, approve with conditions, or deny the application within three hundred sixty days after the second public meeting.~~

Comment [JJ35]: This paragraph is removed/deleted as it is replaced by 18.3.8.4.

18.3.8.3 Within ninety (90) days of the initial public meeting required by 18.3.8.2, a response, if any, written by the local Board of County Commissioners to the applicant's environmental assessment is to be provided to the applicant,

Comment [JJ36]: The requirements of 18.3.9.3 have been incorporated here.

Upon request of and documentation of the expenditure by such Board, the applicant shall provide the Board with up to fifty thousand dollars, as adjusted for inflation since 2003, which is available to assist the Board in responding to the application, including an independent environmental analysis and identification of any substantial adverse impact upon the safety or maintenance of transportation infrastructure or transportation facilities within the county.

Comment [JJ37]: The phrase "as adjusted for inflation..." is included, consistent with the 2014 RCA changes.

Senate Bill 14-192

~~18.3.8.4 Upon completion of the Department's review of the application, the Department shall provide notice to the public of issuance of an initial draft decision where the license application is approved, approved with conditions, or is denied.~~

Comment [JJ38]: Language is added consistent with the 2014 RCA changes

NOTE: The 360 day time period specified in the current rule (in 18.3.8.3) is deleted, consistent with the 2014 RCA changes (via SB 14-192).

RCA: 25-11-203 (3)(c)(V)(C).
Senate Bill (SB) 14-192

(1) The initial draft decision shall be posted on the Department's website at the time of notice and shall include:

- (a) A decision analysis;**
- (b) The final technical and environmental impact analysis conducted by the Department as specified in 18.4;**
- (c) All requests from the Department seeking information from the applicant and all of the applicant's responses;**
- (d) All public comments;**
- (e) Any additional information that may assist the public review of the Department's draft decision; and**
- (f) A draft license for any proposed approval.**

(2) Upon issuance of the initial draft decision in 18.3.8.4, the Department shall initiate a final public comment process which shall include:

(a) A public comment period that shall be noticed at the time the initial draft decision is published; and

~~**(b) A public meeting, held within thirty (30) days after giving public notice of the initial draft decision. Such meeting shall, at a minimum require:**~~

Comment [JJ39]:
The requirement for a public meeting to be held within 30 days of providing notice of the initial draft decision, is specified by the RCA.

- (i) At least two weeks' written notice before the meeting;**
- (ii) The meeting to be hosted and presided over by a person selected upon agreement by the Department, the local Board of County Commissioners and the applicant;**

395 (iii) The summary of the facilities' license to receive, store, process,
396 or dispose of radioactive material and the nature of the
397 radioactive material;

398 (iv) The opportunity for cross-examination;

399 (v) An opportunity for the public to comment and be heard;

400 (vi) The licensee or applicant to provide transcripts of the meeting,
401 which:

402 (a) Allows the public access to make copies of a transcript of
403 the meeting; and

404 (b) Shall be provided to the Department in an electronic format
405 in a manner that allows posting on the Department's
406 website within ten (10) days after receipt from the
407 transcription service.

408 (3) For applications which are denied, the Department shall issue a decision
409 document summarizing the basis for denial.

410 18.3.8.5 The expense of public notice, public comment periods, or public meetings
411 required by Section 18.3 shall be at the expense of the applicant or licensee.

412 18.3.8.6 Following the public comment period specified in 18.3.8.4(2), the Department
413 shall:

414 (1) After review of all final public comments, issue a final draft decision; and

415 (2) Provide affected parties, including the applicant in the case of approval with
416 conditions or denial, an opportunity to request an adjudicatory hearing in
417 accordance with Section 24-4-105, C.R.S.

418 18.3.8.7 If none of the parties specified in 18.3.8.6(2) seeks an adjudicatory hearing, the
419 final draft decision becomes final agency action.

420 18.3.8.8 If any party specified in 18.3.8.6(2) seeks an adjudicatory hearing, resolution of all
421 material issues of fact, law, or discretion presented by the record and the
422 appropriate order, sanction, relief, or denial of the material issues must be through
423 an initial decision of a hearing officer or administrative law judge.

424 18.3.8.9 Upon issuance of the initial decision of the hearing officer or administrative law
425 judge, and after any allowable appeal to the executive director of the Department,
426 the Department shall issue within a reasonable time a final decision to approve,
427 approve with conditions, or deny the application.

428 18.3.8.10 The final decision in 18.3.8.9 is subject to judicial review pursuant to Section 24-
429 4-106, C.R.S.

430 18.3.8.11 The applicant shall pay all reasonable, necessary, and documented expenses of
431 the hearing held in accordance with 18.3.8.8.

432 18.3.9 Upon receipt of an application or notice as provided in Section 18.3, the Department shall
433 notify the public and forward a copy of the application or notice to the Governor and the
434 General Assembly, as appropriate. The Department will take no further formal action on
435 notices that are not accompanied by the proper application and application fee.

Comment [JJ40]: The opportunity for cross-examination was requested by NRC in correspondence dated January 14, 2014 and is necessary for compatibility with federal rule in 10 CFR 150.31.

NRC Compatibility = C

Comment [JJ41]: Provisions 18.3.8.7, 18.3.8.8, 18.3.8.9 and 18.3.8.10 originate from RCA provision (3)(c)(D)(V)(D)

436 ~~18.3.9~~ In addition to the requirements of section 18.3 and 18.4, each new, renewal or amendment
437 application pertaining to the facility's receipt of classified material shall include a written
438 application to the Department and information relevant to the pending application, including:

Comment [JJ42]:
Applicable elements of this requirement exist in the "preamble" language to 18.3, and in 18.3.5.4

439 ~~18.3.9.1~~ transcripts of two public meetings hosted and presided over by a person selected upon
440 agreement by the Department, the local Board of County Commissioners, and the
441 applicant. One or both of the meetings shall be a hearing conducted to comply with
442 section 24-4-104 or 24-4-105, CRS. The expense of the meetings or hearing shall be
443 paid by the facility. ~~Such meetings shall not be held until the Department determines that~~
444 ~~the application is substantially complete. The facility shall provide the public with:~~

Comment [JJ43]: The requirements of this section have been incorporated into 18.3.8.2 and 18.3.8.4

445 ~~(1)~~ at least two weeks' written notice before the first meeting and an additional two
446 ~~weeks' written notice before the second meeting;~~

Comment [JJ44]:
The requirement relating to expenses have been incorporated into 18.3.8.5, 18.3.8.11

447 ~~(2)~~ At both meetings, summaries of the facility's license to receive, store, process, or
448 ~~dispose of classified material and the nature of the classified material, and an~~
449 ~~opportunity to be heard; and~~

Comment [JJ45]: The requirement of this section has been incorporated into 18.3.8.2, and 18.3.8.4

450 ~~(3)~~ access to make copies of a transcript of the meetings, and shall provide an
451 ~~electronic copy to the Department in a manner that allows posting on the~~
452 ~~department's web site within ten days after receipt from the transcription service.~~

Comment [JJ46]: The requirements of this section have been relocated to 18.3.8.2(3), and 18.3.8.4(2)(b)

453 ~~18.3.9.2~~ an environmental assessment as defined in 18.3.5;

Comment [JJ47]: The requirements of this section have been relocated to 18.3.8.2(5), 18.3.8.4(2)(b)

454 ~~18.3.9.3~~ a response, if any, to the environmental assessment written by the Board of County
455 ~~Commissioners provided to the facility within ninety days after the first public meeting.~~
456 ~~Upon request of and documentation of the expenditure by such Board, the applicant shall~~
457 ~~provide the Board with up to fifty thousand dollars, which shall be available to assist the~~
458 ~~Board in responding to the application, including an independent environmental analysis~~
459 ~~and identification of any substantial adverse impact upon the safety or maintenance of~~
460 ~~transportation infrastructure or transportation facilities within the county.~~

Comment [JJ48]: The requirements of this section have been relocated to (new) Section 18.3.5.2

Comment [JJ49]: The requirements of this section have been relocated to (new) Section 18.3.8.3

461 **18.4 Department Environmental Impact Analysis**

Comment [JJ50]: The word "Department" added for clarity.

462 ~~18.4.1~~ **The Department shall prepare a written Environmental Impact Analysis (EIA) of the impact**
463 **of the licensed activity on the environment** For each license application or application to
464 amend or renew an existing license to receive, possess, or use source material for uranium or
465 thorium milling or byproduct material ~~as in definition (2) of 1.2.2~~ which will have a significant
466 impact on the environment, ~~the Department shall prepare a written analysis of the impact of the~~
467 ~~licensed activity on the environment, which~~ **The written EIA shall be made available for review to**
468 **by the public and for review by the NRC at the time of public notice in 18.3.8.45 of hearing. ; The**
469 **EIA which** analysis shall include:

Comment [JJ51]: The wording of this section is modified for clarity and understanding.

470 18.4.1.1 An assessment of the radiological and nonradiological impacts to the public health;

471 18.4.1.2 An assessment of any impact on any waterway and ground water;

472 18.4.1.3 Consideration of alternatives to the activities to be conducted; and

473 18.4.1.4 Consideration of the long-term impacts of the licensed activities.

474 18.4.2 In preparing the ~~EIA environmental impact analysis~~, the Department may use and incorporate by
475 reference the environmental ~~report assessment~~ prepared by the applicant and environmental
476 ~~assessments analysis~~ prepared by Federal, State or local agencies.

477 18.4.3 The ~~EIA environmental impact analysis~~, or any part thereof, shall be prepared directly by the
478 Department or the Department shall utilize the third party method set forth in 3.13.

479 **18.5 Notices Requirements Pertaining to Materials Not Subject to 18.3 and 18.4 and Financial**
480 **Assurance**

481 **18.5.1** At least ninety (90) days before a facility proposes to receive, store, process, or dispose of
 482 ~~classified-radioactive~~ material in a license application or amendment that is not subject to 18.3
 483 and 18.4, **and for which a material acceptance report has not already been filed with the**
 484 **Department**, the facility shall notify the Department **in writing**, and the Department shall notify
 485 the public and the board of county commissioners of the county in which the facility is located, of
 486 the specific ~~classified-radioactive~~ material to be received, stored, processed, or disposed of. The
 487 notice ~~shall~~ **must** include:

Comment [JJ52]: The requirements of this provision originate from RCA requirements in 25-11-203(4)(a) and updated in 2015.

The phrase "in writing" is added for clarity.

488 18.5.1.1 **Aa** representative analysis of the physical, chemical, and radiological properties of the
 489 ~~classified-radioactive~~ material;

490 18.5.1.2 **T**he material acceptance report that demonstrates that the ~~classified-radioactive~~
 491 material does not contain hazardous waste characteristics not found in uranium ore;

492 18.5.1.3 **Aa** detailed plan for transport, acceptance, storage, handling, processing, and disposal
 493 of the material;

494 18.5.1.4 **Aa** demonstration that the material contains technically and economically recoverable
 495 uranium, without taking into account its value as disposal material;

496 18.5.1.5 **T**he existing location of the ~~classified-radioactive~~ material;

497 18.5.1.6 **T**he history of the ~~classified-radioactive~~ material;

498 18.5.1.7 **Aa** written statement by the applicant describing any pre-existing regulatory
 499 classification of the ~~classified-wasteradioactive material~~ in the state of origin that
 500 describes all steps taken by the applicant to identify ~~such~~ **the** classification;

501 18.5.1.8 **Aa** written statement from the United States Department of Energy or successor agency
 502 that the receipt, storage, processing, or disposal of the ~~classified-radioactive~~ material at
 503 the facility will not adversely affect the Department of Energy's receipt of title to the facility
 504 pursuant to the federal "Atomic Energy Act of 1954", 42 U.S.C. Sec. 2113;

505 18.5.1.9 **D**ocumentation showing any necessary approvals of the ~~u~~United ~~s~~States
 506 ~~e~~Environmental ~~p~~rotection ~~a~~gency; and

507 **18.5.1.10** **Aa** an environmental assessment **containing the information required by 18.3.5.4as**
 508 **defined in section 18.4 and 18.5 of this section, and** which may incorporate by reference
 509 relevant information contained in an environmental assessment previously submitted for
 510 the facility.

Comment [JJ53]: The specific reference to the contents of the environmental assessment are referenced for clarity.

511 18.5.2 Within thirty (30) days after the department's receipt of notice pursuant to 18.5.1, the Department
 512 shall determine whether the notice is complete.

513 **18.5.3** **O**nce the department determines that the notice pursuant to 18.5.1 is complete, the Department
 514 shall:

Comment [JJ54]: Sub-section 18.5.3 is revised to incorporate language similar to that found in 18.5.1. This provision is intended to improve the clarity and flow of this subsection.

515 **18.5.3.1** **P**ublish the notice of the specific material to be received, stored, processed, or
 516 **disposed of, to:**

Comment [JJ55]: Section added consistent with the 2014 RCA changes.

517 **(1) The public, through publishing on the Department's web site; and**

25-11-203(4)(a)(II)(c)

518 **(2) The county commissioners of the county in which the facility is located.**

519 ~~publish the notice on its web site and~~

520 **18.5.3.2** **T**he notice required in 18.5.3.1 shall include the information contained in 18.5.1.1
 521 **through 18.5.1.10.**

- 522 **18.5.3.3** Provide a sixty (60) -day public comment period for the receipt of written comments
 523 concerning the notice. ~~Aa-~~ public hearing may be held, at the Department's discretion, at the
 524 operator's expense.
- 525 **18.5.4** ~~W~~within thirty (30) days after the close of the written public comment period held pursuant to
 526 18.5.3, the Department shall approve, approve with conditions, or deny the receipt, storage,
 527 processing, or disposal as described in the notice based on whether the material proposed for
 528 receipt, storage, processing, or disposal complies with the facility's license and:
- 529 18.5.4.1 Be conducted such that the exposures to workers and the public are within the dose
 530 limits of part 4 of the department's rules pertaining to radiation control for workers and the
 531 public;
- 532 18.5.4.2 Not cause releases to the air, ground, or surface or ground water that exceed permitted
 533 limits; and
- 534 18.5.4.3 Not prevent transfer of the facility to the United States in accordance with 42 U.S.C. sec.
 535 2113 upon completion of decontamination, decommissioning, and reclamation of the
 536 facility.

