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1 DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT  
2 Hazardous Materials and Waste Management Division  
3 6 CCR 1007-1 Part 18  
4 RULES AND REGULATIONS PERTAINING TO RADIATION CONTROL  
5 PART 18: LICENSING REQUIREMENTS FOR URANIUM AND THORIUM PROCESSING  
6 RH.18.1 Purpose and Scope.

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7 18.1.1 The regulations in this part establish criteria, terms and conditions upon which the Department  
8 issues licenses to receive title to, receive, possess, use, transfer, or deliver source and byproduct  
9 materials, to operate uranium and thorium processing facilities and for the disposition of the  
10 resulting byproduct material. The requirements of this part are in addition to, and not in  
11 substitution for, other applicable requirements of these regulations.

12 18.1.2 This part establishes performance objectives and procedural requirements applicable to any  
13 uranium or thorium material processing operation, to waste systems for byproduct material as in  
14 definition (2) of RH-1.42.2, and to related activities concerning uranium-bearing and thorium-  
15 bearing materials. It establishes specific technical and financial requirements for siting,  
16 construction, operation, and decontamination, reclamation and ultimate stabilization, as well as  
17 requirements for license transfer and termination, long-term site monitoring and surveillance, and  
18 ownership and ultimate custody of source material milling facilities and byproduct material  
19 impoundments.

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20 18.1.3 The requirements of this part apply to byproduct material that is located at a site where milling  
21 operations are no longer active, if such site is not covered by the remedial action program of Title  
22 I of the Uranium Mill Tailings Radiation Control Act (UMTRCA) OF 1978 (92 STAT. 3021; 42  
23 U.S.C. 7901). The regulations in this part do not establish procedures and criteria for the  
24 issuance of licenses for materials covered under Title I of the Uranium Mill Tailings Radiation  
25 Control Act of 1978 (92 Stat. 3021) unless that program fails to accomplish remedial action.  
26 Disposal at a uranium or thorium processing site of radioactive material which is not type 2  
27 byproduct material must not inhibit reclamation of the tailings impoundment or the ability of the  
28 U.S. Government to take title to the impoundment as long-term custodian.

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29 **18.1.4 NOTHING IN THIS PART SHALL APPLY TO THE FOLLOWING NATURALLY OCCURRING RADIOACTIVE**  
30 **MATERIALS (NORM) OR TECHNOLOGICALLY ENHANCED NATURALLY OCCURRING RADIOACTIVE**  
31 **MATERIALS (TENORM):**

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32 **18.1.4.1 RESIDUALS OR SLUDGES FROM THE TREATMENT OF DRINKING WATER BY ALUMINUM, FERRIC**  
33 **CHLORIDE, OR SIMILAR PROCESSES; EXCEPT THAT THE MATERIAL MAY NOT CONTAIN**  
34 **HAZARDOUS SUBSTANCES THAT OTHERWISE WOULD PRECLUDE RECEIPT;**

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35 **18.1.4.2 SLUDGES, SOILS, OR PIPE SCALE IN OR ON EQUIPMENT FROM OIL AND GAS EXPLORATION,**  
36 **PRODUCTION, OR DEVELOPMENT OPERATIONS OR DRINKING WATER OR WASTEWATER**  
37 **TREATMENT OPERATIONS; EXCEPT THAT THE MATERIAL MAY NOT CONTAIN HAZARDOUS**  
38 **SUBSTANCES THAT OTHERWISE WOULD PRECLUDE RECEIPT;**

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39 **18.1.4.3 MATERIALS FROM OR ACTIVITIES RELATED TO CONSTRUCTION MATERIAL MINING REGULATED**  
40 **UNDER ARTICLE 5 OF TITLE 6, CRS.**

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**18.1.4.4 THE TREATMENT, STORAGE, MANAGEMENT, PROCESSING, OR DISPOSAL OF SOLID WASTE, WHICH MAY INCLUDE NORM AND TENORM, EITHER PURSUANT TO A CERTIFICATE OF DESIGNATION OR CONSIDERED APPROVED OR OTHERWISE DEEMED TO SATISFY.**

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**18.1.5 THE REGULATION OF URANIUM IN SITU LEACH MINING (IN SITU RECOVERY), AS DEFINED IN SECTION 34-32-103, CRS., INVOLVES THE DEPARTMENT OF NATURAL RESOURCES, DIVISION OF RECLAMATION, MINING AND SAFETY OR THEIR SUCCESSOR. THE REQUIREMENTS OF THAT AGENCY MAY, DUE TO THE USE OF TERMS-OF-ART AND OTHER TECHNICAL WORDS, PHRASES AND DEFINITIONS, BE INTERPRETED INCONSISTENTLY OR BE HELD IN CONFLICT WITH HE DEPARTMENT’S REQUIREMENTS. THE DEPARTMENT WILL COORDINATE WITH THAT AGENCY TO THE MAXIMUM EXTENT PRACTICABLE TO RESOLVE ANY SUCH CONFLICTS OR INCONSISTENCIES. AN APPLICANT OR LICENSEE THAT IDENTIFIES SUCH INCONSISTENCY OR CONFLICT SHALL PROVIDE THAT INFORMATION TO BOTH AGENCIES FOR RESOLUTION.**

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**18.1.6 LICENSE AMENDMENTS FOR THE RECEIPT OF CLASSIFIED MATERIAL AT A FACILITY ARE SUBJECT TO SECTIONS 18.3 AND 18.4 EXCEPT WHEN THE MATERIAL IS FROM AN APPROVED SOURCE AND SUCH AMENDMENT WOULD NOT RESULT IN A CHANGE IN OWNERSHIP, DESIGN, OR OPERATION OF THE FACILITY. LICENSE AMENDMENTS NOT SUBJECT TO 18.3 AND 18.4 OF THIS PART ARE SUBJECT TO 18.5 OF THIS SECTION.**

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**RH-18.2 As used in this regulation:**

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

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

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

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

“Available radon barrier technology” means technologies and methods for emplacing a final radon barrier on uranium mill tailings piles or impoundments. This term shall not be construed to include extraordinary measures or techniques that would impose costs that are grossly excessive as measured by practice within the industry (or one that is reasonably analogous), (such as, by way of illustration only, unreasonable overtime, staffing, or transportation requirements, etc., considering normal practice in the industry; laser fusion of soils, etc.), provided there is reasonable progress toward emplacement of the final radon barrier. To determine grossly

86 excessive costs, the relevant baseline against which cost shall be compared is the cost estimate  
87 for tailings impoundment closure contained in the licensee's approved reclamation plan, but costs  
88 beyond these estimates shall not automatically be considered grossly excessive.

89 **"CERTIFICATE OF DESIGNATION" MEANS THE APPROVAL PURSUANT TO ARTICLE OF TITLE, CRS., OR**  
90 **SECTION ,15-204 (6),**

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

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

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

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

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

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

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

107 **"FACILITY" IN THIS PART MEANS THE PHYSICAL LOCATION AT ONE SITE OR ADDRESS AND UNDER THE**  
108 **SAME ADMINISTRATIVE CONTROL AT WHICH:**

109 **(1) THE POSSESSION, USE, PROCESSING OR STORAGE OF URANIUM-BEARING AND**  
110 **THORIUM-BEARING RADIOACTIVE MATERIAL IS OR WAS AUTHORIZED BY LICENSE**  
111 **PURSUANT TO THIS PART; OR,**

112 **(2) URANIUM AND THORIUM IS MILLED, OR OTHERWISE PROCESSED AND THE RESULTING**  
113 **BYPRODUCT MATERIAL IS DISPOSITIONED,**

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

- 118 (1) physical conditions at the site;
- 119 (2) inclement weather or climatic conditions;
- 120 (3) an act of god;
- 121 (4) an act of war;

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- 122 (5) a judicial or administrative order or decision, or change to the statutory, regulatory, or  
123 other legal requirements applicable to the licensee's facility that would preclude or delay  
124 the performance of activities required for compliance;
- 125 (6) labor disturbances;
- 126 (7) any modifications, cessation or delay ordered by state, federal, or local agencies;
- 127 (8) delays beyond the time reasonably required in obtaining necessary government permits,  
128 licenses, approvals, or consent for activities described in the reclamation plan proposed  
129 by the licensee that result from agency failure to take final action after the licensee has  
130 made a good faith, timely effort to submit legally sufficient applications, responses to  
131 requests (including relevant data requested by the agencies), or other information,  
132 including approval of the reclamation plan; and
- 133 (9) an act or omission of any third party over whom the licensee has no control.
- 134 "Final radon barrier" means the earthen cover (or approved alternative cover) over tailings or  
135 waste constructed to comply with Criterion 6 of this Appendix (excluding erosion protection  
136 features).
- 137 "Ground water" means water below the land surface in a zone of saturation. For purposes of  
138 Appendix A to this Part 18, ground water is the water contained within an aquifer as defined  
139 above.
- 140 "Leachate" means any liquid, including any suspended or dissolved components in the liquid that  
141 has percolated through or drained from the byproduct material.
- 142 "Licensed site" means the area contained within the boundary of a location under the control of  
143 persons generating or storing radioactive materials under a Department license.
- 144 "Liner" means a continuous layer of natural or man-made materials, beneath or on the sides of a  
145 surface impoundment, which restricts the downward or lateral escape of byproduct material,  
146 hazardous constituents, or leachate.
- 147 "Long term care" means the observation and maintenance of a site following the postclosure  
148 period and termination of the license.
- 149 "Milestone" means an action or event that is required to occur by an enforceable date.
- 150 "Monitoring" means observing and making measurements to provide data to evaluate the  
151 performance and characteristics of a site.
- 152 "Operation" means that a uranium or thorium mill tailings pile or impoundment is being used for  
153 the continued placement of byproduct material or is in standby status for such placement. A pile  
154 or impoundment is in operation from the day that byproduct material is first placed in the pile or  
155 impoundment until the day final closure begins.
- 156 "Point of compliance" is the site specific location in the uppermost aquifer where the ground-water  
157 protection standard must be met.
- 158 "Postclosure" means the period of time from completion of the site closure plan for  
159 decontamination, reclamation, and stabilization of the site and disposal area and prior to the  
160 termination of the license.