537 **18.6** **Financial Assurance**

538 ~~18.6.15.5~~ Prior to issuance of the license, the applicant shall:

539 ~~18.6.1.1(4)~~ Establish **separate** financial assurance arrangements, as provided by 3.9.5, to
 540 ensure decontamination and decommissioning of the facility; and

541 **18.6.1.2(2)** Provide a fund adequate to cover the payment of the cost for long-term care and
 542 monitoring as provided by 3.9.5. ~~1015.~~

543 (1) Such fund shall be sufficient to meet the requirements of 3.9.5. ~~1015.~~ (4).

544 (2) The Department will consider proposals to combine the two types of financial
 545 assurance.

546 (3) Financial assurance shall be provided prior to commencement of construction or
 547 operation.

548 ~~18.6.2~~ **Financial surety arrangements must be established by each mill operator before the**
 549 **commencement of operations to assure that sufficient funds will be available to carry out**
 550 **the decontamination and decommissioning of the mill and site and for the reclamation of**
 551 **any tailings or waste disposal areas. The amount of funds to be ensured by such surety**
 552 **arrangements must be based on Department-approved cost estimates in a Department-**
 553 **approved plan, or a proposed revision to the plan submitted to the Department for**
 554 **approval, if the proposed revision contains a higher cost estimate for:**

555 **18.6.2.1 Decontamination and decommissioning of mill buildings and the milling site to**
 556 **levels which allow unrestricted use of these areas upon decommissioning, and**

557 **18.6.2.2 The reclamation of tailings and/or waste areas in accordance with technical**
 558 **criteria delineated in Criterion 1 through 8 of Appendix A.**

559 ~~18.6.3~~ **To avoid unnecessary duplication and expense, the Department may accept financial**
 560 **sureties that have been consolidated with financial or surety arrangements established to**
 561 **meet requirements of other Federal or state agencies and/or local governing bodies for**
 562 **decommissioning, decontamination, reclamation, and long-term site surveillance and**
 563 **control, provided such arrangements are considered adequate to satisfy these**
 564 **requirements and that the portion of the surety which covers the decommissioning and**
 565 **reclamation of the mill, mill tailings site and associated areas, and the long-term funding**
 566 **charge is clearly identified and committed for use in accomplishing these activities.**

Comment [JJ56]:

The previous section (18.5) is divided into two sections (18.5, and 18.6) to enhance functionality and flow.

Comment [jsj57]:

The term "separate" is added, consistent with SSRRC U.9. The concept of separate financial arrangements is implied in the current provision, since 18.6.1.2 discusses the possibility of combining the two "types" of financial assurance. The added language makes this more explicit.

Comment [JJ58]: As requested by NRC, this provision is added for compatibility with 10 CFR Part 40, Appendix A, Criterion 9(a)(1), and (2).

<http://www.nrc.gov/reading-rm/doc-collections/cfr/part040/part040-appa.html>

Compatibility = C
 NRC RATS = 2011-1
 NRC Letter 11/19/14

Comment [JJ59]: As requested by NRC, this provision added for compatibility with 10 CFR Part 40, Appendix A, Criterion 9(d).

NRC Compatibility = C
 NRC Letter 11/19/14

567 **18.67 License Hearings**

568 18.67.1 There shall be an opportunity for public hearings to be held in accordance with the procedures in
 569 **Sections** 24-4-104 and 24-4-105, CRS., and 18.67, prior to the granting, denial or renewal of a
 570 specific license permitting the receipt, possession or use of source material for milling or
 571 byproduct material as **defined in this part** ~~definition (2) of 1.2.2~~, **provided, however, in the**
 572 **event of a conflict between the provisions of 18.7 and the hearing provisions of any**
 573 **applicable administrative hearing forum, including the Office of Administrative Courts, the**
 574 **latter shall apply.**

575 18.67.2 Notice of Hearing

576 18.67.2.1 All hearings shall be preceded by written notice containing:

577 18.67.2.1.1 The nature of the hearing and its time and place;

578 18.67.2.1.2 The legal authority and jurisdiction under which the hearing is to be held;

579 18.67.2.1.3 The matters of fact and law asserted or to be considered;

580 18.67.2.1.4 A description of the proposed licensing action and a statement of the
 581 availability of its text from the Department;

582 18.67.2.1.5 A description of the right of any interested person to make written
 583 comments to the Department or present oral comments at the hearing;

584 18.67.2.1.6 The procedure for applying to become a party to the hearing; and

585 18.67.2.1.7 A description of the procedures to be followed at the hearing and at a
 586 prehearing conference if required.

587 18.67.2.2 The notice of the hearing shall be mailed by the Department to the licensee or
 588 applicant and to each person who has filed a written request to receive notice of such
 589 proceedings. The licensee or applicant shall cause the notice to be published for three (3)
 590 days in a newspaper of statewide circulation and in local newspapers designated by the
 591 Department in the area to be affected by the proposed action. The notice shall be mailed
 592 and published not less than ninety (90) days prior to the hearing.

593 18.67.2.3 The time and place of hearing will be fixed with due regard for the convenience of
 594 the parties or their representatives, and the public interest. The hearing will be held in the
 595 locale of the site to be licensed.

596 18.67.2.4 The cost of any licensing action hearing shall be at the expense of the applicant.
 597 These costs shall include, but not be limited to, the hearing officer, the meeting room, the
 598 court reporter and transcript copies, and the required notices. The costs shall not include
 599 the expenses of other parties to the hearing.

600 18.67.3 Party Status

601 18.67.3.1 A person who may be affected or aggrieved by Department action may apply for
 602 party status not less than twenty (20) days prior to the hearing. Thereafter, application to
 603 be made a party shall not be considered except upon motion for good cause shown.

604 18.67.3.2 Application for party status must identify the individual or group applying,
 605 including the address or phone number where they may be contacted, state the nature of
 606 their interest in the hearing and the specific ground on which they claim to be affected or
 607 aggrieved, and the specific aspects of the hearing which they wish to address.

608 18.67.3.3 The Department, or the hearing officer, will grant or deny party status within five
 609 (5) days after receipt of the request for party status based on the nature and extent of the

Comment [JJ60]:

Additional language is added to address possible conflicts between the specific hearing provisions in 18.7 and the hearing procedures of other hearing forums (such as an administrative court) where specific procedures may exist. The proposed language defers to the hearing procedures outside of Part 18 for the hearing process where such conflicts may arise.

Section 18.6 is renumbered to 18.7 due to the addition of prior renumbering.

610 person's property, financial or other interest in the hearing and the possible effect of any
611 order which may be entered as a result of the hearing on the person's interest. Any
612 person applying for or granted party status may, by motion to the hearing officer or
613 Department, as appropriate, challenge the right of any other person to be a party.

614 18.67.3.4 Parties shall have the right to initiate discovery. Parties shall have the right to
615 make motions or objections, present evidence, cross-examine witnesses, and appeal
616 from the decision of the hearing as provided by the Colorado Administrative Procedures
617 Act, **Section** 24-4-101 et seq., CRS.

618 18.67.3.5 A person who is not a party will be permitted to submit written comments to the
619 Department and may be permitted to make an oral presentation at the hearing, but will
620 not have the other rights of a party.

621 18.67.4 Prehearing Conference

622 18.67.4.1 The Department or hearing officer, on its own motion or at the request of any
623 party or any person who has applied to become a party, may direct the parties to appear
624 at a specific time and place for a conference to consider:

625 18.67.4.1.1 The simplification and clarification of the issues;

626 18.67.4.1.2 The obtaining of stipulations and admissions of fact and of the contents
627 and authenticity of documents to avoid unnecessary proof;

628 18.67.4.1.3 Identification of witnesses and the limitation of the number of expert
629 witnesses, and other steps to expedite the presentation of evidence;

630 18.67.4.1.4 The setting of a hearing schedule;

631 18.67.4.1.5 Granting or denying requests for party status, if such decisions have not
632 previously been made;

633 18.67.4.1.6 Such other matters as may aid in the orderly disposition of the hearing.

634 18.67.4.2 At such conference each party or person who has applied to become a party
635 shall present to every other person, party, and the Department a prehearing statement
636 containing the following:

637 18.67.4.2.1 A brief summary of the nature of the claim of the party and the basis
638 therefore;

639 18.67.4.2.2 A copy of all exhibits proposed to be introduced; and

640 18.67.4.2.3 A list of all witnesses who may be called and a brief description of their
641 testimony.

642 18.67.4.3 Except for good cause shown or for evidence or testimony accepted as rebuttal,
643 no witness may testify nor may any exhibits be introduced on behalf of a party who had
644 notice of the prehearing conference unless such witness has been previously listed
645 and/or his written testimony and related exhibits have been presented to opposing parties
646 at the prehearing conference.

647 18.67.4.4 The Department or hearing officer shall issue a written summary of the action
648 taken at the conference and agreements by the parties, which limits the issues or defines
649 the matters in controversy to be determined in the hearing.

650 18.67.5 Discovery

- 651 | 18.67.5.1 Any party may initiate discovery in the form of interrogatories to another party,
652 | requests for admission to another party, requests for production of documents to another
653 | party, or depositions of any persons, or any combination thereof. The Colorado Rules of
654 | Civil Procedure, to the extent not inconsistent with the Colorado Administrative Procedure
655 | Act, shall apply. Such discovery may be modified by a motion for protective order filed
656 | with the Department or hearing officer within seven (7) days of receipt of the notice or
657 | request for discovery. Motions for protective order shall set forth the grounds in support
658 | thereof and shall be ruled upon immediately. Discovery shall be completed no later than
659 | ten (10) days preceding the hearing date, except as otherwise ordered by the
660 | Department or hearing officer.
- 661 | 18.67.6 Conduct of Hearings
- 662 | 18.67.6.1 Hearing presentations will proceed in the following order unless otherwise
663 | directed by the Department or hearing officer.
- 664 | 18.67.6.1.1 Call to order, introductory remarks, and action on applications for party
665 | status, if not already decided.
- 666 | 18.67.6.1.2 Presentation of any stipulations or agreements of the parties, and any
667 | other matters which were required to be dealt with at the prehearing conference,
668 | if held.
- 669 | 18.67.6.1.3 Opening statement by the party upon whom the burden of proof rests.
- 670 | 18.67.6.1.4 Opening statements by all other parties.
- 671 | 18.67.6.1.5 Presentation of case by party upon whom burden of proof rests.
- 672 | 18.67.6.1.6 Presentation by all other persons wishing to offer evidence in the order to
673 | be determined by the Department or hearing officer.
- 674 | 18.67.6.1.7 Rebuttal by the party upon whom the burden of proof rests, followed by
675 | rebuttal of other parties.
- 676 | 18.67.6.1.8 Closing statements by party upon whom the burden of proof rests,
677 | followed by closing statements of all other parties.
- 678 | 18.67.6.2 Public participation as provided for in these rules shall be allowed at that time or
679 | times during the hearing as determined by the Department or hearing officer in their
680 | discretion to be appropriate.
- 681 | 18.67.6.3 At the conclusion of any witness's testimony, or at the conclusion of the party's
682 | entire presentation, as may be determined by the Department or hearing officer, all
683 | parties may then cross-examine such witness or witnesses. The Department or hearing
684 | officer may examine and cross-examine any witness. A person who is not a party shall
685 | not have the right to cross-examine.
- 686 | 18.67.6.4 Any person, not a party to the proceeding, wishing to present testimony may do
687 | so by indicating his desire in writing. A form will be available prior to and during the
688 | hearing. This form will request the person's name, address, whom he represents, the
689 | general nature of his testimony, and the time required for his presentation. This form is to
690 | be presented to a representative of the Department during the hearing. Voluntary
691 | testimony not specifically requested on or by the written form may also be allowed. Any
692 | person presenting testimony shall be under oath and be subject to cross examination.
- 693 | 18.67.6.5 The proponent of any motion, order, or license issuance bears the burden of
694 | proof.

695 18.67.6.6 No interested person, party, or applicant for party status outside the Department
 696 will have any oral or written communication with any Department personnel or hearing
 697 officer relevant to the merits of a hearing pending before the Department unless
 698 reasonable prior notice is given to all participants in the hearing. This prohibition shall
 699 apply after the hearing is noticed. Any Department employee or hearing officer who is
 700 involved in such a prohibited communication shall make a written record of it and transmit
 701 it to all the parties to the hearing.

702 18.67.7 Department Decision

703 18.67.7.1 Any party to a hearing may, or if so directed by the Department or the hearing
 704 officer shall, file proposed findings of fact and conclusions of law and a proposed form of
 705 order or decision within twenty (20) days after the record is closed. A party who has the
 706 burden of proof may reply within ten (10) days after service of proposed findings of fact
 707 and conclusions of law.

708 18.67.7.2 After due consideration of the hearing record, the Department or hearing officer
 709 shall issue its findings of fact, conclusions of law, and decision and order.

710 18.78 Operational Requirements.

711 Each licensee authorized to receive, possess or use source material for milling or byproduct material ~~as in~~
 712 ~~definition (2) of 1.2.2~~ shall:

713 18.78.1 Operate in accordance with the requirements of this Part 18, in particular the procedures required
 714 by 18.3.2, monitoring required by 18.3.3, and the requirements and objectives of Appendix A to
 715 this Part 18.

716 18.78.2 Submit a report to the Department within **sixty (60)** days after January 1 and July 1 of each year,
 717 specifying the quantity of each of the radioactive materials released to unrestricted areas in liquid
 718 and in gaseous effluents during the previous six months of operation, and such other information
 719 as the Department may require to estimate maximum potential annual radiation doses to the
 720 public resulting from effluent releases. If quantities of radioactive materials released during the
 721 reporting period are significantly above the licensee's design objectives previously reviewed as
 722 part of the licensing action, the report shall cover this specifically. On the basis of such reports
 723 and any additional information the Department may obtain from the licensee or others, the
 724 Department may from time to time require the licensee to take such action as the Department
 725 deems appropriate.
 726
 727

728 18.78.3 For any licensed site or facility determined by the Department to have caused a release to the
 729 groundwater that exceeds the basic standards for groundwater as established by the water
 730 quality control commission, until remediation has been completed, the licensee shall provide
 731 annual written notice of the status of the release and any remediation activities associated with
 732 the release, by certified or registered mail, return receipt requested, to the current address for
 733 each registered groundwater well within one mile of the release as identified in the corrective
 734 action monitoring program, ~~unless the licensee demonstrates that a distance less than one mile is~~
 735 ~~warranted~~. Documentation of this activity will be retained and made available to the Department
 736 upon request.

737 **18.8.3.1 Under no circumstances shall remediation be deemed complete until all**
 738 **groundwater wells affected by any release associated with the site or facility are**
 739 **restored to at least the numeric groundwater standards as established by the**
 740 **water quality control commission that apply to the historic uses of the wells.**
 741 **The licensee shall remediate any release affecting groundwater wells in the**
 742 **most expedited manner reasonably possible using best available active**
 743 **restoration and groundwater monitoring technologies.**

Comment [JJ61]: Phrase removed, consistent with 2014 RCA changes.

Comment [JJ62]: This provision is added consistent with the 2014 changes to the Colorado Radiation Control Act.

SENATE BILL 14-192
 RCA: 25-11-107(5)(j)

744
745
746
747
748

18.8.3.2 Prior to the application of any numeric groundwater standard different from the baseline standard contained in 10 CFR Part 40, the standard must have been approved by the United States Nuclear Regulatory Commission in accordance with section 274o of the federal “Atomic Energy Act of 1954”, 42 U.S.C. sec 2021(o).

Comment [JJ63]: This provision is added consistent with the 2015 changes to the Colorado Radiation Control Act.

HOUSE BILL 15-1145
RCA: 25-11-107(5)(j)

749
750
751
752
753
754

18.8.4 For any facility licensed under Part 18, in addition to any reporting requirements provided in the license or rules, the license shall provide notice to the Department as soon as practicable upon discovery of any spill or release involving toxic or radioactive materials and shall provide an initial written report within seven (7) days after any discovery. The department shall post all such written reports on the Department’s web site as soon as practicable, and in no case later than seven (7) days after receipt by the Department.

Comment [JJ64]: This provision is added consistent with the 2014 changes to the Colorado Radiation Control Act.

SENATE BILL 14-192
RCA: 25-11-107(5)(k)

755

18.89 Decommissioning Requirements.

756
757
758
759

18.89.1 In addition to the information required under 3.16, each licensee authorized to receive, possess or use source material for milling or byproduct material ~~as in definition (2) of 1.2.2~~ shall submit a plan for completion of decommissioning if the procedures necessary to carry out decommissioning:

760

18.89.1.1 — Have not been previously approved by the Department; and

761
762

18.89.1.2 — Could increase potential health and safety impacts to workers or to the public, such as in any of the following cases:

763
764

18.89.1.2.1 — Procedures would involve techniques not applied routinely during cleanup or maintenance operations; or

765
766
767

18.89.1.2.2 — Workers would be entering areas not normally occupied where surface contamination and radiation levels are significantly higher than routinely encountered **during operation**; or

768
769

18.89.1.2.3 — Procedures could result in significantly greater airborne concentrations of radioactive materials than are present during operation; or

770
771

18.89.1.2.4 — Procedures could result in significantly greater releases of radioactive material to the environment than those associated with operation.

Comment [jsj65]:
The phrase “during operation” is added, consistent with 10 CFR 40.42 and SSRCR U.12.a.ii(2) and is consistent with similar language within this subsection. The concept was implied in the current provision, but the added language makes it more explicit.

772
773

18.89.2 Procedures with potential health and safety impacts may not be carried out prior to approval of the decommissioning plan.

774

18.89.3 The proposed decommissioning plan, if required by 18.89.1 or by license condition, must include:

775

18.89.3.1 — Description of planned decommissioning activities;

776
777

18.89.3.2 — Description of methods used to assure protection of workers and the environment against radiation hazards during decommissioning;

778

18.89.3.3 A description of the planned final radiation survey; and

779
780
781

18.89.3.4 — 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.

782
783
784

18.89.4 The proposed decommissioning plan will be approved by the Department 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.

785
786

18.89.5 Upon approval of the decommissioning plan by the Department, the licensee shall complete decommissioning in accordance with the approved plan.

787 **18.9.6** As a final step in decommissioning, the licensee shall:

788 **18.9.6.1** submit the information required in 3.16.4.1.5 and shall certify the disposition of all
 789 licensed material, including accumulated wastes, from decommissioning by
 790 submitting a completed NRC Form 314 or equivalent information; and

791 **18.9.6.2** Conduct a radiation survey of the premises where the licensed activities were
 792 carried out and submit a report of the results of this survey, unless the licensee
 793 demonstrates in some other manner that the premises are suitable for release in
 794 accordance with the criteria for decommissioning in Part 4 of these regulations,
 795 or for uranium milling (uranium and thorium recovery) facilities, Criterion 6(6) of
 796 Appendix A of this Part. The licensee shall, as appropriate, report the information
 797 specified in 3.16.6.4.

798 **18.89.67** If the information submitted under ~~3.16.4.1.5~~ **3.16.6.4** or ~~18.818.9~~ does not adequately
 799 demonstrate that the premises are suitable for release for unrestricted use, the Department will
 800 inform the licensee of the appropriate further actions required for termination of license.
 801

Comment [jsj66]:

Language in section 18.9.5 is divided between 18.9.5 and 18.9.6.

18.9.6 is added, consistent with language in 10 CFR 40.42(j)(1), and (2) and SSR CR U.12.g.

Upon further review of draft 1 of the rule it was determined that the original cross-reference to 3.16.4.1.5 did not exist/was in error. The proposed change eliminates the cross reference error and introduces language consistent with federal rule.

NRC Compatibility = H&S

802 **PART 18, APPENDIX A — CRITERIA RELATING TO THE OPERATION OF MILLS AND THE**
803 **DISPOSITION OF THE TAILINGS OR WASTES FROM THESE OPERATIONS**

804 Introduction: Every applicant for a license to possess and use radioactive material in conjunction with
805 uranium or thorium milling, or byproduct material at sites formerly associated with such milling, is required
806 by the provisions of 18.3 to include in a license application proposed specifications relating to milling
807 operations and the disposition of tailings or wastes resulting from such milling activities. This appendix
808 establishes technical, ownership, and long-term site surveillance criteria relating to the siting, operation,
809 decontamination, decommissioning, and reclamation of mills and tailings or waste systems and sites at
810 which such mills and systems are located.

811 As used in this appendix, the term "as low as is reasonably achievable" has the same meaning as in
812 1.2.2.

813 In many cases, flexibility is provided in the criteria to allow achieving an optimum tailings disposal
814 program on a site-specific basis. However, in such cases the objectives, technical alternatives and
815 concerns which must be taken into account in developing a tailings program are identified. As provided by
816 the provisions of 18.3, applications for licenses must clearly demonstrate how the criteria have been
817 addressed.

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

823 Licensees or applicants may propose to the Department alternatives to meet the specific requirements in
824 this Appendix. The alternative proposals may take into account local or regional conditions, including
825 geology, topography, hydrology, and meteorology. The Department may find that the proposed
826 alternatives meet the Department's requirements if the alternatives will achieve a level of stabilization and
827 containment of the sites concerned and a level of protection for public health, safety, and the environment
828 from radiological and nonradiological hazards associated with the site, which is equivalent to, to the
829 extent practicable, or more stringent than the level which would be achieved by the requirements of this
830 Appendix and the standards promulgated by the Environmental Protection Agency in 40 CFR Part 192,
831 Subparts D and E. Proposed alternatives to specific regulations in this Part 18 require notice and
832 opportunity for hearing before the NRC.

833 All site-specific licensing decisions based on the criteria in this Appendix or alternatives proposed by
834 licensees or applicants will take into account the risk to the public health and safety and the environment
835 with due consideration to the economic costs involved and any other factors the Department determines
836 to be appropriate. In implementing this Appendix, the Department will consider "practicable" and
837 "reasonably achievable" as equivalent terms. Decisions involving these terms will take into account the
838 state of technology, and the economics of improvements in relation to benefits to the public health and
839 safety, and other societal and socioeconomic considerations, and in relation to the utilization of atomic
840 energy in the public interest.

841 **Criterion 1.**

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

- 848 (1) Remoteness from populated areas;
- 849 (2) Hydrologic and other natural conditions as they contribute to continued immobilization and
850 isolation of contaminants from ground-water sources; and

851 (3) Potential for minimizing erosion, disturbance, and dispersion by natural forces over the long-term.

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

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

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

861 **Criterion 2.**

862 To avoid proliferation of small waste disposal sites and thereby reduce perpetual surveillance obligations,
863 byproduct material ~~as in definition (2) of 1-2.2~~, from in situ extraction operations, such as residues from
864 solution evaporation or contaminated control processes, and wastes from small remote above ground
865 extraction operations shall be disposed of at existing large mill tailings disposal sites; unless considering
866 the nature of the wastes, such as their volume and specific activity and the costs and environmental
867 impacts of transporting the wastes to a large disposal site, such offsite disposal is demonstrated to be
868 impracticable or the advantages of onsite burial clearly outweigh the benefits of reducing the perpetual
869 surveillance obligations.

870 **Criterion 3.**

871 The "prime option" for disposal of tailings is placement below grade, either in mines or specially
872 excavated pits (that is, where the need for any specially constructed retention structure is eliminated).
873 The evaluation of alternative sites and disposal methods performed by mill operators in support of their
874 proposed tailings disposal program (provided in applicants' environmental ~~reports~~assessment) must
875 reflect serious consideration of this disposal mode. In some instances, below grade disposal may not be
876 the most environmentally sound approach, such as might be the case if a ground-water formation is
877 relatively close to the surface or not very well isolated by overlying soils and rock. Also, geologic and
878 topographic conditions might make full below grade burial impracticable: For example, bedrock may be
879 sufficiently near the surface that blasting would be required to excavate a disposal pit at excessive cost,
880 and more suitable alternative sites are not available. Where full below grade burial is not practicable, the
881 size of retention structures, and size and steepness of slopes associated with exposed embankments
882 must be minimized by excavation to the maximum extent reasonably achievable or appropriate given the
883 geologic and hydrologic conditions at a site. In these cases, it must be demonstrated that an above grade
884 disposal program will provide reasonably equivalent isolation of the tailings from natural erosional forces.

885 **Criterion 4.**

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

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

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

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

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

901 (1) Where a full vegetative cover is not likely to be self-sustaining due to climatic or other conditions,
902 such as in semi-arid and arid regions, rock cover must be employed on slopes of the
903 impoundment system. The Department will consider relaxing this requirement for extremely
904 gentle slopes such as those, which may exist on the top of the pile.

905 (2) The following factors must be considered in establishing the final rock cover design to avoid
906 displacement of rock particles by human and animal traffic or by natural process, and to preclude
907 undercutting and piping:

908 (a) Shape, size, composition, and gradation of rock particles (excepting bedding material
909 average particles size must be at least cobble size or greater);

910 (b) Rock cover thickness and zoning of particles by size; and

911 (c) Steepness of underlying slopes.

912 (3) Individual rock fragments must be dense, sound, and resistant to abrasion, and must be free from
913 cracks, seams, and other defects that would tend to unduly increase their destruction by water
914 and frost actions. Weak, friable, or laminated aggregate may not be used.

915 (4) Rock covering of slopes may be unnecessary where top covers are very thick (on the order of
916 10m or greater); impoundment slopes are very gentle (on the order of 10h:1v or less); bulk cover
917 materials have inherently favorable erosion resistance characteristics; and, there is negligible
918 drainage catchment area upstream of the pile and good wind protection as described in Criteria
919 4A and 4B.

920 (5) Furthermore, all impoundment surfaces must be contoured to avoid areas of concentrated
921 surface runoff or abrupt or sharp changes in slope gradient. In addition to rock cover on slopes,
922 areas toward which surface runoff might be directed must be well protected with substantial rock
923 cover (rip rap). In addition to providing for stability of the impoundment system itself, overall
924 stability, erosion potential, and geomorphology of surrounding terrain must be evaluated to
925 assure that there are not ongoing or potential processes, such as gully erosion, which would lead
926 to impoundment instability.

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

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

938 **Criterion 5.**

939 Criteria 5A-5D and Criterion 10 incorporate the basic ground-water protection standards imposed by the
940 Environmental Protection Agency in 40 CFR Part 192, Subparts D and E (48 FR 45926; October 7, 1983)
941 which apply during operations and prior to the end of closure. Groundwater monitoring to comply with
942 these standards is required by Criterion 7A.

943 Criterion 5A.

Comment [JJ67]: Cross-reference error
correction – reference should be to Criterion 7 and
not Criterion 7A. Criterion 7A does not exist.

NRC Compatibility = C
NRC Letter 01/14/14

- 944 (1) The primary ground-water protection standard is a design standard for surface impoundments
945 used to manage byproduct material. Unless exempted under paragraph 5A(3) of this criterion,
946 surface impoundments (except for an existing portion) shall have a liner that is designed,
947 constructed, and installed to prevent any migration of wastes out of the impoundment to the
948 adjacent subsurface soil, ground water, or surface water at any time during the active life
949 (including the closure period) of the impoundment. The liner may be constructed of materials that
950 may allow wastes to migrate into the liner (but not into the adjacent subsurface soil, ground water,
951 or surface water) during the active life of the facility, provided that impoundment closure includes
952 removal or decontamination of all waste residues, contaminated containment system components
953 (liners, etc.) contaminated subsoils, and structures and equipment contaminated with waste and
954 leachate. For impoundments that will be closed with the liner material left in place, the liner must
955 be constructed of materials that can prevent wastes from migrating into the liner during the active
956 life of the facility.
- 957 (2) The liner required by paragraph 5A(1) above shall be:
- 958 (a) Constructed of materials that have appropriate chemical properties and sufficient strength
959 and thickness to prevent failure due to pressure gradients (including static head and
960 external hydrogeologic forces), physical contact with the waste or leachate to which they
961 are exposed, climatic conditions, the stress of installation, and the stress of daily
962 operation;
- 963 (b) Placed upon a foundation or base capable of providing support to the liner and resistance
964 to pressure gradients above and below the liner to prevent failure of the liner due to
965 settlement, compression, or uplift; and
- 966 (c) Installed to cover all surrounding earth likely to be in contact with the wastes or leachate.
- 967 (3) The applicant or licensee will be exempted from the requirements of paragraph 5A(1) of this
968 criterion if the Department finds, based on a demonstration by the applicant or licensee, that
969 alternate design and operating practices, including the closure plan, together with site
970 characteristics will prevent the migration of any hazardous constituents into ground water or
971 surface water at any future time.
- 972 In deciding whether to grant an exemption, the Department will consider:
- 973 (a) The nature and quantity of the wastes;
- 974 (b) The proposed alternate design and operation;
- 975 (c) The hydrogeologic setting of the facility, including the attenuative capacity and thickness
976 of the liners and soils present between the impoundment and ground water or surface
977 water; and
- 978 (d) All other factors which would influence the quality and mobility of the leachate produced
979 and the potential for it to migrate to ground water or surface water.
- 980 (4) A surface impoundment must be designed, constructed, maintained, and operated to prevent
981 overtopping resulting from normal or abnormal operations, overfilling, wind and wave actions,
982 rainfall, or run-on; from malfunctions of level controllers, alarms, and other equipment; and from
983 human error.
- 984 (5) When dikes are used to form the surface impoundment, the dikes must be designed, constructed,
985 and maintained with sufficient structural integrity to prevent massive failure of the dikes. In
986 ensuring structural integrity, it must not be presumed that the liner system will function without
987 leakage during the active life of the impoundment.