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161 “Reclamation plan” , for the purposes of Criterion 6A of Appendix A of this Part 18, means the  
162 plan detailing activities to accomplish reclamation of the tailings or waste disposal area in  
163 accordance with the technical criteria of Appendix A of this Part. The reclamation plan must  
164 include a schedule for reclamation milestones that are key to the completion of the final radon  
165 barrier including as appropriate, but not limited to, wind blown tailings retrieval and placement on  
166 the pile, interim stabilization (including dewatering or the removal of freestanding liquids and  
167 recontouring), and final radon barrier construction. (Reclamation of tailings must also be  
168 addressed in the closure plan; the detailed reclamation plan may be incorporated into the closure  
169 plan.)

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

173 “Surveillance” means the observation of the site for the purposes of visual detection of the need  
174 for maintenance, custodial care, evidence of unauthorized access, and compliance with other  
175 license and regulatory requirements.

176 “Third-party contractor” or “Third-party agreement” means a legal or contractual mechanism  
177 whereby an applicant or licensee voluntarily agrees to pay for the services, solely selected and  
178 supervised by the Department, of qualified persons not Department staff nor under contract  
179 directly to the Department.

180 “Uppermost aquifer” means the geologic formation nearest the natural ground surface that is an  
181 aquifer, as well as lower aquifers that are hydraulically interconnected with this aquifer within the  
182 facility’s property boundary.

183 **RH 18.3 Special Requirements for Issuance of Specific Licenses For Source Material**  
184 **Milling.**

185 In addition to the requirements set forth in RH 3.8 and 3.9, a specific license for source material milling  
186 will be issued if the applicant submits to the Department a complete and accurate application that clearly  
187 demonstrates how objectives and requirements of this Part are met. Failure to clearly so demonstrate  
188 shall be grounds for refusing to accept an application. **ANY PERSON DESIRING TO HAVE A FACILITY OR SITE**  
189 **REFERRED TO IN THIS PART SHALL APPLY TO THE DEPARTMENT FOR APPROVAL OF SUCH FACILITY OR SITE. THE**  
190 **APPLICATION SHALL CONTAIN SUCH INFORMATION AS THE DEPARTMENT REQUIRES AND SHALL BE ACCOMPANIED**  
191 **BY AN APPLICATION FEE DETERMINED BY THE BOARD PURSUANT TO THE PROVISIONS OF PART 12 OF THESE**  
192 **REGULATIONS.**

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193 18.3.1 An application for a license or to amend or renew an existing license to receive, possess, and use  
194 source material for milling or byproduct material as in definition (2) of RH 1.42.2 shall include all  
195 information required under these regulations and such other information as the Department may  
196 deem necessary, and shall address the following:

197 18.3.1.1 Description of the proposed project or action;

198 18.3.1.2 Area/site characteristics including geology, topography, hydrology and  
199 meteorology;

200 18.3.1.3 Radiological and nonradiological impacts of the proposed project or action,  
201 including waterway and groundwater impacts;

202 18.3.1.4 Environmental effects of accidents;

203 18.3.1.5 Tailings disposal and decommissioning;

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- 204 18.3.1.6 Site and project alternatives.
- 205 18.3.2 The applicant shall provide procedures describing the means employed to meet the following  
206 requirements during the operational phase of any project.
- 207 18.3.2.1 Milling operations shall be conducted so that all releases are reduced to as low  
208 as is reasonably achievable below the limits of Part 4.
- 209 18.3.2.2 The mill operator shall conduct at least daily inspection of any tailings or waste  
210 retention systems. The inspection shall be performed by a person who is qualified and  
211 approved by the Department. Records of such inspections shall be maintained for review  
212 by the Department.
- 213 18.3.2.3 The mill operator shall immediately notify the Department of the following:
- 214 18.3.2.3.1 Any failure in a tailings or waste retention system which results in a  
215 release of tailings or waste into uncontrolled areas; and
- 216 18.3.2.3.2 Any unusual conditions which are not contemplated in the design of the  
217 retention system and which if not corrected could lead to failure of the system  
218 and result in a release of tailings or waste into uncontrolled areas.
- 219 18.3.3 During any one full year prior to ~~any major site construction~~, **SUBMITTAL OF A NEW APPLICATION OR**  
220 **AMENDMENT EXPANDING THE FACILITY** the applicant/licensee shall conduct a preoperational  
221 monitoring program to provide complete baseline data on a milling site and its environs.  
222 Throughout the construction and operating phases of the mill, the applicant/licensee shall conduct  
223 an operational monitoring program to measure or evaluate compliance with applicable standards  
224 and regulations, to evaluate performance of control systems and procedures, to evaluate  
225 environmental impacts of operation, and to detect potential long-term effects.
- 226 18.3.4 The environmental report required by **RH** 3.8.8 shall contain all information deemed necessary by  
227 the agency to assist the agency in the evaluation of the short-term and long-range environmental  
228 impact of the project and activity so that the agency may weigh environmental, economic,  
229 technical, and other benefits against environmental costs, while considering available  
230 alternatives. The environmental report shall be submitted ~~nine (9) months prior to the anticipated~~  
231 ~~commencement of construction~~ **WITH THE LICENSE APPLICATION OR AMENDMENT REQUEST**, unless an  
232 exemption as provided by **RH** 3.8.7.1 has been obtained from the Department.
- 233 18.3.5 The following types of actions require an applicant's environmental report:
- 234 ~~18.3.5.1i~~, issuance or renewal of a source material milling license;
- 235 ~~18.3.5.2ii~~, issuance of an amendment that would authorize or result in:
- 236 (1) A significant expansion of a site;
- 237 (2) A significant change in the types of releases;
- 238 (3) A significant increase in the amounts of releases;
- 239 (4) A significant increase in individual or cumulative occupational radiation exposure;  
240 or
- 241 (5) A significant increase in the potential for or consequences from radiological  
242 accidents.

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**REVIEW AND ANY ASSOCIATED UPDATES THAT HAVE BEEN ISSUED BY THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY.**

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18.3.6 An application for a license to receive, possess and use source material for milling or byproduct material as in definition (2) of **RH-1.42.2** shall contain proposed specifications relating to the milling operations and the disposition of tailings or wastes resulting from such milling activities to achieve the requirements and objectives set forth in the criteria listed in Appendix A to this Part 18. Each application for a new license or for license renewal must clearly demonstrate how the requirements and objectives set forth in Appendix A to this Part 18 have been addressed. Failure to clearly demonstrate how the requirements and objectives in Appendix A to this Part 18 have been addressed shall be grounds for refusing to accept an application.

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**18.3.7 NOTHING IN 18.3 SHALL APPLY TO A CONTRACT FOR THE STORAGE, PROCESSING, OR DISPOSAL OF LESS THAN THE SUM OF ONE HUNDRED TEN TONS OF CLASSIFIED MATERIAL PER SOURCE OR TO A CONTRACT FOR A BENCH-SCALE OR A PILOT-SCALE TESTING PROJECT OR A CONTRACT FOR LESS THAN A DE MINIMIS AMOUNT OF CLASSIFIED MATERIAL AS DETERMINED BY THE DEPARTMENT FOR STORAGE, PROCESSING, OR DISPOSAL.**

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**18.3.8 UPON RECEIPT OF AN APPLICATION OR NOTICE AS PROVIDED IN THIS SECTION, THE DEPARTMENT SHALL NOTIFY THE PUBLIC AND FORWARD A COPY OF THE APPLICATION OR NOTICE TO THE GOVERNOR AND THE GENERAL ASSEMBLY, AS APPROPRIATE.**

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**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.**

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**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.**

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**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.**

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**18.3.9 IN ADDITION TO THE REQUIREMENTS OF SECTION 18.3 AND 18.4, EACH NEW, RENEWAL OR AMENDMENT APPLICATION PERTAINING TO THE FACILITY'S RECEIPT OF CLASSIFIED MATERIAL SHALL INCLUDE A WRITTEN APPLICATION TO THE DEPARTMENT AND INFORMATION RELEVANT TO THE PENDING APPLICATION, INCLUDING:**