988 Criterion 5B.

- 989 (1) Uranium and thorium byproduct material ~~in definition (2) of 1.2.2~~ shall be managed to conform to
 990 the following secondary ground-water protection standard: hazardous constituents entering the
 991 ground water from a licensed site must not exceed the specified concentration limits in the
 992 uppermost aquifer beyond the point of compliance during the compliance period. Hazardous
 993 constituents are those constituents identified by the Department pursuant to paragraph 5B(2) of
 994 this criterion. Specified concentration limits are those limits established by the Department as
 995 indicated in paragraph 5B(5) of this criterion. The Department will also establish the point of
 996 compliance and compliance period on a site-specific basis through license conditions and orders.
 997 The objective in selecting the point of compliance is to provide the earliest practicable warning
 998 that the impoundment is releasing hazardous constituents to the ground water. The point of
 999 compliance must be selected to provide prompt indication of ground-water contamination on the
 1000 hydraulically downgradient edge of the disposal area. The Department shall identify hazardous
 1001 constituents, establish concentration limits, set the compliance period, and may adjust the point of
 1002 compliance if needed to accord with developed data and site information as to the flow of ground
 1003 water or contaminants, when the detection monitoring established under Criterion ~~7A~~ indicates
 1004 leakage of hazardous constituents from the disposal area.
- 1005 (2) A constituent becomes a hazardous constituent subject to paragraph 5B(5) only when the
 1006 constituent meets all three of the following tests:
- 1007 (a) The constituent is reasonably expected to be in or derived from the uranium and thorium
 1008 byproduct material in the disposal area;
- 1009 (b) The constituent has been detected in the ground water in the uppermost aquifer; and
- 1010 (c) The constituent is listed in Criterion 10 of this appendix.
- 1011
- 1012 (3) Even when constituents meet all three tests in paragraph 5B(2) of this criterion, the Department
 1013 may exclude a detected constituent from the set of hazardous constituents on a site-specific
 1014 basis if it finds that the constituent is not capable of posing a substantial present or potential
 1015 hazard to human health or the environment. In deciding whether to exclude constituents, the
 1016 Department will consider the following:
- 1017 (a) Potential adverse effects on ground-water quality, considering
- 1018 (i) The physical and chemical characteristics of the waste in the licensed site,
 1019 including its potential for migration;
- 1020 (ii) The hydrogeological characteristics of the facility and surrounding land;
- 1021 (iii) The quantity of ground water and the direction of ground water flow;
- 1022 (iv) The proximity and withdrawal rates of ground-water users;
- 1023 (v) The current and future uses of ground water in the area;
- 1024 (vi) The existing quality of ground water, including other sources of contamination
 1025 and their cumulative impact on the ground water quality;
- 1026 (vii) The potential for health risks caused by human exposure to waste constituents;
- 1027 (viii) The potential damage to wildlife, crops, vegetation, and physical structures
 1028 caused by exposure to waste constituents;
- 1029 (ix) The persistence and permanence of the potential adverse effects.
- 1030 (b) Potential adverse effects on hydraulically-connected surface water quality, considering

Comment [JJ68]: Cross-reference error correction – reference should be to Criterion 7 and not Criterion 7A. Criterion 7A does not exist.

NRC Compatibility = C
 NRC Letter 01/14/14

- 1031 (i) The volume and physical and chemical characteristics of the waste in the
1032 licensed site;
- 1033 (ii) The hydrogeological characteristics of the facility and surrounding land;
- 1034 (iii) The quantity and quality of ground water and the direction of ground water flow;
- 1035 (iv) The patterns of rainfall in the region;
- 1036 (v) The proximity of the licensed site to surface waters;
- 1037 (vi) The current and future uses of surface waters in the area and any water quality
1038 standards established for those surface waters;
- 1039 (vii) The existing quality of surface water, including other sources of contamination
1040 and the cumulative impact on surface water quality;
- 1041 (viii) The potential for health risks caused by human exposure to waste constituents;
- 1042 (ix) The potential damage to wildlife, crops, vegetation, and physical structures
1043 caused by exposure to waste constituents; and
- 1044 (x) The persistence and permanence of the potential adverse effects.
- 1045 (4) In making any determinations under paragraphs 5B(3) and 5B(6) of this criterion about the use of
1046 ground water in the area around the facility, the Department will consider any identification of
1047 underground sources of drinking water and exempted aquifers made by the Colorado Water
1048 Quality Control Commission, as in 5 CCR 1002-8, or other agency having jurisdiction.
- 1049 (5) At the point of compliance, the concentration of a hazardous constituent must not exceed:
- 1050 (a) The Department-approved background concentration of that constituent in the ground
1051 water;
- 1052 (b) The respective value given in the table in paragraph 5C if the constituent is listed in the
1053 table and if the background level of the constituent is below the value listed; or
- 1054 (c) An alternate concentration limit established by the Department.
- 1055 (6) Conceptually, background concentrations pose no incremental hazards and the drinking water
1056 limits in Criterion 5C state acceptable hazards but these two options may not be practically
1057 achievable at a specific site. Alternate concentration limits that present no significant hazard may
1058 be proposed by licensees for Department consideration. Licensees must provide the basis for any
1059 proposed limits including consideration of practicable corrective actions, that limits are as low as
1060 reasonably achievable, and information on the factors the Department must consider. The
1061 Department will establish a site specific alternate concentration limit for a hazardous constituent
1062 as provided in paragraph 5B(5) of this criterion if it finds that the proposed limit is as low as
1063 reasonably achievable after considering practicable corrective actions, and that the constituent
1064 will not pose a substantial present or potential hazard to human health or the environment as long
1065 as the alternate concentration limit is not exceeded. In making the present and potential hazard
1066 finding, the Department will consider the following factors:
- 1067 (a) Potential adverse effects on ground water quality, considering:
- 1068 (i) The physical and chemical characteristics of the waste in the licensed site
1069 including its potential for migration;
- 1070 (ii) The hydrogeological characteristics of the facility and surrounding land;
- 1071 (iii) The quantity of ground water and the direction of ground water flow;

- 1072 (iv) The proximity and withdrawal rates of ground water users;
- 1073 (v) The current and future uses of ground water in the area;
- 1074 (vi) The existing quality of ground water, including other sources of contamination
1075 and their cumulative impact on the ground water quality;
- 1076 (vii) The potential for health risks caused by human exposure to waste constituents;
- 1077 (viii) The potential damage to wildlife, crops, vegetation, and physical structures
1078 caused by exposure to waste constituents;
- 1079 (ix) The persistence and permanence of the potential adverse effects.
- 1080 (b) Potential adverse effects on hydraulically-connected surface water quality, considering:
- 1081 (i) The volume and physical and chemical characteristics of the waste in the
1082 licensed site;
- 1083 (ii) The hydrogeological characteristics of the facility and surrounding land;
- 1084 (iii) The quantity and quality of ground water, and the direction of ground water flow;
- 1085 (iv) The patterns of rainfall in the region;
- 1086 (v) The proximity of the licensed site to surface waters;
- 1087 (vi) The current and future uses of surface waters in the area and any water quality
1088 standards established for those surface waters;
- 1089 (vii) The existing quality of surface water including other sources of contamination
1090 and the cumulative impact on surface water quality;
- 1091 (viii) The potential for health risks caused by human exposure to waste constituents;
- 1092 (ix) The potential damage to wildlife, crops, vegetations, and physical structures
1093 caused by exposure to waste constituents; and
- 1094 (x) The persistence and permanence of the potential adverse effects.

1095 Criterion 5C.

1096 **Maximum Values for Ground Water Protection**

Constituent or property	Maximum Concentration (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 percent chlorine)	0.005

2,4-D (2,4-Dichlorophenoxyacetic acid)	0.1
2,4,5-TP Silvex (2,4,5-Trichloro-phenoxypropionic acid)	0.01

1097

	Becquerels per liter	PicoCuries per liter
Combined radium-226 and radium-228	0.185	5
Gross alpha-particle activity (excluding radon and uranium when producing uranium byproduct material or radon and thorium when producing thorium byproduct material)	0.555	15

1098

1099 Criterion 5D. If the ground water protection standards established under paragraph 5B(1) of this criterion
 1100 are exceeded at a licensed site, a corrective action program must be put into operation as soon as is
 1101 practicable, and in no event later than eighteen (18) months after the Department finds that the standards
 1102 have been exceeded. The licensee shall submit the proposed corrective action program and supporting
 1103 rationale for Department approval prior to putting the program into operation, unless otherwise directed by
 1104 the Department. The objective of the program is to return hazardous constituent concentration levels in
 1105 ground water to the concentration limits set as standards. The licensee's proposed program shall address
 1106 removing the hazardous constituents that have entered the ground water at the point of compliance or
 1107 treating them in place. The program shall also address removing or treating in place any hazardous
 1108 constituents that exceed concentration limits in ground water between the point of compliance and the
 1109 down gradient facility property boundary. The licensee shall continue corrective action measures to the
 1110 extent necessary to achieve and maintain compliance with the ground water protection standard. The
 1111 Department will determine when the licensee may terminate corrective action measures based on data
 1112 from the ground water monitoring program and other information that provide reasonable assurance that
 1113 the ground water protection standard will not be exceeded.

1114 Criterion 5E. In developing and conducting ground water protection programs, applicants and licensees
 1115 shall also consider the following:

1116 (1) Installation of bottom liners (Where synthetic liners are used, a leakage detection system must be
 1117 installed immediately below the liner to ensure major failures are detected if they occur. This is in
 1118 addition to the ground water monitoring program conducted as provided in [Criterion 7.18.3.3](#).
 1119 Where clay liners are proposed or relatively thin, in situ clay soils are to be relied upon for
 1120 seepage control, tests must be conducted with representative tailings solutions and clay materials
 1121 to confirm that no significant deterioration of permeability or stability properties will occur with
 1122 continuous exposure of clay to tailings solutions. Tests must be run for a sufficient period of time
 1123 to reveal any effects if they are going to occur (in some cases deterioration has been observed to
 1124 occur rather rapidly after about nine months of exposure)).

1125 (2) Mill process designs which provide the maximum practicable recycle of solutions and
 1126 conservation of water to reduce the net input of liquid to the tailings impoundment.

1127 (3) Dewatering of tailings by process devices and/or in situ drainage systems (At new sites, tailings
 1128 must be dewatered by a drainage system installed at the bottom of the impoundment to lower the
 1129 phreatic surface and reduce the driving head of seepage, unless tests show tailings are not
 1130 amenable to such a system. Where in situ dewatering is to be conducted, the impoundment
 1131 bottom must be graded to assure that the drains are at a low point. The drains must be protected
 1132 by suitable filter materials to assure that drains remain free running. The drainage system must
 1133 also be adequately sized to assure good drainage).

1134 (4) Neutralization to promote immobilization of hazardous constituents.

1135 Criterion 5F. Where ground water impacts are occurring at an existing site due to seepage, action must
 1136 be taken to alleviate conditions that lead to excessive seepage impacts and restore ground water quality.
 1137 The specific seepage control and ground water protection method, or combination of methods, to be used
 1138 must be worked out on a site-specific basis. Technical specifications must be prepared to control
 1139 installation of seepage control systems. A quality assurance, testing, and inspection program, which
 1140 includes supervision by a qualified engineer or scientist, must be established to assure the specifications
 1141 are met.

Comment [JJ69]: Cross-reference error correction – reference should be to 18.3.3 and not Criterion 7, consistent with 10 CFR 40 Appendix A, I (Technical Criteria).

NRC Compatibility = C
 NRC Letter 01/14/14

1142 Criterion 5G. In support of a tailings disposal system proposal, the applicant/operator shall supply
1143 information concerning the following:

- 1144 (1) The chemical and radioactive characteristics of the waste solutions.
- 1145 (2) The characteristics of the underlying soil and geologic formations particularly as they will control
1146 transport of contaminants and solutions. This includes detailed information concerning extent,
1147 thickness, uniformity, shape, and orientation of underlying strata. Hydraulic gradients and
1148 conductivities of the various formations must be determined. This information must be gathered
1149 from borings and field survey methods taken within the proposed impoundment area and in
1150 surrounding areas where contaminants might migrate to ground water. The information gathered
1151 on boreholes must include both geological and geophysical logs in sufficient number and degree
1152 of sophistication to allow determining significant discontinuities, fractures, and channeled deposits
1153 of high hydraulic conductivity. If field survey methods are used, they should be in addition to and
1154 calibrated with borehole logging. Hydrologic parameters such as permeability may not be
1155 determined on the basis of laboratory analysis of samples alone; a sufficient amount of field
1156 testing (e.g., pump tests) must be conducted to assure actual field properties are adequately
1157 understood. Testing must be conducted to allow estimating chemi-sorption attenuation properties
1158 of underlying soil and rock.
- 1159 (3) Location, extent, quality, capacity and current uses of any ground water at and near the site.

1160 Criterion 5H. Steps must be taken during stockpiling of ore to minimize penetration of radionuclides into
1161 underlying soils; suitable methods include lining and/or compaction of ore storage areas.