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**18.3.9.1 TRANSCRIPTS OF TWO PUBLIC MEETINGS HOSTED AND PRESIDED OVER BY A PERSON SELECTED UPON AGREEMENT BY THE DEPARTMENT, THE LOCAL BOARD OF COUNTY COMMISSIONERS, AND THE APPLICANT. ONE OR BOTH OF THE MEETINGS SHALL BE A HEARING CONDUCTED TO COMPLY WITH SECTION 24-4-104 OR 24-4-105, CRS. THE EXPENSE OF THE MEETINGS OR HEARING SHALL BE PAID BY THE FACILITY. SUCH MEETINGS SHALL NOT BE HELD UNTIL THE DEPARTMENT DETERMINES THAT THE APPLICATION IS SUBSTANTIALLY COMPLETE. THE FACILITY SHALL PROVIDE THE PUBLIC WITH:**

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**(1) AT LEAST TWO WEEKS' WRITTEN NOTICE BEFORE THE FIRST MEETING AND AN ADDITIONAL TWO WEEKS' WRITTEN NOTICE BEFORE THE SECOND MEETING;**

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**(2) AT BOTH MEETINGS, SUMMARIES OF THE FACILITY'S LICENSE TO RECEIVE, STORE, PROCESS, OR DISPOSE OF CLASSIFIED MATERIAL AND THE NATURE OF THE CLASSIFIED MATERIAL, AND AN OPPORTUNITY TO BE HEARD; AND**

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328 (3) ACCESS TO MAKE COPIES OF A TRANSCRIPT OF THE MEETINGS, AND SHALL PROVIDE AN  
329 ELECTRONIC COPY TO THE DEPARTMENT IN A MANNER THAT ALLOWS POSTING ON THE  
330 DEPARTMENT'S WEB SITE WITHIN TEN DAYS AFTER RECEIPT FROM THE TRANSCRIPTION  
331 SERVICE.

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332 18.3.9.2 AN ENVIRONMENTAL ASSESSMENT AS DEFINED IN 18.3.5;

333 18.3.9.3 A RESPONSE, IF ANY, TO THE ENVIRONMENTAL ASSESSMENT WRITTEN BY THE BOARD OF  
334 COUNTY COMMISSIONERS PROVIDED TO THE FACILITY WITHIN NINETY DAYS AFTER THE FIRST  
335 PUBLIC MEETING. UPON REQUEST OF AND DOCUMENTATION OF THE EXPENDITURE BY SUCH  
336 BOARD, THE APPLICANT SHALL PROVIDE THE BOARD WITH UP TO FIFTY THOUSAND DOLLARS,  
337 WHICH SHALL BE AVAILABLE TO ASSIST THE BOARD IN RESPONDING TO THE APPLICATION,  
338 INCLUDING AN INDEPENDENT ENVIRONMENTAL ANALYSIS AND IDENTIFICATION OF ANY  
339 SUBSTANTIAL ADVERSE IMPACT UPON THE SAFETY OR MAINTENANCE OF TRANSPORTATION  
340 INFRASTRUCTURE OR TRANSPORTATION FACILITIES WITHIN THE COUNTY.

341 **RH 18.4 Environmental Impact Analysis**

342 18.4.1 For each license application or application to amend or renew an existing license to receive,  
343 possess, or use source material for uranium or thorium milling or byproduct material as in  
344 definition (2) of RH 1.42.2 which will have a significant impact on the environment, the  
345 Department shall prepare a written analysis of the impact of the licensed activity on the  
346 environment, which shall be available to the public and for review by the U.S. Nuclear Regulatory  
347 CommissionNRC at the time of public notice of hearing, which analysis shall include:

- 348 18.4.1.1 An assessment of the radiological and nonradiological impacts to the public health;
- 349
- 350 18.4.1.2 An assessment of any impact on any waterway and ground water;
- 351
- 352 18.4.1.3 Consideration of alternatives to the activities to be conducted; and
- 353
- 354 18.4.1.4 Consideration of the long-term impacts of the licensed activities.

353 18.4.2 In preparing the environmental impact analysis, the Department may use and incorporate by  
354 reference the environmental report prepared by the applicant as required by RH 3.8.8 and  
355 environmental assessments prepared by Federal, State or local agencies.

356 18.4.3 The environmental impact analysis, or any part thereof, shall be prepared directly by the  
357 Department or the Department shall utilize the third party method set forth in RH 3.13.

358 **RH-18.5 NOTICES AND FINANCIAL ASSURANCE**

359 18.5.1 AT LEAST NINETY DAYS BEFORE A FACILITY PROPOSES TO RECEIVE, STORE, PROCESS, OR DISPOSE OF  
360 CLASSIFIED MATERIAL IN A LICENSE APPLICATION OR AMENDMENT THAT IS NOT SUBJECT TO 18.3 AND  
361 18.4, THE FACILITY SHALL NOTIFY THE DEPARTMENT, AND THE DEPARTMENT SHALL NOTIFY THE PUBLIC  
362 AND THE BOARD OF COUNTY COMMISSIONERS OF THE COUNTY IN WHICH THE FACILITY IS LOCATED, OF  
363 THE SPECIFIC CLASSIFIED MATERIAL TO BE RECEIVED, STORED, PROCESSED, OR DISPOSED OF. THE  
364 NOTICE SHALL INCLUDE:

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365 18.5.1.1 A REPRESENTATIVE ANALYSIS OF THE PHYSICAL, CHEMICAL, AND RADIOLOGICAL PROPERTIES  
366 OF THE CLASSIFIED MATERIAL;

367 18.5.1.2 THE MATERIAL ACCEPTANCE REPORT THAT DEMONSTRATES THAT THE CLASSIFIED MATERIAL  
368 DOES NOT CONTAIN HAZARDOUS WASTE CHARACTERISTICS NOT FOUND IN URANIUM ORE;

369 18.5.1.3 A DETAILED PLAN FOR TRANSPORT, ACCEPTANCE, STORAGE, HANDLING, PROCESSING, AND  
370 DISPOSAL OF THE MATERIAL;

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371 18.5.1.4 A DEMONSTRATION THAT THE MATERIAL CONTAINS TECHNICALLY AND ECONOMICALLY  
372 RECOVERABLE URANIUM, WITHOUT TAKING INTO ACCOUNT ITS VALUE AS DISPOSAL MATERIAL;

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373 18.5.1.5 THE EXISTING LOCATION OF THE CLASSIFIED MATERIAL;

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374 18.5.1.6 THE HISTORY OF THE CLASSIFIED MATERIAL;

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375 18.5.1.7 A WRITTEN STATEMENT BY THE APPLICANT DESCRIBING ANY PRE-EXISTING REGULATORY  
376 CLASSIFICATION OF THE CLASSIFIED WASTE IN THE STATE OF ORIGIN THAT DESCRIBES ALL  
377 STEPS TAKEN BY THE APPLICANT TO IDENTIFY SUCH CLASSIFICATION;

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378 18.5.1.8 A WRITTEN STATEMENT FROM THE UNITED STATES DEPARTMENT OF ENERGY OR SUCCESSOR  
379 AGENCY THAT THE RECEIPT, STORAGE, PROCESSING, OR DISPOSAL OF THE CLASSIFIED  
380 MATERIAL AT THE FACILITY WILL NOT ADVERSELY AFFECT THE DEPARTMENT OF ENERGY'S  
381 RECEIPT OF TITLE TO THE FACILITY PURSUANT TO THE FEDERAL "ATOMIC ENERGY ACT OF 1954  
382 ", 42 U.S.C. SEC. 2113;

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383 18.5.1.9 DOCUMENTATION SHOWING ANY NECESSARY APPROVALS OF THE UNITED STATES  
384 ENVIRONMENTAL PROTECTION AGENCY; AND

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385 18.5.1.10 AN ENVIRONMENTAL ASSESSMENT AS DEFINED IN SECTION 18.4 AND 18.5 OF THIS SECTION,  
386 WHICH MAY INCORPORATE BY REFERENCE RELEVANT INFORMATION CONTAINED IN AN  
387 ENVIRONMENTAL ASSESSMENT PREVIOUSLY SUBMITTED FOR THE FACILITY.

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388 18.5.2 WITHIN THIRTY DAYS AFTER THE DEPARTMENT'S RECEIPT OF NOTICE PURSUANT TO 18.5.1, THE  
389 DEPARTMENT SHALL DETERMINE WHETHER THE NOTICE IS COMPLETE.

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390 18.5.3 ONCE THE DEPARTMENT DETERMINES THAT THE NOTICE PURSUANT TO 18.5.1 IS COMPLETE, THE  
391 DEPARTMENT SHALL PUBLISH THE NOTICE ON ITS WEB SITE AND PROVIDE A SIXTY-DAY PUBLIC COMMENT  
392 PERIOD FOR THE RECEIPT OF WRITTEN COMMENTS CONCERNING THE NOTICE. A PUBLIC HEARING MAY BE  
393 HELD, AT THE DEPARTMENT'S DISCRETION, AT THE OPERATOR'S EXPENSE.