1162 **Criterion 6.**

- 1163 (1) In disposing of waste byproduct material, licensees shall place an earthen cover (or approved
1164 alternative) over tailings or wastes at the end of milling operations and shall close the waste
1165 disposal area in accordance with a design¹ which provides reasonable assurance of control of
1166 radiological hazards to (i) be effective for 1,000 years, to the extent reasonably achievable, and,
1167 in any case, for at least 200 years, and (ii) limit releases of radon-222 from uranium byproduct
1168 materials, and radon-220 from thorium byproduct materials, to the atmosphere so as not to
1169 exceed an average² release rate of 0.74 Becquerel per square meter per second (Bq/m² s), or 20
1170 picocuries per square meter per second (pCi/m² s), to the extent practicable throughout the
1171 effective design life determined pursuant to (1)(i) of this criterion. In computing required tailings
1172 cover thicknesses, moisture in soils in excess of amounts found normally in similar soils in similar
1173 circumstances may not be considered. Direct gamma exposure from the tailings or wastes should
1174 be reduced to background levels. The effects of any thin synthetic layer may not be taken into
1175 account in determining the calculated radon exhalation level. If non-soil materials are proposed
1176 as cover materials, it must be demonstrated that these materials will not crack or degrade by
1177 differential settlement, weathering, or other mechanism, over long-term intervals.

1178 ¹ In the case of thorium byproduct materials, the standard applies only to design. Monitoring for radon emissions from thorium
1179 byproduct materials after installation of an appropriately designed cover is not required.

1180 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
1181 100 years. Radon will come from both byproduct materials and from covering materials. Radon emissions from covering materials
1182 should be estimated as part of developing a closure plan for each site. The standard, however, applies only to the emissions from
1183 byproduct materials to the atmosphere.

- 1184 (2) As soon as reasonably achievable after emplacement of the final cover to limit releases of radon-
1185 222 from uranium byproduct material and prior to placement of erosion protection barriers or
1186 other features necessary for long-term control of the tailings, the licensee shall verify through
1187 appropriate testing and analysis that the design and construction of the final radon barrier is
1188 effective in limiting releases of radon-222 to a level not exceeding 0.74 Bq/m² s (20 pCi/m² s)
1189 averaged over the entire pile or impoundment using the procedures described in 40 CFR Part 61,
1190 Appendix B, Method 115, or another method of verification approved by the Department as being
1191 at least as effective in demonstrating the effectiveness of the final radon barrier.
1192

- 1193 (3) When phased emplacement of the final radon barrier is included in the applicable reclamation
1194 plan, the verification of radon-222 release rates required in paragraph (2) of this Criterion must be
1195 conducted for each portion of the pile or impoundment as the final radon barrier for that portion is
1196 emplaced.
- 1197 (4) Within ninety days of the completion of all testing and analysis relevant to the required verification
1198 in paragraphs (2) and (3) of this Criterion, the uranium mill licensee shall report to the Department
1199 the results detailing the actions taken to verify that levels of release of radon-222 do not exceed
1200 0.74 Bq/m² s (20 pCi/m² s) when averaged over the entire pile or impoundment. The licensee
1201 shall maintain records until termination of the license documenting the source of input parameters
1202 including the results of all measurements on which they are based, the calculations and/or
1203 analytical methods used to derive values for input parameters, and the procedure used to
1204 determine compliance. These records shall be kept in a form suitable for transfer to the custodial
1205 agency at the time of transfer of the site to the U.S. Department of Energy or State for long-term
1206 care if requested.
- 1207 (5) Near surface cover materials, i.e., within the top three meters (10 feet), may not include waste or
1208 rock that contains elevated levels of radium; soils used for near surface cover must be essentially
1209 the same, as far as radioactivity is concerned, as that of surrounding surface soils. This is to
1210 ensure that surface radon exhalation is not significantly above background because of the cover
1211 material itself.
- 1212 (6) The design requirements in this Criterion for longevity and control of radon releases apply to any
1213 portion of a licensed and/or disposal site unless such portion contains a concentration of radium
1214 in land, averaged over areas of 100 square meters, which as a result of byproduct material, does
1215 not exceed the background level by more than: (i) 0.18 Becquerels (5 picocuries) per gram of
1216 radium-226, or, in the case of thorium byproduct material, radium-228, averaged over the first 15
1217 centimeters (cm) below the surface, and (ii) 0.56 Becquerels (15 pCi) of radium-226, or, in the
1218 case of thorium byproduct material, radium-228, averaged over 15-cm thick layers more than 15
1219 cm below the surface.
- 1220 Byproduct material containing concentrations of radionuclides other than radium in soil, and surface
1221 activity on remaining structures, must not result in a total effective dose equivalent (TEDE) exceeding the
1222 dose from cleanup of radium contaminated soil to the above standard (benchmark dose), and must be at
1223 levels which are as low as reasonably achievable. If more than one residual radionuclide is present in the
1224 same 100 square-meter area, the sum of the ratios for each radionuclide of concentration present to the
1225 concentration limit will not exceed "1" (unity). A calculation of the potential peak annual TEDE within 1000
1226 years to the average member of the critical group that would result from applying the radium standard
1227 (not including radon) on the site must be submitted for approval. The use of decommissioning plans with
1228 benchmark doses which exceed 1 millisievert per year (100 mrem/year), before application of ALARA,
1229 requires the approval of the Department. This requirement for dose criteria does not apply to sites that
1230 have decommissioning plans for soil and structures approved before the effective date of this Criterion
1231 6(6).
- 1232 (7) The licensee shall also address the nonradiological hazards associated with the wastes in
1233 planning and implementing closure. The licensee shall ensure that disposal areas are closed in a
1234 manner that minimizes the need for further maintenance. To the extent necessary to prevent
1235 threats to human health and the environment, the licensee shall control, minimize, or eliminate
1236 post-closure escape of nonradiological hazardous constituents, leachate, contaminated rainwater,
1237 or waste decomposition products to the ground or surface waters or to the atmosphere.
- 1238
1239
1240

Comment [JJ70]:

Editorial change: comma added based on editorial comment made by NRC in letter dated 11/10/2004.

1241 Criterion 6A.

- 1242 (1) For impoundments containing uranium byproduct materials, the final radon barrier must be
1243 completed as expeditiously as practicable considering technological feasibility after the pile or
1244 impoundment ceases operation in accordance with a written, Department-approved reclamation
1245 plan. (The term as expeditiously as practicable considering technological feasibility as specifically

1246 | defined in **section** 18.2 includes factors beyond the control of the licensee). Deadlines for
 1247 | completion of the final radon barrier and, if applicable, the following interim milestones must be
 1248 | established as a condition of the individual license: windblown tailings retrieval and placement on
 1249 | the pile and interim stabilization including dewatering or the removal of freestanding liquids and
 1250 | recontouring. The placement of erosion protection barriers or other feature necessary for long-
 1251 | term control of the tailings must also be completed in a timely manner in accordance with a
 1252 | written, Department-approved reclamation plan.

1253 | (2) The Department may approve a licensee's request to extend the time for performance of
 1254 | milestones related to emplacement of the final radon barrier if, after providing an opportunity for
 1255 | public participation, the Department finds that the licensee has adequately demonstrated in the
 1256 | manner required in paragraph (2) of Criterion 6 that releases of radon-222 do not exceed an
 1257 | average of 0.74 Becquerel/m² s (20 pCi/m² s). If the delay is approved on the basis that the radon
 1258 | releases do not exceed 0.74 Becquerel/m² s (20 pCi/m² s), a verification of radon levels, as
 1259 | required by paragraph (2) of Criterion 6, must be made annually during the period of delay. In
 1260 | addition, once the Department has established the date in the reclamation plan for the milestone
 1261 | for completion of the final radon barrier, the Department may extend that date based on cost if
 1262 | after providing an opportunity for public participation, the Department finds that the licensee is
 1263 | making good faith efforts to emplace the final radon barrier, the delay is consistent with the
 1264 | definition of available technology, and the radon releases caused by the delay will not result in a
 1265 | significant incremental risk to the public health.

1266 | (3) The Department may authorize by license amendment, upon licensee **report request**, a portion of
 1267 | the impoundment to accept uranium byproduct material or such materials that are similar in
 1268 | physical, chemical, and radiological characteristics to the uranium mill tailings and associated
 1269 | wastes already in the pile or impoundment from other sources, during the closure process. No
 1270 | such authorization will be made if it results in a delay or impediment to emplacement of the final
 1271 | radon barrier over the remainder of the impoundment in a manner that will achieve levels of
 1272 | radon-222 releases not exceeding 0.74 Becquerel/m² s (20 pCi/m² s) averaged over the entire
 1273 | impoundment. The verification required in paragraph (2) of Criterion 6 may be completed with a
 1274 | portion of the impoundment being used for further disposal if the Department makes a final
 1275 | finding that the impoundment will continue to achieve a level of radon-222 release not exceeding
 1276 | 0.74 Becquerel/m² s (20 pCi/m² s) averaged over the entire impoundment. In this case, after the
 1277 | final radon barrier is complete except for the continuing disposal area, (a) only byproduct material
 1278 | will be authorized for disposal, (b) the disposal will be limited to the specified existing disposal
 1279 | area, and (c) this authorization will only be made after providing opportunity for public
 1280 | participation. Reclamation of the disposal area, as appropriate, must be completed in a timely
 1281 | manner after disposal operations cease in accordance with paragraph (1) of Criterion 6; however,
 1282 | these actions are not required to be complete as part of meeting the deadline for final radon
 1283 | barrier construction.

Comment [JJ71]: Change in wording based on
 editorial comment made by NRC in letter dated
 11/10/2004.

1289 | **Criterion 7.**

1290 | The licensee shall establish a detection monitoring program needed for the Department to set the site-
 1291 | specific ground water protection standards in paragraph 5B(1) of this appendix. For all monitoring under
 1292 | this paragraph, the licensee or applicant will propose for Department approval as license conditions which
 1293 | constituents are to be monitored on a site-specific basis. A detection monitoring program has two
 1294 | purposes. The initial purpose of the program is to detect leakage of hazardous constituents from the
 1295 | disposal area so that the need to set ground water protection standards is monitored. If leakage is
 1296 | detected, the second purpose of the program is to generate data and information needed for the
 1297 | Department to establish the standards under Criterion 5B. The data and information must provide a
 1298 | sufficient basis to identify those hazardous constituents which require concentration limit standards and to
 1299 | enable the Department to set the limits for those constituents and the compliance period. They may also
 1300 | need to provide the basis for adjustments to the point of compliance. The detection monitoring programs
 1301 | must be in place when specified by the Department in orders or license conditions. Once ground water

1302 protection standards have been established pursuant to paragraph 5B(1), the licensee shall establish and
1303 implement a compliance monitoring program. The purpose of the compliance monitoring program is to
1304 determine that the hazardous constituent concentrations in ground water continue to comply with the
1305 standards set by the Department. In conjunction with a corrective action program, the licensee shall
1306 establish and implement a corrective action monitoring program. The purpose of the corrective action
1307 monitoring program is to demonstrate the effectiveness of the corrective actions. Any monitoring program
1308 required by this paragraph may be based on existing monitoring programs to the extent the existing
1309 programs can meet the stated objective for the program.

1310 **Criterion 8.**

1311 Milling operations must be conducted so that all airborne effluent releases are reduced to levels as low as
1312 is reasonably achievable. The primary means of accomplishing this must be by means of emission
1313 controls. Institutional controls, such as extending the site boundary and exclusion area, may be employed
1314 to ensure that offsite exposure limits are met, but only after all practicable measures have been taken to
1315 control emissions at the source. Notwithstanding the existence of individual dose standards, strict control
1316 of emissions is necessary to assure that population exposures are reduced to the maximum extent
1317 reasonably achievable and to avoid site contamination. The greatest potential sources of offsite radiation
1318 exposure (aside from radon exposure) are dusting from dry surfaces of the tailings disposal area not
1319 covered by tailings solution and emissions from yellowcake drying and packaging operations. During
1320 operations and prior to closure, radiation doses from radon emissions from surface impoundments of
1321 uranium or thorium byproduct materials must be kept as low as is reasonably achievable.

1322 Checks must be made and logged hourly for all parameters (e.g., differential pressures and scrubber
1323 water flow rates) that determine the efficiency of yellowcake stack emission control equipment operation.
1324 The licensee shall retain each log as a record for three years after the last entry in the log is made. It
1325 must be determined whether or not conditions are within a range prescribed to ensure that the equipment
1326 is operating consistently near peak efficiency; corrective action must be taken when performance is
1327 outside of prescribed ranges. Effluent control devices must be operative at all times during drying and
1328 packaging operations and whenever air is exhausting from the yellowcake stack. Drying and packaging
1329 operations must terminate when controls are inoperative. When checks indicate the equipment is not
1330 operating within the range prescribed for peak efficiency, actions must be taken to restore parameters to
1331 the prescribed range. When this cannot be done without shutdown and repairs, drying and packaging
1332 operations must cease as soon as practicable. Operations may not be restarted after cessation due to off-
1333 normal performance until needed corrective actions have been identified and implemented. All these
1334 cessations, corrective actions, and restarts must be reported to the Department as indicated in Criterion
1335 8A, in writing, within ten days of the subsequent restart.
1336
1337

1338 To control dusting from tailings, that portion not covered by standing liquids must be wetted or chemically
1339 stabilized to prevent or minimize blowing and dusting to the maximum extent reasonably achievable. This
1340 requirement may be relaxed if tailings are effectively sheltered from wind, such as may be the case where
1341 they are disposed of below grade and the tailings surface is not exposed to wind. Consideration must be
1342 given in planning tailings disposal programs to methods which would allow phased covering and
1343 reclamation of tailings impoundments because this will help in controlling particulate and radon emissions
1344 during operation. To control dusting from diffuse sources, such as tailings and ore pads where automatic
1345 controls do not apply, operators shall develop written operating procedures specifying the methods of
1346 control which will be utilized.

1347 Milling operations producing or involving uranium and thorium byproduct materials must be conducted in
1348 such a manner as to provide reasonable assurance that the annual dose equivalent does not exceed 0.25
1349 millisievert (25 millirem) to the whole body, 0.75 millisievert (75 millirem) to the thyroid, and 0.25
1350 millisievert (25 millirem) to any other organ of any member of the public as a result of exposures to the
1351 planned discharge of radioactive material, radon and its progeny excepted, to the general environment.