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394 18.5.4 WITHIN THIRTY DAYS AFTER THE CLOSE OF THE WRITTEN PUBLIC COMMENT PERIOD HELD PURSUANT TO  
395 18.5.3, THE DEPARTMENT SHALL APPROVE, APPROVE WITH CONDITIONS, OR DENY THE RECEIPT,  
396 STORAGE, PROCESSING, OR DISPOSAL AS DESCRIBED IN THE NOTICE BASED ON WHETHER THE MATERIAL  
397 PROPOSED FOR RECEIPT, STORAGE, PROCESSING, OR DISPOSAL COMPLIES WITH THE FACILITY'S  
398 LICENSE AND:

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399 18.5.4.1 BE CONDUCTED SUCH THAT THE EXPOSURES TO WORKERS AND THE PUBLIC ARE WITHIN THE  
400 DOSE LIMITS OF PART 4 OF THE DEPARTMENT'S RULES PERTAINING TO RADIATION CONTROL FOR  
401 WORKERS AND THE PUBLIC;

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402 18.5.4.2 NOT CAUSE RELEASES TO THE AIR, GROUND, OR SURFACE OR GROUND WATER THAT EXCEED  
403 PERMITTED LIMITS; AND

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404 18.5.4.3 NOT PREVENT TRANSFER OF THE FACILITY TO THE UNITED STATES IN ACCORDANCE WITH 42  
405 U.S.C. SEC. 2113 UPON COMPLETION OF DECONTAMINATION, DECOMMISSIONING, AND  
406 RECLAMATION OF THE FACILITY.  
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408 18.5.5 Prior to issuance of the license, the applicant shall (1) establish financial assurance  
409 arrangements, as provided by R-H 3.9.5, to ensure decontamination and decommissioning of the

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410 facility and (2) provide a fund adequate to cover the payment of the cost for long-term care and  
411 monitoring as provided by **RH** 3.9.5.10. Such fund shall be sufficient to meet the requirements of  
412 **RH** 3.9.5.10.4. The Department will consider proposals to combine the two types of financial  
413 assurance. Financial assurance shall be provided prior to commencement of construction or  
414 operation.

415 **RH-18.6 License Hearings**

416 18.6.1 There shall be an opportunity for public hearings to be held in accordance with the procedures in  
417 24-4-104 and 24-4-105, C.R.S. ~~1973, as amended~~, and **RH** 18.6, prior to the granting, denial or  
418 renewal of a specific license permitting the receipt, possession or use of source material for  
419 milling or byproduct material as in definition (2) of **RH** 1.42.2.

420 18.6.2 Notice of Hearing

421 18.6.2.1 All hearings shall be preceded by written notice containing:

422 18.6.2.1.1 The nature of the hearing and its time and place;

423 18.6.2.1.2 The legal authority and jurisdiction under which the hearing is to be held;

424 18.6.2.1.3 The matters of fact and law asserted or to be considered;

425 18.6.2.1.4 A description of the proposed licensing action and a statement of the  
426 availability of its text from the Department;

427 18.6.2.1.5 A description of the right of any interested person to make written  
428 comments to the Department or present oral comments at the hearing;

429 18.6.2.1.6 The procedure for applying to become a party to the hearing; and

430 18.6.2.1.7 A description of the procedures to be followed at the hearing and at a  
431 prehearing conference if required.

432 18.6.2.2 The notice of the hearing shall be mailed by the Department to the licensee or  
433 applicant and to each person who has filed a written request to receive notice of such  
434 proceedings. The licensee or applicant shall cause the notice to be published for three (3)  
435 days in a newspaper of statewide circulation and in local newspapers designated by the  
436 Department in the area to be affected by the proposed action. The notice shall be mailed  
437 and published not less than ninety (90) days prior to the hearing.

438 18.6.2.3 The time and place of hearing will be fixed with due regard for the convenience of  
439 the parties or their representatives, and the public interest. The hearing will be held in the  
440 locale of the site to be licensed.

441 18.6.2.4 The cost of any licensing action hearing shall be at the expense of the applicant.  
442 These costs shall include, but not be limited to, the hearing officer, the meeting room, the  
443 court reporter and transcript copies, and the required notices. The costs shall not include  
444 the expenses of other parties to the hearing.

445 18.6.3 Party Status

446 18.6.3.1 A person who may be affected or aggrieved by Department action may apply for  
447 party status not less than twenty (20) days prior to the hearing. Thereafter, application to  
448 be made a party shall not be considered except upon motion for good cause shown.

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- 449 18.6.3.2 Application for party status must identify the individual or group applying,  
450 including the address or phone number where they may be contacted, state the nature of  
451 their interest in the hearing and the specific ground on which they claim to be affected or  
452 aggrieved, and the specific aspects of the hearing which they wish to address.
- 453 18.6.3.3 The Department, or the hearing officer, will grant or deny party status within five  
454 (5) days after receipt of the request for party status based on the nature and extent of the  
455 person's property, financial or other interest in the hearing and the possible effect of any  
456 order which may be entered as a result of the hearing on the person's interest. Any  
457 person applying for or granted party status may, by motion to the hearing officer or  
458 Department, as appropriate, challenge the right of any other person to be a party.
- 459 18.6.3.4 Parties shall have the right to initiate discovery. Parties shall have the right to  
460 make motions or objections, present evidence, cross-examine witnesses, and appeal  
461 from the decision of the hearing as provided by the Colorado Administrative Procedures  
462 Act, 24-4-101 et seq. , C.R.S.-1973, as amended.
- 463 18.6.3.5 A person who is not a party will be permitted to submit written comments to the  
464 Department and may be permitted to make an oral presentation at the hearing, but will  
465 not have the other rights of a party.
- 466 18.6.4 Prehearing Conference
- 467 18.6.4.1 The Department or hearing officer, on its own motion or at the request of any  
468 party or any person who has applied to become a party, may direct the parties to appear  
469 at a specific time and place for a conference to consider:
- 470 18.6.4.1.1 The simplification and clarification of the issues;
- 471 18.6.4.1.2 The obtaining of stipulations and admissions of fact and of the contents  
472 and authenticity of documents to avoid unnecessary proof;
- 473 18.6.4.1.3 Identification of witnesses and the limitation of the number of expert  
474 witnesses, and other steps to expedite the presentation of evidence;
- 475 18.6.4.1.4 The setting of a hearing schedule;
- 476 18.6.4.1.5 Granting or denying requests for party status, if such decisions have not  
477 previously been made;
- 478 18.6.4.1.6 Such other matters as may aid in the orderly disposition of the hearing.
- 479 18.6.4.2 At such conference each party or person who has applied to become a party  
480 shall present to every other person, party, and the Department a prehearing statement  
481 containing the following:
- 482 18.6.4.2.1 A brief summary of the nature of the claim of the party and the basis  
483 therefore;
- 484 18.6.4.2.2 A copy of all exhibits proposed to be introduced; and
- 485 18.6.4.2.3 A list of all witnesses who may be called and a brief description of their  
486 testimony.

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- 487 18.6.4.3 Except for good cause shown or for evidence or testimony accepted as rebuttal,  
488 no witness may testify nor may any exhibits be introduced on behalf of a party who had  
489 notice of the prehearing conference unless such witness has been previously listed  
490 and/or his written testimony and related exhibits have been presented to opposing parties  
491 at the prehearing conference.
- 492 18.6.4.4 The Department or hearing officer shall issue a written summary of the action  
493 taken at the conference and agreements by the parties, which limits the issues or defines  
494 the matters in controversy to be determined in the hearing.
- 495 18.6.5 Discovery
- 496 18.6.5.1 Any party may initiate discovery in the form of interrogatories to another party,  
497 requests for admission to another party, requests for production of documents to another  
498 party, or depositions of any persons, or any combination thereof. The Colorado Rules of  
499 Civil Procedure, to the extent not inconsistent with the Colorado Administrative Procedure  
500 Act, shall apply. Such discovery may be modified by a motion for protective order filed  
501 with the Department or hearing officer within seven (7) days of receipt of the notice or  
502 request for discovery. Motions for protective order shall set forth the grounds in support  
503 thereof and shall be ruled upon immediately. Discovery shall be completed no later than  
504 ten (10) days preceding the hearing date, except as otherwise ordered by the  
505 Department or hearing officer.
- 506 18.6.6 Conduct of Hearings
- 507 18.6.6.1 Hearing presentations will proceed in the following order unless otherwise  
508 directed by the Department or hearing officer.
- 509 18.6.6.1.1 Call to order, introductory remarks, and action on applications for party  
510 status, if not already decided.
- 511 18.6.6.1.2 Presentation of any stipulations or agreements of the parties, and any  
512 other matters which were required to be dealt with at the prehearing conference,  
513 if held.
- 514 18.6.6.1.3 Opening statement by the party upon whom the burden of proof rests.
- 515 18.6.6.1.4 Opening statements by all other parties.
- 516 18.6.6.1.5 Presentation of case by party upon whom burden of proof rests.
- 517 18.6.6.1.6 Presentation by all other persons wishing to offer evidence in the order to  
518 be determined by the Department or hearing officer.
- 519 18.6.6.1.7 Rebuttal by the party upon whom the burden of proof rests, followed by  
520 rebuttal of other parties.
- 521 18.6.6.1.8 Closing statements by party upon whom the burden of proof rests,  
522 followed by closing statements of all other parties.
- 523 18.6.6.2 Public participation as provided for in these rules shall be allowed at that time or  
524 times during the hearing as determined by the Department or hearing officer in their  
525 discretion to be appropriate.