1352 Uranium and thorium byproduct materials must be managed so as to conform to the applicable provisions
1353 of Title 40 of the *Code of Federal Regulations*, Part 440, "Ore Mining and Dressing Point Source
1354 Category: Effluent Limitations Guidelines and New Source Performance Standards, Subpart C, Uranium,
1355 Radium, and Vanadium Ores Subcategory", as codified on January 1, 1983.

1356 Criterion 8A. Inspections of tailings or waste retention systems must be conducted daily during
 1357 operations, or at an alternate frequency approved by the Department for other conditions. Such
 1358 inspections shall be conducted by, or under the supervision of, a qualified engineer or scientist, and
 1359 documented. The licensee shall retain the documentation for each inspection as a record for three years
 1360 after the documentation is made. The Department must be immediately notified of any failure in a tailings
 1361 or waste retention system that results in a release of tailings or waste into unrestricted areas, or any
 1362 unusual conditions (conditions not contemplated in the design of the retention system) that if not
 1363 corrected could indicate the potential or lead to failure of the system and result in a release of tailings or
 1364 waste into unrestricted areas.

1365 **Criterion 9.**

1366 Criterion 9A. These criteria relating to ownership of tailings and their disposal sites became effective on
 1367 November 8, 1981, and apply to all licenses terminated, issued, or renewed after that date.

1368 Criterion 9B. Any uranium or thorium milling license or tailings license must contain such terms and
 1369 conditions as the NRC and Department determine necessary to assure that prior to termination of the
 1370 license, the licensee will comply with ownership requirements of this criterion for sites used for tailings
 1371 disposal.

1372
 1373
 1374
 1375
 1376
 1377
 1378

1379 Criterion 9C. Title to the byproduct material licensed under this Part 18 and land, including any interests
 1380 therein (other than land owned by the United States or by the State), which is used for the disposal of any
 1381 such byproduct material, or is essential to ensure the long-term stability of such disposal site, must be
 1382 transferred to the United States or the State in which such land is located, at the option of such State. In
 1383 view of the fact that physical isolation must be the primary means of long-term control, and Government
 1384 land ownership is a desirable supplementary measure, ownership of certain severable subsurface
 1385 interests (for example, mineral rights) may be determined to be unnecessary to protect the public health
 1386 and safety and the environment. In any case, however, the applicant/operator must demonstrate a
 1387 serious effort to obtain such subsurface rights, and must in the event that certain rights cannot be
 1388 obtained, provide notification in local public land records of the fact that the land is being used for the
 1389 disposal of radioactive material and is subject to ~~either an NRC or Department~~ general or specific license
 1390 prohibiting the disruption and disturbance of the tailings. In some rare cases, such as may occur with
 1391 deep burial where no ongoing site surveillance will be required, surface land ownership transfer
 1392 requirements may be waived with the approval of the ~~Department and~~ NRC. For licenses issued before
 1393 November 8, 1981, the ~~Department and~~ NRC may take into account the status of the ownership of such
 1394 land, and interests therein, and the ability of a licensee to transfer title and custody thereof to the United
 1395 States or the State.

1396 Criterion 9D. If the NRC, ~~or the Department if title is held by the State,~~ subsequent to title transfer
 1397 determines that use of the surface or subsurface estates, or both, of the land transferred to the United
 1398 States or to a State will not endanger the public health, safety, welfare, or environment, the NRC, ~~or the~~
 1399 ~~Department if title is held by the State,~~ may **shall** permit the use of the surface or subsurface estates, or
 1400 both, of such **land and** in a manner consistent with the provisions provided in these criteria. If the NRC, ~~or~~
 1401 ~~the Department if title is held by the state,~~ permits such use of such land, it will provide the person who
 1402 transferred such land with the right of first refusal with respect to such use of such land.

1403 Criterion 9E. Material and land transferred to the United States or the State in accordance with this
 1404 Criterion 9 must be transferred to the United States or the State without cost other than administrative or
 1405 legal costs incurred in carrying out such transfer.

1406 Criterion 9F. The provisions of this part respecting transfer of title and custody to land and tailings and
 1407 wastes do not apply in the case of lands held in trust by the United States for any Indian tribe or lands
 1408 owned by such Indian tribe subject to a restriction against alienation imposed by the United States. In the

Comment [JJ72]:

In order to meet the compatibility for the equivalent section in 10 CFR 40, Criterion 11, NRC requires that references to the Department (CDPHE) be deleted since NRC has regulatory jurisdiction for the matters discussed in Criterion 9C, and 9D.

NRC Ltr dated 06/28/12 (#28)

10 CFR 40.2a; 10 CFR Part 40, Appendix A.
 Compatibility = NRC

Comment [JJ73]:

The changes in Criterion 9C, and 9D are a result of comments from the NRC in correspondence dated March 28, 2002.

The basis for the comment is that the NRC retains regulatory jurisdiction in the matters described in Criterion 9C and 9D.

NRC Ltr dated 03/28/02

10 CFR 40.2a; 10 CFR Part 40, Appendix A.

1409 case of such lands which are used for the disposal of uranium or thorium byproduct material, as defined
1410 | in **this** Part 4, the licensee shall enter into arrangements with the NRC as may be appropriate to assure
1411 the long-term surveillance of such lands by the United States.

Comment [JJ74]: Consistent with the addition of a definition for type 2 byproduct material in 18.2, the language is modified here.

1412 **Criterion 10.**

1413 Secondary ground-water protection standards required by Criterion 5 of this Appendix are concentration
1414 limits for individual hazardous constituents. The following list of constituents identifies the constituents for
1415 which standards must be set and complied with if the specific constituent is reasonably expected to be in
1416 or derived from the radioactive material and has been detected in ground water. For purposes of this
1417 Appendix, the property of gross alpha activity will be treated as if it is a hazardous constituent. Thus,
1418 when setting standards under paragraph 5B(5) of Criterion 5, the Department will also set a limit for gross
1419 alpha activity. The Department does not consider the following list imposed by 40 CFR Part 192 to be
1420 exhaustive and may determine other constituents to be hazardous on a case-by-case basis, independent
1421 of those specified by the U.S. Environmental Protection Agency in Part 192.

1422

1423

1424

1425 |

1426 **PART 18 - CRITERION 10 HAZARDOUS CONSTITUENTS**

- 1427 - Acetonitrile (Ethanenitrile)
- 1428 - Acetophenone (Ethanone, 1-phenyl)
- 1429 - 3-(alpha-Acetylbenzyl)-4-hydroxycoumarin and salts (Warfarin)
- 1430 - 2-Acetylaminofluorene (Acetamide, N-(9H- fluoren-2-yl)-)
- 1431 - Acetyl chloride (Ethanoyl chloride)
- 1432 - 1-Acetyl-2-thiourea (Acetamide, N- (aminothioxomethyl)-)
- 1433 - Acrolein (2-Propenal)
- 1434 - Acrylamide (2-Propenamide)
- 1435 - Acrylonitrile (2-Propenenitrile)
- 1436 - Aflatoxins
- 1437 - Aldrin (1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a,8b-hexahydro-endo,exo-1,4:5,8-
1438 Dimethanonaphthalene)
- 1439 - Allyl alcohol (2-Propen-1-ol)
- 1440 - Aluminum phosphide
- 1441 - 4-Aminobiphenyl ([1,1-Biphenyl])-4-amine)
- 1442 - 6-Amino-1,1a,2,8,8a,8b-hexahydro-8-(hydroxymethyl)-8a-methoxy-5-methyl-carbamate
1443 azirino(2,3:3,4)pyrrolo(1,2-a]indole-4,7-dione,(ester) (Mitomycin C) (Azirino[2,3:3,4]pyrrolo(1,2-
1444 a]indole-4,7-dione,6-amino-8-(((amino-cabonyl)oxy)methyl)-1,1a,2,8,8a,8b-hexahydro-8a
1445 methoxy-5-methyl-)
- 1446 - 5-(Aminomethyl)-3-isoxazolol (3(2H)-Isoxazolone, 5-(aminomethyl)-4-Aminopyridine (4-
1447 Pyridinamine)
- 1448 - Amitrole (1H-1,2,4-Triazol-3-amine)
- 1449 - Aniline (Benzenamine)
- 1450 - Antimony and compounds, N.O.S.³
- 1451 - Aramite (Sulfurous acid,2-chloroethyl-,2-(4-(1,1-dimethylethyl)phenoxy)-1-methylethyl ester)
- 1452 - Arsenic and compounds, N.O.S.³
- 1453 - Arsenic acid (Orthoarsenic acid)
- 1454 - Arsenic pentoxide (Arsenic (V) oxide)
- 1455 - Arsenic trioxide (Arsenic (III) oxide)
- 1456 - Auramine (Benzenamine,4,4-carbonimidoylbis (N,N-Dimethyl-,monohydrochloride)
- 1457 - Azaserine (L-Serine, diazoacetate (ester))

- 1458 - Barium and compounds, N.O.S.³
- 1459 - Barium cyanide
- 1460 - Benz(c)acridine (3,4-Benzacridine)
- 1461 - Benz(a)anthracene (1,2-Benzanthracene)
- 1462 - Benzene (Cyclohexatriene)
- 1463 - Benzenearsonic acid (Arsonic acid, phenyl-)
- 1464 - Benzene, dichloromethyl-(Benzal chloride)
- 1465 - Benzenethiol (Thiophenol)
- 1466 - Benzidine ([1,1-Biphenyl]-4,4 diamine)
- 1467 - Benzo(b)fluoranthene (2,3-Benzofluoranthene)
- 1468 - Benzo(j)fluoranthene (7,8-Benzofluoranthene)
- 1469 - Benzo(a)pyrene (3,4-Benzopyrene)
- 1470 - p-Benzoquinone (1,4-Cyclohexadienedione)
- 1471 - Benzotrichloride (Benzene, Trichloromethyl)
- 1472 - Benzyl chloride (Benzene, (chloromethyl)-)
- 1473 - Beryllium and compounds, N.O.S.³
- 1474 - Bis(2-chloroethoxy)methane (Ethane,1,1-(methylenebis(oxy))bis[2-chloro-])
- 1475 - Bis(2-chloroethyl) ether (Ethane, 1,1-oxybis (2-chloro-))
- 1476 - N,N-Bis(2-chloroethyl)-2-naphthylamine (Chlornaphazine)
- 1477 - Bis(2-Chloroisopropyl) ether (Propane, 2,2-oxybis[2-chloro-])
- 1478 - Bis(chloromethyl) ether (methane,oxybis[chloro-])
- 1479 - Bis(2-ethylhexyl) phthalate (1,2-Benzenedicarboxylic acid, bis(2-ethylhexyl) ester)
- 1480 - Bromoacetone (2-Propanone, 1-bromo-)
- 1481 - Bromomethane (Methyl bromide)
- 1482 - 4-Bromophenyl phenyl ether (Benzene, 1-bromo-4-phenoxy-)
- 1483 - Brucine (Strychnidin-10-one, 2,3-dimethoxy-)
- 1484 - 2-Butanone peroxide (Methyl ethyl ketone,peroxide)
- 1485 - Butyl benzyl phthalate (1,2-Benzenedicarboxylic acid, butylphenylmethyl ester)
- 1486 - 2-sec-Butyl-4,6-dinitrophenol (DNBP) (Phenol,2,4-dinitro-6-(1-methylpropyl)-)
- 1487 - Cadmium and compounds, N.O.S.³

- 1488 - Calcium chromate (Chromic acid, calcium salt)
- 1489 - Calcium cyanide
- 1490 - Carbon disulfide (Carbon bisulfide)
- 1491 - Carbon oxyfluoride (Carbonyl fluoride)
- 1492 - Chloral (Acetaldehyde, trichloro-)
- 1493 - Chlorambucil (Butanoic acid, 4-(bis(2-chloroethyl)amino)benzene-)
- 1494 - Chlordane (alpha and gamma isomers)4,7-Methanoindan, 1,2,4,5,6,7,8,8-octachloro-3,4,7,7a-
1495 tetrahydro-) (alpha and gammaisomers)
- 1496 - Chlorinated benzenes, N.O.S.³
- 1497 - Chlorinated ethane, N.O.S.³
- 1498 - Chlorinated fluorocarbons, N.O.S.³
- 1499 - Chlorinated naphthalene, N.O.S.³
- 1500 - Chlorinated phenol, N.O.S.³
- 1501 - Chloroacetaldehyde (Acetaldehyde, chloro-)
- 1502 - Chloroalkyl ethers N.O.S.³
- 1503 - p-Chloroaniline (Benzenamine, 4-chloro-)
- 1504 - Chlorobenzene (Benzene, chloro-)
- 1505 - Chlorobenzilate (Benzeneacetic acid, 4-chloro-alpha-(4-chlorophenyl)-alpha-hydroxy-,ethyl ester)
- 1506 - p-Chloro-m-cresol (Phenol, 4-chloro-3-methyl)
- 1507 - 1-Chloro-2,3-epoxypropane (Oxirane, 2-(chloromethyl)-)
- 1508 - 2-Chloroethyl vinyl ether (Ethene, (2-chloroethoxy)-)
- 1509 - Chloroform (Methane, trichloro-)
- 1510 - Chloromethane (Methyl chloride)
- 1511 - Chloromethyl methyl ether (Methane, chloromethoxy-)
- 1512 - 2-Chloronaphthalene (Naphthalene, betachloro-)
- 1513 - 2-Chlorophenol (Phenol, o-chloro-)
- 1514 - 1-(o-Chlorophenyl) thiourea (Thiourea, (2-chlorophenyl)-)
- 1515 - 3-Chloropropionitrile (Propanenitrile, 3-chloro-)
- 1516 - Chromium and compounds, N.O.S.³
- 1517 - Chrysene (1,2-Benzphenanthrene)