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- 526 18.6.6.3 At the conclusion of any witness's testimony, or at the conclusion of the party's  
527 entire presentation, as may be determined by the Department or hearing officer, all  
528 parties may then cross-examine such witness or witnesses. The Department or hearing  
529 officer may examine and cross-examine any witness. A person who is not a party shall  
530 not have the right to cross-examine.
- 531 18.6.6.4 Any person, not a party to the proceeding, wishing to present testimony may do  
532 so by indicating his desire in writing. A form will be available prior to and during the  
533 hearing. This form will request the person's name, address, whom he represents, the  
534 general nature of his testimony, and the time required for his presentation. This form is to  
535 be presented to a representative of the Department during the hearing. Voluntary  
536 testimony not specifically requested on or by the written form may also be allowed. Any  
537 person presenting testimony shall be under oath and be subject to cross examination.
- 538 18.6.6.5 The proponent of any motion, order, or license issuance bears the burden of  
539 proof.
- 540 18.6.6.6 No interested person, party, or applicant for party status outside the Department  
541 will have any oral or written communication with any Department personnel or hearing  
542 officer relevant to the merits of a hearing pending before the Department unless  
543 reasonable prior notice is given to all participants in the hearing. This prohibition shall  
544 apply after the hearing is noticed. Any Department employee or hearing officer who is  
545 involved in such a prohibited communication shall make a written record of it and transmit  
546 it to all the parties to the hearing.
- 547 18.6.7 Department Decision
- 548 18.6.7.1 Any party to a hearing may, or if so directed by the Department or the hearing  
549 officer shall, file proposed findings of fact and conclusions of law and a proposed form of  
550 order or decision within twenty (20) days after the record is closed. A party who has the  
551 burden of proof may reply within ten (10) days after service of proposed findings of fact  
552 and conclusions of law.
- 553 18.6.7.2 After due consideration of the hearing record, the Department or hearing officer  
554 shall issue its findings of fact, conclusions of law, and decision and order.
- 555 **RH-18.7 Operational Requirements.**
- 556 Each licensee authorized to receive, possess or use source material for milling or byproduct material as in  
557 definition (2) of **RH 1.42.2** shall:
- 558 18.7.1 Operate in accordance with the requirements of this Part 18, in particular the procedures required  
559 by **RH 18.3.2**, monitoring required by 18.3.3, and the requirements and objectives of Appendix A  
560 to this Part 18.
- 561 18.7.2 Submit a report to the Department within 60 days after January 1 and July 1 of each year,  
562 specifying the quantity of each of the radioactive materials released to unrestricted areas in liquid  
563 and in gaseous effluents during the previous six months of operation, and such other information  
564 as the Department may require to estimate maximum potential annual radiation doses to the  
565 public resulting from effluent releases. If quantities of radioactive materials released during the  
566 reporting period are significantly above the licensee's design objectives previously reviewed as  
567 part of the licensing action, the report shall cover this specifically. On the basis of such reports  
568 and any additional information the Department may obtain from the licensee or others, the  
569 Department may from time to time require the licensee to take such action as the Department  
570 deems appropriate.

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571 **18.7.3 FOR ANY LICENSED SITE OR FACILITY DETERMINED BY THE DEPARTMENT TO HAVE CAUSED A RELEASE**  
572 **TO THE GROUNDWATER THAT EXCEEDS THE BASIC STANDARDS FOR GROUNDWATER AS ESTABLISHED BY**  
573 **THE WATER QUALITY CONTROL COMMISSION, UNTIL REMEDIATION HAS BEEN COMPLETED, THE LICENSEE**  
574 **SHALL PROVIDE ANNUAL WRITTEN NOTICE OF THE STATUS OF THE RELEASE AND ANY REMEDIATION**  
575 **ACTIVITIES ASSOCIATED WITH THE RELEASE. BY CERTIFIED OR REGISTERED MAIL, RETURN RECEIPT**  
576 **REQUESTED, TO THE CURRENT ADDRESS FOR EACH REGISTERED GROUNDWATER WELL WITHIN ONE MILE**  
577 **OF THE RELEASE AS IDENTIFIED IN THE CORRECTIVE ACTION MONITORING PROGRAM, UNLESS THE**  
578 **LICENSEE DEMONSTRATES THAT A DISTANCE LESS THAN ONE MILE IS WARRANTED. DOCUMENTATION OF**  
579 **THIS ACTIVITY WILL BE RETAINED AND MADE AVAILABLE TO THE DEPARTMENT UPON REQUEST.**

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580 **RH 18.8 Decommissioning Requirements.**

581 18.8.1 In addition to the information required under RH 3.16, each licensee authorized to receive,  
582 possess or use source material for milling or byproduct material as in definition (2) of RH 1.42.2  
583 shall submit a plan for completion of decommissioning if the procedures necessary to carry out  
584 decommissioning:

585 18.8.1.1 Have not been previously approved by the Department; and

586 18.8.1.2 Could increase potential health and safety impacts to workers or to the public,  
587 such as in any of the following cases:

588 18.8.1.2.1 Procedures would involve techniques not applied routinely during  
589 cleanup or maintenance operations; or

590 18.8.1.2.2 Workers would be entering areas not normally occupied where surface  
591 contamination and radiation levels are significantly higher than routinely  
592 encountered; or

593 18.8.1.2.3 Procedures could result in significantly greater airborne concentrations of  
594 radioactive materials than are present during operation; or

595 18.8.1.2.4 Procedures could result in significantly greater releases of radioactive  
596 material to the environment than those associated with operation.

597 18.8.2 Procedures with potential health and safety impacts may not be carried out prior to approval of the  
598 decommissioning plan.

599 18.8.3 The proposed decommissioning plan, if required by RH 18.8.1 or by license condition, must  
600 include:

601 18.8.3.1 Description of planned decommissioning activities;

602 18.8.3.2 Description of methods used to assure protection of workers and the  
603 environment against radiation hazards during decommissioning;

604 18.8.3.3 A description of the planned final radiation survey; and

605 18.8.3.4 An updated detailed cost estimate for decommissioning, comparison of that  
606 estimate with present funds set aside for decommissioning, and plan for assuring the  
607 availability of adequate funds for completion of decommissioning.

608 18.8.4 The proposed decommissioning plan will be approved by the Department if the information  
609 therein demonstrates that the decommissioning will be completed as soon as is reasonable and  
610 that the health and safety of workers and the public will be adequately protected.

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611 18.8.5 Upon approval of the decommissioning plan by the Department, the licensee shall complete  
612 decommissioning in accordance with the approved plan. As a final step in decommissioning, the  
613 licensee shall submit the information required in RH 3.16.4.1.5 and shall certify the disposition of  
614 accumulated wastes from decommissioning.

615 18.8.6 If the information submitted under RH 3.16.4.1.5 or 18.8 does not adequately demonstrate that  
616 the premises are suitable for release for unrestricted use, the Department will inform the licensee  
617 of the appropriate further actions required for termination of license.

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

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

627 As used in this appendix, the term "as low as is reasonably achievable" has the same meaning as in RH  
628 1.42.2.

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

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

639 Licensees or applicants may propose to the Department alternatives to meet the specific requirements in  
640 this Appendix. The alternative proposals may take into account local or regional conditions, including  
641 geology, topography, hydrology, and meteorology. The Department may find that the proposed  
642 alternatives meet the Department's requirements if the alternatives will achieve a level of stabilization and  
643 containment of the sites concerned and a level of protection for public health, safety, and the environment  
644 from radiological and nonradiological hazards associated with the site, which is equivalent to, to the  
645 extent practicable, or more stringent than the level which would be achieved by the requirements of this  
646 Appendix and the standards promulgated by the Environmental Protection Agency in 40 CFR Part 192,  
647 Subparts D and E. Proposed alternatives to specific regulations in this Part 18 require notice and  
648 opportunity for hearing before the ~~U.S. Nuclear Regulatory Commission~~ NRC.

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

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657 **Criterion 1.**

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

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

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

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

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

677 **Criterion 2.**

678 To avoid proliferation of small waste disposal sites and thereby reduce perpetual surveillance obligations,  
679 byproduct material as in definition (2) of RH 1.42.2, from in situ extraction operations, such as residues  
680 from solution evaporation or contaminated control processes, and wastes from small remote above  
681 ground extraction operations shall be disposed of at existing large mill tailings disposal sites; unless  
682 considering the nature of the wastes, such as their volume and specific activity and the costs and  
683 environmental impacts of transporting the wastes to a large disposal site, such offsite disposal is  
684 demonstrated to be impracticable or the advantages of onsite burial clearly outweigh the benefits of  
685 reducing the perpetual surveillance obligations.

686 **Criterion 3.**

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

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701 **Criterion 4.**

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

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

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

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

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

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

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

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

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

727 (c) Steepness of underlying slopes.

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

731 (4) Rock covering of slopes may be unnecessary where top covers are very thick (on the order of  
732 10m or greater); impoundment slopes are very gentle (on the order of 10h:1v or less); bulk cover  
733 materials have inherently favorable erosion resistance characteristics; and, there is negligible  
734 drainage catchment area upstream of the pile and good wind protection as described in Criteria  
735 4A and 4B.

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

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

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

754 **Criterion 5.**

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

759 Criterion 5A.

760 (1) The primary ground-water protection standard is a design standard for surface impoundments  
761 used to manage byproduct material. Unless exempted under paragraph 5A(3) of this criterion,  
762 surface impoundments (except for an existing portion) shall have a liner that is designed,  
763 constructed, and installed to prevent any migration of wastes out of the impoundment to the  
764 adjacent subsurface soil, ground water, or surface water at any time during the active life  
765 (including the closure period) of the impoundment. The liner may be constructed of materials that  
766 may allow wastes to migrate into the liner (but not into the adjacent subsurface soil, ground water,  
767 or surface water) during the active life of the facility, provided that impoundment closure includes  
768 removal or decontamination of all waste residues, contaminated containment system components  
769 (liners, etc.) contaminated subsoils, and structures and equipment contaminated with waste and  
770 leachate. For impoundments that will be closed with the liner material left in place, the liner must  
771 be constructed of materials that can prevent wastes from migrating into the liner during the active  
772 life of the facility.

773 (2) The liner required by paragraph 5A(1) above shall be:

774 (a) Constructed of materials that have appropriate chemical properties and sufficient strength  
775 and thickness to prevent failure due to pressure gradients (including static head and  
776 external hydrogeologic forces), physical contact with the waste or leachate to which they  
777 are exposed, climatic conditions, the stress of installation, and the stress of daily  
778 operation;

779 (b) Placed upon a foundation or base capable of providing support to the liner and resistance  
780 to pressure gradients above and below the liner to prevent failure of the liner due to  
781 settlement, compression, or uplift; and

782 (c) Installed to cover all surrounding earth likely to be in contact with the wastes or leachate.

783 (3) The applicant or licensee will be exempted from the requirements of paragraph 5A(1) of this  
784 criterion if the Department finds, based on a demonstration by the applicant or licensee, that  
785 alternate design and operating practices, including the closure plan, together with site  
786 characteristics will prevent the migration of any hazardous constituents into ground water or  
787 surface water at any future time.

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

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

804 Criterion 5B.

- 805 (1) Uranium and thorium byproduct material in definition (2) of [RH 1.42.2](#) shall be managed to  
806 conform to the following secondary ground-water protection standard: hazardous constituents  
807 entering the ground water from a licensed site must not exceed the specified concentration limits  
808 in the uppermost aquifer beyond the point of compliance during the compliance period.  
809 Hazardous constituents are those constituents identified by the Department pursuant to  
810 paragraph 5B(2) of this criterion. Specified concentration limits are those limits established by the  
811 Department as indicated in paragraph 5B(5) of this criterion. The Department will also establish  
812 the point of compliance and compliance period on a site-specific basis through license conditions  
813 and orders. The objective in selecting the point of compliance is to provide the earliest practicable  
814 warning that the impoundment is releasing hazardous constituents to the ground water. The point  
815 of compliance must be selected to provide prompt indication of ground-water contamination on  
816 the hydraulically downgradient edge of the disposal area. The Department shall identify  
817 hazardous constituents, establish concentration limits, set the compliance period, and may adjust  
818 the point of compliance if needed to accord with developed data and site information as to the  
819 flow of ground water or contaminants, when the detection monitoring established under Criterion  
820 7A indicates leakage of hazardous constituents from the disposal area.
- 821 (2) A constituent becomes a hazardous constituent subject to paragraph 5B(5) only when the  
822 constituent meets all three of the following tests:
  - 823 (a) The constituent is reasonably expected to be in or derived from the uranium and thorium  
824 byproduct material in the disposal area;
  - 825 (b) The constituent has been detected in the ground water in the uppermost aquifer; and
  - 826 (c) The constituent is listed in Criterion 10 of this appendix.
- 827 (3) Even when constituents meet all three tests in paragraph 5B(2) of this criterion, the Department  
828 may exclude a detected constituent from the set of hazardous constituents on a site-specific  
829 basis if it finds that the constituent is not capable of posing a substantial present or potential

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- 830 hazard to human health or the environment. In deciding whether to exclude constituents, the  
831 Department will consider the following:
- 832 (a) Potential adverse effects on ground-water quality, considering
- 833 (i) The physical and chemical characteristics of the waste in the licensed site,  
834 including its potential for migration;
  - 835 (ii) The hydrogeological characteristics of the facility and surrounding land;
  - 836 (iii) The quantity of ground water and the direction of ground water flow;
  - 837 (iv) The proximity and withdrawal rates of ground-water users;
  - 838 (v) The current and future uses of ground water in the area;
  - 839 (vi) The existing quality of ground water, including other sources of contamination  
840 and their cumulative impact on the ground water quality;
  - 841 (vii) The potential for health risks caused by human exposure to waste constituents;
  - 842 (viii) The potential damage to wildlife, crops, vegetation, and physical structures  
843 caused by exposure to waste constituents;
  - 844 (ix) The persistence and permanence of the potential adverse effects.
- 845 (b) Potential adverse effects on hydraulically-connected surface waterquality, considering
- 846 (i) The volume and physical and chemical characteristics of the waste in the  
847 licensed site;
  - 848 (ii) The hydrogeological characteristics of the facility and surrounding land;
  - 849 (iii) The quantity and quality of ground water and the direction of ground water flow;
  - 850 (iv) The patterns of rainfall in the region;
  - 851 (v) The proximity of the licensed site to surface waters;
  - 852 (vi) The current and future uses of surface waters in the area and any water quality  
853 standards established for those surface waters;
  - 854 (vii) The existing quality of surface water, including other sources of contamination  
855 and the cumulative impact on surface water quality;
  - 856 (viii) The potential for health risks caused by human exposure to waste constituents;
  - 857 (ix) The potential damage to wildlife, crops, vegetation, and physical structures  
858 caused by exposure to waste constituents; and
  - 859 (x) The persistence and permanence of the potential adverse effects.
- 860 (4) In making any determinations under paragraphs 5B(3) and 5B(6) of this criterion about the use of  
861 ground water in the area around the facility, the Department will consider any identification of

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- 862 underground sources of drinking water and exempted aquifers made by the Colorado Water  
863 Quality Control Commission, as in 5 CCR 1002-8, or other agency having jurisdiction.
- 864 (5) At the point of compliance, the concentration of a hazardous constituent must not exceed:
- 865 (a) The Department-approved background concentration of that constituent in the ground  
866 water;
- 867 (b) The respective value given in the table in paragraph 5C if the constituent is listed in the  
868 table and if the background level of the constituent is below the value listed; or
- 869 (c) An alternate concentration limit established by the Department.
- 870 (6) Conceptually, background concentrations pose no incremental hazards and the drinking water  
871 limits in Criterion 5C state acceptable hazards but these two options may not be practically  
872 achievable at a specific site. Alternate concentration limits that present no significant hazard may  
873 be proposed by licensees for Department consideration. Licensees must provide the basis for any  
874 proposed limits including consideration of practicable corrective actions, that limits are as low as  
875 reasonably achievable, and information on the factors the Department must consider. The  
876 Department will establish a site specific alternate concentration limit for a hazardous constituent  
877 as provided in paragraph 5B(5) of this criterion if it finds that the proposed limit is as low as  
878 reasonably achievable after considering practicable corrective actions, and that the constituent  
879 will not pose a substantial present or potential hazard to human health or the environment as long  
880 as the alternate concentration limit is not exceeded. In making the present and potential hazard  
881 finding, the Department will consider the following factors:
- 882 (a) Potential adverse effects on ground water quality, considering:
- 883 (i) The physical and chemical characteristics of the waste in the licensed site  
884 including its potential for migration;
- 885 (ii) The hydrogeological characteristics of the facility and surrounding land;
- 886 (iii) The quantity of ground water and the direction of ground water flow;
- 887 (iv) The proximity and withdrawal rates of ground water users;
- 888 (v) The current and future uses of ground water in the area;
- 889 (vi) The existing quality of ground water, including other sources of contamination  
890 and their cumulative impact on the ground water quality;
- 891 (vii) The potential for health risks caused by human exposure to waste constituents;
- 892 (viii) The potential damage to wildlife, crops, vegetation, and physical structures  
893 caused by exposure to waste constituents;
- 894 (ix) The persistence and permanence of the potential adverse effects.
- 895 (b) Potential adverse effects on hydraulically-connected surface water quality, considering:
- 896 (i) The volume and physical and chemical characteristics of the waste in the  
897 licensed site;
- 898 (ii) The hydrogeological characteristics of the facility and surrounding land;

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- 899 (iii) The quantity and quality of ground water, and the direction of ground water flow;
- 900 (iv) The patterns of rainfall in the region;
- 901 (v) The proximity of the licensed site to surface waters;
- 902 (vi) The current and future uses of surface waters in the area and any water quality standards established for those surface waters;
- 903
- 904 (vii) The existing quality of surface water including other sources of contamination and the cumulative impact on surface water quality;
- 905
- 906 (viii) The potential for health risks caused by human exposure to waste constituents;
- 907 (ix) The potential damage to wildlife, crops, vegetations, and physical structures caused by exposure to waste constituents; and
- 908
- 909 (x) The persistence and permanence of the potential adverse effects.