- 1518 - Citrus red No. 2 (2-Naphthol, 1-((2,5-dimethoxyphenyl)azo)-)
- 1519 - Coal tars
- 1520 - Copper cyanide
- 1521 - Creosote (Creosote, wood)
- 1522 - Cresols (Cresylic acid) (Phenol, methyl-)
- 1523 - Crotonaldehyde (2-Butenal)
- 1524 - Cyanides (soluble salts and complexes),N.O.S.³
- 1525 - Cyanogen (Ethanedinitrile)
- 1526 - Cyanogen bromide (Bromine cyanide)
- 1527 - Cyanogen chloride (Chlorine cyanide)
- 1528 - Cycasin (beta-D-Glucopyranoside, (methyl-ONN-azoxy)methyl-)
- 1529 - 2-Cyclohexyl-4,6-dinitrophenol (phenol, 2-cyclohexyl-4,6-dinitro-)
- 1530 - Cyclophosphamide (2H-1,3,2-Oxazaphosphorine (bis(2-chloroethyl)amino)-tetrahydro-,2-oxide)
- 1531 - Daunomycin (5,12-Naphthacenedione, (8S-cis)-8-acetyl-10-((3-amino-2,3,6-trideoxy)-alpha-L-
1532 lyxo-hexopyranosyl)oxy)7,8,9,10-tetrahydro-6,8,11-trihydroxy-1-methoxy-)
- 1533 - DDD (Dichlorodipenyldichloroethane)(Ethane, 1,1-dichloro-2,2-bis(p-chlorophenyl)-)
- 1534 - DDE (Ethylene, 1,1-dichloro-2,2-bis(4-chlorophenyl)-)
- 1535 - DDT (Dichlorodiphenyltrichloroethane) (Ethane, 1,1,1-trichloro-2,2-bis (p-chlorophenyl)-)
- 1536 - Diallylate (S-(2,3-dichloroallyl)diisopropylthiocarbamate)
- 1537 - Dibenz(a,h)acridine(1,2,5,6-Dibenzacridine)
- 1538 - Dibenz(a,j)acridine(1,2,7,8-Dibenzacridine)
- 1539 - Dibenz(a,h)anthracene (1,2,5,6-Dibenzanthracene)
- 1540 - 7H-Dibenzo(c,g)carbazole (3,4,5,6-Dibenzcarbazole)
- 1541 - Dibenzo(a,e)pyrene(1,2,4,5-Dibenzpyrene)
- 1542 - Dibenzo(a,h)pyrene(1,2,5,6-Dibenzpyrene)
- 1543 - Dibenzo(a,i)pyrene(1,2,7,8-Dibenzpyrene)
- 1544 - 1,2-Dibromo-3-chloropropane (Propane, 1,2-dibromo-3-chloro-)
- 1545 - 1,2 Dibromoethane (Ethylene dibromide)
- 1546 - Dibromomethane (Methylene bromide)
- 1547 - Di-n-butyl phthalate (1,2-Benzenedicarboxylic acid, dibutyl ester)

- 1548 - o-Dichlorobenzene (Benzene, 1,2-dichloro-)
- 1549 - m-Dichlorobenzene (Benzene, 1,3-dichloro-)
- 1550 - p-Dichlorobenzene (Benzene, 1,4-dichloro-)
- 1551 - Dichlorobenzene, N.O.S.³ (Benzene, dichloro-N.O.S.³)
- 1552 - 3,3-Dichlorobenzidine ([1,1, Biphenyl]-4,4-diamine, 3,3-dichloro-)
- 1553 - 1,4-Dichloro-2-butene (2-Butene, 1,4-dichloro-)
- 1554 - Dichlorodifluoromethane (Methane, dichlorodifluoro-)
- 1555 - 1,1 Dichloroethane (Ethylidene dichloride)
- 1556 - 1,2 Dichloroethane (Ethylene dichloride)
- 1557 - trans-1,2-Dichloroethene (1,2-Dichloroethylene)
- 1558 - Dichloroethylene, N.O.S.³ (Ethene, dichloro-N.O.S.³)
- 1559 - 1,1-Dichloroethylene (Ethene, 1,1-dichloro-)
- 1560 - Dichloromethane (Methylene chloride)
- 1561 - 2,4-Dichlorophenol (Phenol, 2,4-dichloro-)
- 1562 - 2,6-Dichlorophenol (Phenol, 2,6-dichloro-)
- 1563 - 2,4-Dichlorophenoxyacetic acid (2,4-D), salts and esters (Acetic acid, 2,4-dichlorophenoxy-, salts and esters)
- 1564
- 1565 - Dichlorophenylarsine (Phenyl dichloroarsine)
- 1566 - Dichloropropane, N.O.S.³ (Propane, dichloro-N.O.S.³)
- 1567 - 1,2-Dichloropropane (Propylene dichloride)
- 1568 - Dichloropropanol, N.O.S.³ (Propanol, dichloro-N.O.S.³)
- 1569 - Dichloropropene, N.O.S.³ (Propene, dichloro-N.O.S.³)
- 1570 - 1,3-Dichloropropene (1-Propene, 1,3-dichloro-)
- 1571 - Dieldrin (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)
- 1572
- 1573 - 1,2:3,4-Diepoxybutane (2,2,-Bioxirane)
- 1574 - Diethylarsine (Arsine, diethyl-)
- 1575 - N,N-Diethylhydrazine (Hydrazine, 1,2-diethyl)
- 1576 - O,O-Diethyl S-methyl ester of phosphorodithioic acid (Phosphorodithioic acid, O,O-diethyl S-methyl ester)
- 1577
- 1578 - O,O-Diethylphosphoric acid, O-p-nitrophenyl ester (Phosphoric acid, diethyl p-nitrophenyl ester)

- 1579 - Diethyl phthalate (1,2-Benzenedicarboxylic acid, diethyl ester)
- 1580 - O,O-Diethyl O-2-pyrazinyl phosphorothioate (Phosphorothioic acid, O,O-diethyl O-pyrazinyl ester)
- 1581 - Diethylstilbesterol (4,4-Stilbenediol, alpha, alpha-diethyl, bis(dihydrogen phosphate, (E)-)
- 1582 - Dihydrosafrole (Benzene, 1,2-methylenedioxy-4-propyl-)
- 1583 - 3,4-Dihydroxy-alpha-(methylamino)methylbenzyl alcohol (1,2-Benzenediol, 4-(1-hydroxy-2
1584 (methylamino)ethyl))
- 1585 - Dilsopropylfluorophosphate (DFP) (Phosphorofluoridic acid, bis(1-methylethyl) ester)
- 1586 - Dimethoate (Phosphorodithioic acid, O,O-dimethyl S-(2-(methylamino)-2-oxoethyl) ester)
- 1587 - 3,3,-Dimethoxybenzidine ((1,1,-Biphenyl)-4,4,-diamine, 3-3,-dimethoxy-)
- 1588 - p-Dimethylaminoazobenzene (Benzenamine, N,N-dimethyl-4-(phenylazo)-)
- 1589 - 7,12-Dimethylbenz(a)anthracene(1,2-Benzathracene, 7,12-dimethyl-)
- 1590 - 3,3-Dimethylbenzidine (1,1-Biphenyl)-4,4,diamine, 3,3-dimethyl-)
- 1591 - Dimethylcarbamoyl chloride (Carbamoyl chloride, dimethyl)
- 1592 - 1,1 Dimethylhydrazine (Hydrazine, 1,1-dimethyl-)
- 1593 - 1,2-Dimethylhydrazine (Hydrazine, 1,2-dimethyl-)
- 1594 - 3,3-Dimethyl-1-(methylthio)-2-butanone, O-[(methylamino) carbonyl] oxime (Thiofanox)
- 1595 - alpha, alpha-Dimethylphenethylamine (Ethanamine, 1,1-dimethyl-2-phenyl-)
- 1596 - 2,4-Dimethylphenol (Phenol, 2,4-dimethyl-)
- 1597 - Dimethyl phthalate (1,2-Benzenedicarboxylic acid, dimethyl ester)
- 1598 - Dimethyl sulfate (Sulfuric acid, dimethyl ester)
- 1599 - Dinitrobenzene, N.O.S.³ (Benzene, dinitro-N.O.S.³)
- 1600 - 4,6-Dinitro-o-cresol and salts (Phenol, 2,4-dinitro-6-methyl-, and salts)
- 1601 - 2,4-Dinitrophenol (Phenol, 2,4-dinitro-)
- 1602 - 2,4-Dinitrotoluene (Benzene, 1-methyl-2,4-dinitro-)
- 1603 - 2,6-Dinitrotoluene (Benzene, 1-methyl 2,6-dinitro-)
- 1604 - Di-n-octyl phthalate (1,2-Benzenedicarboxylic acid, dioctyl ester)
- 1605 - 1,4-Dioxane (1,4-Diethylene oxide)
- 1606 - Diphenylamine (Benzenamine, N-phenyl-)
- 1607 - 1,2-Diphenylhydrazine (Hydrazine, 1,2-diphenyl-)
- 1608 - Di-n-propylnitrosamine (N-Nitroso-di-n-propylamine)

- 1609 - Disulfoton (O,O-diethyl S-(2-(ethylthio)ethyl) phosphorodithioate)
- 1610 - 2,4-Dithiobiuret (Thiomidodicarbonic diamide)
- 1611 - Endosulfan (5-Norbornene, 2,3-dimethanol,1,4,5,6,7,7-hexachloro-cyclic sulfite)
- 1612 - Endrin and metabolites (1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-endo,
1613 endo-1,4,5,8-dimethanonaphthalene, and metabolites)
- 1614 - Ethyl carbamate (Urethan) (Carbamic acid, ethyl ester)
- 1615 - Ethyl cyanide (Propanenitrile)
- 1616 - Ethylenebisdithiocarbamic acid, salts, and esters (1,2-Ethanediy-biscarbamodithioic acid, salts
1617 and esters)
- 1618 - Ethyleneimine (Aziridine)
- 1619 - Ethylene oxide (Oxirane)
- 1620 - Ethylenethiourea (2-Imidazolidinethione)
- 1621 - Ethyl methacrylate (2-Propenoic acid, 2-methyl-, ethyl ester)
- 1622 - Ethyl methanesulfonate (Methanesulfonic acid, ethyl ester)
- 1623 - Fluoranthene (Benzo[j,k]fluorene)
- 1624 - Fluorine
- 1625 - 2-Fluoroacetamide (Acetamide, 2-fluoro-)
- 1626 - Fluoroacetic acid, sodium salt (Acetic acid, fluoro-sodium salt)
- 1627 - Formaldehyde (Methylene oxide)
- 1628 - Formic acid (Methanoic acid)
- 1629 - Glycidylaldehyde (1-Propanol-2,3 epoxy)
- 1630 - Halomethane, N.O.S. ³
- 1631 - Heptachlor (4,7-Methano-1H-indene.1,4,5,6,7,8,8-heptachloro-3a,4,7,7a-tetrahydro-)
- 1632 - Heptachlor epoxide (alpha, beta, and gamma isomers) (4,7-Methano-1H-indene, 1,4,5,6,7,8,8-
1633 heptachloro-2,3-epoxy-3a,4,7,7-tetrahydro-,alpha, beta, and gamma isomers)
- 1634 - Hexachlorobenzene (Benzene, hexachloro-)
- 1635 - Hexachlorobutadiene (1,3-Butadiene, 1,1,2,3,4,4-hexachloro-)
- 1636 - Hexachlorocyclohexane (all isomers) (Lindane and isomers)
- 1637 - Hexachlorocyclopentadiene (1,3-Cyclopentadiene, 1,2,3,4,5,5-hexachloro-)
- 1638 - Hexachloroethane (Ethane, 1,1,1,2,2,2-hexachloro-)
- 1639 - 1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a-hexahydro-1,4,5,8-endo,endo-dimethanonaphthalene
1640 (Hexachlorohexa-hydro-endo,endo-dimethanonaphthalene)

- 1641 - Hexachlorophene (2,2,-Methylenebis(3,4,6-trichlorophenol))
- 1642 - Hexachloropropene (1-Propene, 1,1,2,3,3,3-hexachloro-)
- 1643 - Hexaethyl tetraphosphate (Tetraphosphoric acid, hexaethyl ester)
- 1644 - Hydrazine (Diamine)
- 1645 - Hydrocyanic acid (Hydrogen cyanide)
- 1646 - Hydrofluoric acid (Hydrogen fluoride)
- 1647 - Hydrogen sulfide (Sulfur hydride)
- 1648 - Hydroxydimethylarsine oxide (Cacodylic acid)
- 1649 - Indeno (1,2,3-cd)pyrene(1,10-(1,2-phenylene)pyrene)
- 1650 - Iodomethane (Methyl iodide)
- 1651 - Iron dextran (Ferric dextran)
- 1652 - Isocyanic acid, methyl ester (Methyl isocyanate)
- 1653 - Isobutyl alcohol (1-Propanol, 2-methyl-)
- 1654 - Isosafrole (Benzene, 1,2-methylenedioxy-4-allyl-)
- 1655 - Kepone (decachlorooctahydro-1,3,4-Methano-2H-cyclobuta[cd]pentalen-2-one)
- 1656 - 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)
- 1657
- 1658 - Lead and compounds, N.O.S.³
- 1659 - Lead acetate (Acetic acid, lead salt)
- 1660 - Lead phosphate (Phosphoric acid, lead salt)
- 1661 - Lead subacetate (Lead, bis(acetato-O)tetrahydroxytri-)
- 1662 - Maleic anhydride (2,5-Furandione)
- 1663 - Maleic hydrazide (1,2-Dihydro-3,6-pyridazinedione)
- 1664 - Malononitrile (Propanedinitrile)
- 1665 - Melphalan (Alanine, 3-(p-bis(2-chloroethyl)amino)phenyl-L)- Mercury fulminate (Fulminic acid, mercury salt)
- 1666
- 1667 - Mercury and compounds, N.O.S.³
- 1668 - Methacrylonitrile (2-Propenenitrile,2-methyl-)
- 1669 - Methanethiol (Thiomethanol)
- 1670 - Methapyrilene (Pyridine, 2-[(2-dimethylamino)ethyl]-2-thenylamino-)
- 1671 - Metholmyl (Acetimidic acid, N-[(methylcarbamoyl)oxy] thio-,methyl ester)

- 1672 - Methoxychlor (Ethane, 1,1,1-trichloro-2,2,2-bis(p-methoxyphenyl)-)
- 1673 - 2-Methylaziridine (1,2-Propylenimine)
- 1674 - 3-Methylcholanthrene (Benz[*a*]aceanthrylene,1,2-dihydro-3-methyl-)
- 1675 - Methyl chlorcarbonate (Carbonochloridicacid, methyl ester)
- 1676 - 4,4'-Methylenebis (2-chloroaniline) Benzenamine, 4,4'-methylenebis-(2-chloro-)
- 1677 - Methyl ethyl ketone (MEK) (2-Butanone)
- 1678 - Methyl hydrazine (Hydrazine methyl-)
- 1679 - 2-Methylacetonitrile (Propanenitrile 2-hydroxy-2-methyl-)
- 1680 - Methyl methacrylate (2-Propenoic acid, 2-methyl-, methyl ester)
- 1681 - Methyl methanesulfonate Methanesulfonicacid, methyl ester)
- 1682 - 2-Methyl-2-(methylthio)propionaldehyde-o-(methylcarbonyl) oxime (Propanal,2-methyl-
1683 2(methylthio-0-[(methylamino)carbonyl]oxime)
- 1684 - ~~N~~-Methyl-N',-nitro-N-nitrosoguanidine (Guanidine, N-nitroso-N-methyl-N',-nitro-)
- 1685 - Methyl parathion (0,0-dimethyl 0-(40 nitrophenyl) phosphorothioate)
- 1686 - Methylthiouracil (4-IH-Pyrimidinone, 2,3-dihydro-6-methyl-2-thioxo-)
- 1687 - Molybdenum and compounds, N.O.S.³
- 1688 - Mustard gas (Sulfide, bis(2-chloroethyl)-)
- 1689 - Naphthalene
- 1690 - 1,4-Naphthoquinone (1,4-Naphthalenedione)
- 1691 - 1-Naphthylamine (alpha-Naphthylamine)
- 1692 - 2-Naphthylamine (beta-Naphthylamine)
- 1693 - 1-Naphthyl-2-thiourea (Thiourea, 1-naphthalenyl-)
- 1694 - Nickel and compounds, N.O.S.³
- 1695 - Nickel carbonyl (Nickel tetracarbonyl)
- 1696 - Nickel cyanide (Nickel (II) cyanide)
- 1697 - Nicotine and salts (Pyridine, (S)-3-(1-methyl-2-pyrrolidinyl)-, and salts)
- 1698 - Nitric oxide (Nitrogen (II) oxide)
- 1699 - p-Nitroaniline (Benzenamine, 4-nitro-)
- 1700 - Nitrobenzene (Benzene, nitro-)
- 1701 - Nitrogen dioxide (Nitrogen (IV) oxide)

Comment [JJ75]: Technical formula correction are made in this list, consistent with comments made by NRC to the Conference of Radiation Control Program Directors, Inc. (CRCPD) regarding the Part U regulation.

The correction adds a "prime" (') symbol to the formula.

NRC Letter to CRCPD dated 12/23/13.
http://www.crcpd.org/SSRCRs/nrc_Part-U_letter_12-23-2013.pdf

Comment [JJ76]: Technical formula correction similar to that above.

Comment [JJ77]: Technical formula correction similar to that above.

- 1702 - Nitrogen mustard and hydrochloride salt (Ethanamine, 2-chloro-,N-(2-chloroethyl)-N-methyl-, and
1703 hydrochloride salt)
- 1704 - Nitrogen mustard N-Oxide and hydrochloride salt (Ethanamine, 2-chloro,N-(2-chloroethyl)-N-
1705 methyl-and hydrochloride salt)
- 1706 - Nitroglycerine (1,2,3-Propanetriol, trinitrate)
- 1707 - 4-Nitrophenol (Phenol, 4-nitro)
- 1708 - 4-Nitroquinoline-1-oxide (Quinoline,4-nitro-1-oxide-)
- 1709 - Nitrosamine, N.O.S.³
- 1710 - N-Nitrosodi-n-butylamine (1-Butanamine,N-butyl-N-nitroso-)
- 1711 - ~~N~~-Nitrosodiethanolamine (Ethanol, 2,2'-(nitrosoimino)bis-)
- 1712 - N-Nitrosodiethylamine (Ethanamine, N-ethyl-N-nitroso-)
- 1713 - N-Nitrosodimethylamine (Dimethylnitrosamine)
- 1714 - N-Nitroso-N-ethylurea (Carbamide, N-ethyl-N-nitroso-)
- 1715 - N-Nitrosomethylethylamine (Ethanamine, N-methyl-N-nitroso-)
- 1716 - N-Nitroso-N-methylurea (Carbamide, N-methyl-N-nitroso-)
- 1717 - N-Nitroso-N-methylurethane (Carbamic acid, methylnitroso-, ethyl ester)
- 1718 - N-Nitrosomethylvinylamine (Ethenamine,N-methyl-N-nitroso-)
- 1719 - N-Nitrosomorpholine (Morpholine,-N-nitroso-)
- 1720 - N-Nitrosonomicotine (Nornicotine,-N-nitroso-)
- 1721 - N-Nitrosopiperidine (Pyridine, hexahydro-,N-nitroso-)
- 1722 - Nitrosopyrrolidine (Pyrrole, tetrahydro-N-nitroso-)
- 1723 - N-Nitrososarcosine (Sarcosine,-N-nitroso-)
- 1724 - 5-Nitro-o-toluidine (Benzenamine, 2-methyl-5-nitro-)
- 1725 - Octamethylpyrophosphoramidate (Diphosphoramidate, octamethyl-)
- 1726 - Osmium tetroxide (Osmium(VIII)oxide)
- 1727 - 7-Oxabicyclo(2,2,1)heptane-2,3-dicarboxylic acid (Endothal)
- 1728 - Paraldehyde (1,3,5-Trioxane, 2,4,6-trimethyl-)
- 1729 - Parathion (Phosphorothioic acid O,O-diethylO-(p-nitrophenyl) ester)
- 1730 - Pentachlorobenzene (Benzene, pentachloro-)
- 1731 - Pentachloroethane (Ethane, pentachloro-)
- 1732 - Pentachloronitrobenzene (PCNB) (Benzene, Pentachloronitro-)

Comment [JJ78]: Technical formula correction similar to that above.

- 1733 - Pentachlorophenol (Phenol, pentachloro-)
- 1734 - Phenacetin (Acetamide, N-(4-ethoxyphenyl)-)
- 1735 - Phenol (Benzene, hydroxy-)
- 1736 - Phenylenediamine (Benzenediamine)
- 1737 - Phenylmercury acetate (Mercury acetatophenyl-)
- 1738 - N-Phenylthiourea (Thiourea, phenyl-)
- 1739 - Phosgene (Carbonyl chloride)
- 1740 - Phosphine (Hydrogen phosphide)
- 1741 - Phosphorodithioic acid, O,O-diethyl S-[(ethylthio)methyl]ester (Phorate)
- 1742 - Phosphorothioic acid, O,O-dimethyl O-(p-[(dimethylamino)sulfonyl]phenyl)ester (Famphur)
- 1743 - Phthalic acid esters, N.O.S.³ (Benzene, 1,2-dicarboxylic acid, esters, N.O.S.³)
- 1744 - Phthalic anhydride (1,2-Benzenedicarboxylic acid anhydride)
- 1745 - 2-Picoline (Pyridine, 2-methyl-)
- 1746 - Polychlorinated biphenyl, N.O.S.³
- 1747 - Potassium cyanide
- 1748 - Potassium silver cyanide (Argentate(1-), dicyano-, potassium)
- 1749 - Pronamide (3,5-Dichloro-N-(1,1-dimethyl-2-propynyl)benzamide)
- 1750 - 1,3 Propane sultone (1,2-Oxathiolane, 2,2-dioxide)
- 1751 - n-Propylamine (1-Propanamine)
- 1752 - Propylthiouracil (Undecamethylenediamine, N,N-bis(2-chlorobenzyl-), dihydrochloride)
- 1753 - 2-Propyn-1-ol (Propargyl alcohol)
- 1754 - Pyridine
- 1755 - Radium-226 and -228
- 1756 - Reserpine (Yohimban-16-carboxylic acid, 11,17-dimethoxy-18-[3,4,5-trimethoxybenzoyl]oxy-,
1757 methyl ester)
- 1758 - Resorcinol (1,3-Benzenediol)
- 1759 - Saccharin and salts (1,2-Benzisothiazolin-3-one, 1,1-dioxide, and salts)
- 1760 - Safrole (Benzene, 1,2-methylenedioxy-4-allyl-)
- 1761 - Selenious acid (Selenium dioxide)
- 1762 - Selenium and compounds, N.O.S.³

- 1763 - Selenium sulfide (Sulfur selenide)
- 1764 - Selenourea (Carbamimidoseleoic acid)
- 1765 - Silver and compounds, N.O.S.³
- 1766 - Silver cyanide
- 1767 - Sodium cyanide
- 1768 - Streptozotocin (D-Glucopyranose, 2-deoxy-2-(3-methyl-3-nitrosoureido)-)
- 1769 - Strontium sulfide
- 1770 - Strychnine and salts (Strychnidin-10-one, and salts)
- 1771 - 1,2,4,5-Tetrachlorobenzene (Benzene,1,2,4,5-tetrachloro-)
- 1772 - 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) (Dibenzo-p-dioxin, 2,3,7,8-tetrachloro-)
- 1773 - Tetrachloroethane, N.O.S.³ (Ethane, tetrachloro-N.O.S.³)
- 1774 - 1,1,1,2-Tetrachlorethane (Ethane, 1,1,1,2-tetrachloro-)
- 1775 - 1,1,2,2-Tetrachlorethane (Ethane 1,1,2,2-tetrachloro-)
- 1776 - Tetrachlorethane (Ethene, 1,1,2,2-tetrachloro-)
- 1777 - Tetrachloromethane (Carbon tetrachloride)
- 1778 - 2,3,4,6-Tetrachlorophenol (Phenol 2,3,4,6-tetrachloro-)
- 1779 - Tetraethyldithiopyrophosphate (Dithiopyrophosphoric acid, tetraethyl-ester)
- 1780 - Tetraethyl lead (Plumbane, tetraethyl-)
- 1781 - Tetraethylpyrophosphate (Pyrophosphoricacide, tetraethyl ester)
- 1782 - Tetranitromethane (Methane, tetranitro-)
- 1783 - Thallium and compounds, N.O.S.³
- 1784 - Thallic oxide (Thallium (III) oxide)
- 1785 - Thallium (I) acetate (Acetic acid, thallium (I) salt)
- 1786 - Thallium (I) carbonate (Carbonic acid dithallium (I) salt)
- 1787 - Thallium (I) chloride
- 1788 - Thallium (I) nitrate (Nitric acid, thallium (I) salt)
- 1789 - Thallium selenite
- 1790 - Thallium (I) sulfate (Sulfuric acid, thallium (I) salt)
- 1791 - Thioacetamide (Ethanethioamide)
- 1792 - Thiosemicarbazide (Hydrazinecarbothioamide)

- 1793 - Thiourea (Carbamide thio-)
- 1794 - Thiuram (Bis(dimethylthiocarbamoyl) disulfide)
- 1795 - Thorium and compounds, N.O.S.³ when producing thorium byproduct material
- 1796 - Toluene (Benzene, methyl-)
- 1797 - Toluenediamine (Diaminotoluene)
- 1798 - o-Toluidine hydrochloride (Benzenamine, 2-methyl-,hydrochloride)
- 1799 - Toluene diisocyanate (Benzene, 1,3-diisocyanatomethyl-)
- 1800 - Toxaphene (Camphene, octachloro-)
- 1801 - Tribromomethane (Bromoform)
- 1802 - 1,2,4-Trichlorobenzene (Benzene, 1,2,4-trichloro-)
- 1803 - 1,1,1-Trichloroethane (Methyl chloroform)
- 1804 - 1,1,2-Trichloroethane (Ethane, 1,1,2-trichloro-)
- 1805 - Trichloroethene (Trichloroethylene)
- 1806 - Trichloromethanethiol (Methanethiol, trichloro-)
- 1807 - Trichloromonofluoromethane (Methane, trichlorofluoro-)
- 1808 - 2,4,5-Trichlorophenol (Phenol, 2,4,5-trichloro-)
- 1809 - 2,4,6-Trichlorophenol (Phenol, 2,4,6-trichloro-)
- 1810 - 2,4,5-Trichlorophenoxyacetic acid (2,4,5-T) (Acetic acid, 2,4,5-trichlorophenoxy-)
- 1811 - 2,4,5-Trichlorophenoxypropionic acid (2,4,5-TP) (Silvex) (Propionic acid, 2-(2,4,5-
1812 trichlorophenoxy)-)
- 1813 - Trichloropropane, N.O.S.³ (Propane, trichloro-, N.O.S.³)
- 1814 - 1,2,3-Trichloropropane (Propane, 1,2,3-trichloro-)
- 1815 - O,O,O-Triethyl phosphorothioate (Phosphorothioic acid, O,O,O-triethyl ester)
- 1816 - sym-Trinitrobenzene (Benzene, 1,3,5-trinitro-)
- 1817 - Tris(1-aziridinyl) phosphine sulfide (Phosphine sulfide, tris(1-aziridinyl-)
- 1818 - Tris(2,3-dibromopropyl) phosphate (1-Propanol, 2,3-dibromo-, phosphate)
- 1819 - Trypan blue (2,7-Naphthalenedisulfonic acid, 3,3,-((3,3,-dimethyl (1,1,-biphenyl)-
1820 4,4,diyl)bis(azo))bis(5-amino-4-hydroxy-tetrasodium salt)
- 1821 - Uracil mustard (Uracil-5-[bis(2-chloroethyl)amino]-)
- 1822 - Uranium and compounds, N.O.S.³
- 1823 - Vanadic acid, ammonium salt (ammonium vanadate)

1824 - Vanadium pentoxide (Vanadium (V) oxide)

1825 - Vinyl chloride (Ethene, chloro-)

1826 - Zinc cyanide

1827 - Zinc phosphide

1828 ³ The abbreviation N.O.S. (not otherwise specified) signifies those members of the general class not specifically listed by name in
1829 this list.

1830

1831 **EDITOR'S NOTES**

1832 6 CCR 1007-1 has been divided into separate parts for ease of use. Versions prior to 04/01/2007 are
1833 located in the first section, 6 CCR 1007-1. Prior versions can be accessed from the All Versions list on the
1834 rule's current version page. To view versions effective on or after 04/01/2007, select the desired part of
1835 the rule, for example 6 CCR 1007-1 Part 01 or 6 CCR 1007-1 Part 10.

1836 **History**

1837 Part 18, Rules 8.1 – Appendix A, Criterion 9 eff. 04/30/2011.

1838

1839