910 Criterion 5C.

911 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 <sub>10</sub> H <sub>10</sub> Cl <sub>6</sub> , 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

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	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

913

914 Criterion 5D. If the ground water protection standards established under paragraph 5B(1) of this criterion  
 915 are exceeded at a licensed site, a corrective action program must be put into operation as soon as is

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916 practicable, and in no event later than eighteen (18) months after the Department finds that the standards  
917 have been exceeded. The licensee shall submit the proposed corrective action program and supporting  
918 rationale for Department approval prior to putting the program into operation, unless otherwise directed by  
919 the Department. The objective of the program is to return hazardous constituent concentration levels in  
920 ground water to the concentration limits set as standards. The licensee's proposed program shall address  
921 removing the hazardous constituents that have entered the ground water at the point of compliance or  
922 treating them in place. The program shall also address removing or treating in place any hazardous  
923 constituents that exceed concentration limits in ground water between the point of compliance and the  
924 downgradient facility property boundary. The licensee shall continue corrective action measures to the  
925 extent necessary to achieve and maintain compliance with the ground water protection standard. The  
926 Department will determine when the licensee may terminate corrective action measures based on data  
927 from the ground water monitoring program and other information that provide reasonable assurance that  
928 the ground water protection standard will not be exceeded.

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

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

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

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

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

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

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

959 (1) The chemical and radioactive characteristics of the waste solutions.

960 (2) The characteristics of the underlying soil and geologic formations particularly as they will control  
961 transport of contaminants and solutions. This includes detailed information concerning extent,

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962 thickness, uniformity, shape, and orientation of underlying strata. Hydraulic gradients and  
963 conductivities of the various formations must be determined. This information must be gathered  
964 from borings and field survey methods taken within the proposed impoundment area and in  
965 surrounding areas where contaminants might migrate to ground water. The information gathered  
966 on boreholes must include both geological and geophysical logs in sufficient number and degree  
967 of sophistication to allow determining significant discontinuities, fractures, and channeled deposits  
968 of high hydraulic conductivity. If field survey methods are used, they should be in addition to and  
969 calibrated with borehole logging. Hydrologic parameters such as permeability may not be  
970 determined on the basis of laboratory analysis of samples alone; a sufficient amount of field  
971 testing (e.g., pump tests) must be conducted to assure actual field properties are adequately  
972 understood. Testing must be conducted to allow estimating chemi-sorption attenuation properties  
973 of underlying soil and rock.

974 (3) Location, extent, quality, capacity and current uses of any ground water at and near the site.

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

977 **Criterion 6.**

978 (1) In disposing of waste byproduct material, licensees shall place an earthen cover (or approved  
979 alternative) over tailings or wastes at the end of milling operations and shall close the waste  
980 disposal area in accordance with a design<sup>1</sup> which provides reasonable assurance of control of  
981 radiological hazards to (i) be effective for 1,000 years, to the extent reasonably achievable, and,  
982 in any case, for at least 200 years, and (ii) limit releases of radon-222 from uranium byproduct  
983 materials, and radon-220 from thorium byproduct materials, to the atmosphere so as not to  
984 exceed an average<sup>2</sup> release rate of 0.74 Becquerel per square meter per second ( $Bq/m^2 s$ ), or  
985 20 picocuries per square meter per second ( $pCi/m^2 s$ ), to the extent practicable throughout the  
986 effective design life determined pursuant to (1)(i) of this criterion. In computing required tailings  
987 cover thicknesses, moisture in soils in excess of amounts found normally in similar soils in similar  
988 circumstances may not be considered. Direct gamma exposure from the tailings or wastes should  
989 be reduced to background levels. The effects of any thin synthetic layer may not be taken into  
990 account in determining the calculated radon exhalation level. If non-soil materials are proposed  
991 as cover materials, it must be demonstrated that these materials will not crack or degrade by  
992 differential settlement, weathering, or other mechanism, over long-term intervals.

993 1 In the case of thorium byproduct materials, the standard applies only to design. Monitoring for radon emissions from  
994 thorium byproduct materials after installation of an appropriately designed cover is not required.

995 2 This average applies to the entire surface of each disposal area over a period of a least one year, but a period short  
996 compared to 100 years. Radon will come from both byproduct materials and from covering materials. Radon emissions from  
997 covering materials should be estimated as part of developing a closure plan for each site. The standard, however, applies only to  
998 the emissions from byproduct materials to the atmosphere.

999 (2) As soon as reasonably achievable after emplacement of the final cover to limit releases of radon-  
1000 222 from uranium byproduct material and prior to placement of erosion protection barriers or  
1001 other features necessary for long-term control of the tailings, the licensee shall verify through  
1002 appropriate testing and analysis that the design and construction of the final radon barrier is  
1003 effective in limiting releases of radon-222 to a level not exceeding  $0.74 Bq/m^2 s$  ( $20 pCi/m^2 s$ )  
1004 averaged over the entire pile or impoundment using the procedures described in 40 CFR Part 61,  
1005 Appendix B, Method 115, or another method of verification approved by the Department as being  
1006 at least as effective in demonstrating the effectiveness of the final radon barrier.

1007 (3) When phased emplacement of the final radon barrier is included in the applicable reclamation  
1008 plan, the verification of radon-222 release rates required in paragraph (2) of this Criterion must be  
1009 conducted for each portion of the pile or impoundment as the final radon barrier for that portion is  
1010 emplaced.

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1011 (4) Within ninety days of the completion of all testing and analysis relevant to the required verification  
1012 in paragraphs (2) and (3) of this Criterion, the uranium mill licensee shall report to the Department  
1013 the results detailing the actions taken to verify that levels of release of radon-222 do not exceed  
1014  $0.74 \text{ Bq/m}^2 \text{ s}$  ( $20 \text{ pCi/m}^2 \text{ s}$ ) when averaged over the entire pile or impoundment. The licensee  
1015 shall maintain records until termination of the license documenting the source of input parameters  
1016 including the results of all measurements on which they are based, the calculations and/or  
1017 analytical methods used to derive values for input parameters, and the procedure used to  
1018 determine compliance. These records shall be kept in a form suitable for transfer to the custodial  
1019 agency at the time of transfer of the site to the U.S. Department of Energy or State for long-term  
1020 care if requested.

1021 (5) Near surface cover materials, i.e., within the top three meters (10 feet), may not include waste or  
1022 rock that contains elevated levels of radium; soils used for near surface cover must be essentially  
1023 the same, as far as radioactivity is concerned, as that of surrounding surface soils. This is to  
1024 ensure that surface radon exhalation is not significantly above background because of the cover  
1025 material itself.

1026 (6) The design requirements in this Criterion for longevity and control of radon releases apply to any  
1027 portion of a licensed and/or disposal site unless such portion contains a concentration of radium  
1028 in land, averaged over areas of 100 square meters, which as a result of byproduct material, does  
1029 not exceed the background level by more than: (i) 0.18 Becquerels (5 picocuries) per gram of  
1030 radium-226, or, in the case of thorium byproduct material, radium-228, averaged over the first 15  
1031 centimeters (cm) below the surface, and (ii) 0.56 Becquerels (15 pCi) of radium-226, or, in the  
1032 case of thorium byproduct material, radium-228, averaged over 15-cm thick layers more than 15  
1033 cm below the surface.

1034 Byproduct material containing concentrations of radionuclides other than radium in soil, and surface  
1035 activity on remaining structures, must not result in a total effective dose equivalent (TEDE) exceeding the  
1036 dose from cleanup of radium contaminated soil to the above standard (benchmark dose), and must be at  
1037 levels which are as low as reasonably achievable. If more than one residual radionuclide is present in the  
1038 same 100 square-meter area, the sum of the ratios for each radionuclide of concentration present to the  
1039 concentration limit will not exceed "1" (unity). A calculation of the potential peak annual TEDE within 1000  
1040 years to the average member of the critical group that would result from applying the radium standard  
1041 (not including radon) on the site must be submitted for approval. The use of decommissioning plans with  
1042 benchmark doses which exceed 1 millisievert per year (100 mrem/year), before application of ALARA,  
1043 requires the approval of the Department. This requirement for dose criteria does not apply to sites that  
1044 have decommissioning plans for soil and structures approved before the effective date of this Criterion  
1045 6(6).

1046 (7) The licensee shall also address the nonradiological hazards associated with the wastes in  
1047 planning and implementing closure. The licensee shall ensure that disposal areas are closed in a  
1048 manner that minimizes the need for further maintenance. To the extent necessary to prevent  
1049 threats to human health and the environment, the licensee shall control minimize, or eliminate  
1050 post-closure escape of nonradiological hazardous constituents, leachate, contaminated rainwater,  
1051 or waste decomposition products to the ground or surface waters or to the atmosphere.

1052 Criterion 6A.

1053 (1) For impoundments containing uranium byproduct materials, the final radon barrier must be  
1054 completed as expeditiously as practicable considering technological feasibility after the pile or  
1055 impoundment ceases operation in accordance with a written, Department-approved reclamation  
1056 plan. (The term as expeditiously as practicable considering technological feasibility as specifically  
1057 defined in **RH** 18.2 includes factors beyond the control of the licensee). Deadlines for completion  
1058 of the final radon barrier and, if applicable, the following interim milestones must be established  
1059 as a condition of the individual license: windblown tailings retrieval and placement on the pile and  
1060 interim stabilization including dewatering or the removal of freestanding liquids and recontouring.

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1061 The placement of erosion protection barriers or other feature necessary for long-term control of  
1062 the tailings must also be completed in a timely manner in accordance with a written, Department-  
1063 approved reclamation plan.

1064 (2) The Department may approve a licensee's request to extend the time for performance of  
1065 milestones related to emplacement of the final radon barrier if, after providing an opportunity for  
1066 public participation, the Department finds that the licensee has adequately demonstrated in the  
1067 manner required in paragraph (2) of Criterion 6 that releases of radon-222 do not exceed an  
1068 average of 0.74 Becquerel/m<sup>2</sup> s (20 pCi/m<sup>2</sup> s). If the delay is approved on the basis that the  
1069 radon releases do not exceed 0.74 Becquerel/m<sup>2</sup> s (20 pCi/m<sup>2</sup> s), a verification of radon levels,  
1070 as required by paragraph (2) of Criterion 6, must be made annually during the period of delay. In  
1071 addition, once the Department has established the date in the reclamation plan for the milestone  
1072 for completion of the final radon barrier, the Department may extend that date based on cost if  
1073 after providing an opportunity for public participation, the Department finds that the licensee is  
1074 making good faith efforts to emplace the final radon barrier, the delay is consistent with the  
1075 definition of available technology, and the radon releases caused by the delay will not result in a  
1076 significant incremental risk to the public health.

1077 (3) The Department may authorize by license amendment, upon licensee report, a portion of the  
1078 impoundment to accept uranium byproduct material or such materials that are similar in physical,  
1079 chemical, and radiological characteristics to the uranium mill tailings and associated wastes  
1080 already in the pile or impoundment from other sources, during the closure process. No such  
1081 authorization will be made if it results in a delay or impediment to emplacement of the final radon  
1082 barrier over the remainder of the impoundment in a manner that will achieve levels of radon-222  
1083 releases not exceeding 0.74 Becquerel/m<sup>2</sup> s (20 pCi/m<sup>2</sup> s) averaged over the entire  
1084 impoundment. The verification required in paragraph (2) of Criterion 6 may be completed with a  
1085 portion of the impoundment being used for further disposal if the Department makes a final  
1086 finding that the impoundment will continue to achieve a level of radon-222 release not exceeding  
1087 0.74 Becquerel/m<sup>2</sup> s (20 pCi/m<sup>2</sup> s) averaged over the entire impoundment. In this case, after the  
1088 final radon barrier is complete except for the continuing disposal area, (a) only byproduct material  
1089 will be authorized for disposal, (b) the disposal will be limited to the specified existing disposal  
1090 area, and (c) this authorization will only be made after providing opportunity for public  
1091 participation. Reclamation of the disposal area, as appropriate, must be completed in a timely  
1092 manner after disposal operations cease in accordance with paragraph (1) of Criterion 6; however,  
1093 these actions are not required to be complete as part of meeting the deadline for final radon  
1094 barrier construction.

1095 **Criterion 7.**

1096 The licensee shall establish a detection monitoring program needed for the Department to set the site-  
1097 specific ground water protection standards in paragraph 5B(1) of this appendix. For all monitoring under  
1098 this paragraph, the licensee or applicant will propose for Department approval as license conditions which  
1099 constituents are to be monitored on a site-specific basis. A detection monitoring program has two  
1100 purposes. The initial purpose of the program is to detect leakage of hazardous constituents from the  
1101 disposal area so that the need to set ground water protection standards is monitored. If leakage is  
1102 detected, the second purpose of the program is to generate data and information needed for the  
1103 Department to establish the standards under Criterion 5B. The data and information must provide a  
1104 sufficient basis to identify those hazardous constituents which require concentration limit standards and to  
1105 enable the Department to set the limits for those constituents and the compliance period. They may also  
1106 need to provide the basis for adjustments to the point of compliance. The detection monitoring programs  
1107 must be in place when specified by the Department in orders or license conditions. Once ground water  
1108 protection standards have been established pursuant to paragraph 5B(1), the licensee shall establish and  
1109 implement a compliance monitoring program. The purpose of the compliance monitoring program is to  
1110 determine that the hazardous constituent concentrations in ground water continue to comply with the  
1111 standards set by the Department. In conjunction with a corrective action program, the licensee shall  
1112 establish and implement a corrective action monitoring program. The purpose of the corrective action

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1113 monitoring program is to demonstrate the effectiveness of the corrective actions. Any monitoring program  
1114 required by this paragraph may be based on existing monitoring programs to the extent the existing  
1115 programs can meet the stated objective for the program.

1116 **Criterion 8.**

1117 Milling operations must be conducted so that all airborne effluent releases are reduced to levels as low as  
1118 is reasonably achievable. The primary means of accomplishing this must be by means of emission  
1119 controls. Institutional controls, such as extending the site boundary and exclusion area, may be employed  
1120 to ensure that offsite exposure limits are met, but only after all practicable measures have been taken to  
1121 control emissions at the source. Notwithstanding the existence of individual dose standards, strict control  
1122 of emissions is necessary to assure that population exposures are reduced to the maximum extent  
1123 reasonably achievable and to avoid site contamination. The greatest potential sources of offsite radiation  
1124 exposure (aside from radon exposure) are dusting from dry surfaces of the tailings disposal area not  
1125 covered by tailings solution and emissions from yellowcake drying and packaging operations. During  
1126 operations and prior to closure, radiation doses from radon emissions from surface impoundments of  
1127 uranium or thorium byproduct materials must be kept as low as is reasonably achievable.

1128 Checks must be made and logged hourly for all parameters (e.g., differential pressures and scrubber  
1129 water flow rates) that determine the efficiency of yellowcake stack emission control equipment operation.  
1130 The licensee shall retain each log as a record for three years after the last entry in the log is made. It  
1131 must be determined whether or not conditions are within a range prescribed to ensure that the equipment  
1132 is operating consistently near peak efficiency; corrective action must be taken when performance is  
1133 outside of prescribed ranges. Effluent control devices must be operative at all times during drying and  
1134 packaging operations and whenever air is exhausting from the yellowcake stack. Drying and packaging  
1135 operations must terminate when controls are inoperative. When checks indicate the equipment is not  
1136 operating within the range prescribed for peak efficiency, actions must be taken to restore parameters to  
1137 the prescribed range. When this cannot be done without shutdown and repairs, drying and packaging  
1138 operations must cease as soon as practicable. Operations may not be restarted after cessation due to off-  
1139 normal performance until needed corrective actions have been identified and implemented. All these  
1140 cessations, corrective actions, and restarts must be reported to the Department as indicated in Criterion  
1141 8A, in writing, within ten days of the subsequent restart.

1142 To control dusting from tailings, that portion not covered by standing liquids must be wetted or chemically  
1143 stabilized to prevent or minimize blowing and dusting to the maximum extent reasonably achievable. This  
1144 requirement may be relaxed if tailings are effectively sheltered from wind, such as may be the case where  
1145 they are disposed of below grade and the tailings surface is not exposed to wind. Consideration must be  
1146 given in planning tailings disposal programs to methods which would allow phased covering and  
1147 reclamation of tailings impoundments because this will help in controlling particulate and radon emissions  
1148 during operation. To control dusting from diffuse sources, such as tailings and ore pads where automatic  
1149 controls do not apply, operators shall develop written operating procedures specifying the methods of  
1150 control which will be utilized.

1151 Milling operations producing or involving uranium and thorium byproduct materials must be conducted in  
1152 such a manner as to provide reasonable assurance that the annual dose equivalent does not exceed 0.25  
1153 millisievert (25 millirem) to the whole body, 0.75 millisievert (75 millirem) to the thyroid, and 0.25  
1154 millisievert (25 millirem) to any other organ of any member of the public as a result of exposures to the  
1155 planned discharge of radioactive material, radon and its progeny excepted, to the general environment.

1156 Uranium and thorium byproduct materials must be managed so as to conform to the applicable provisions  
1157 of Title 40 of the *Code of Federal Regulations*, Part 440, "Ore Mining and Dressing Point Source  
1158 Category: Effluent Limitations Guidelines and New Source Performance Standards, Subpart C, Uranium,  
1159 Radium, and Vanadium Ores Subcategory", as codified on January 1, 1983.

1160 Criterion 8A. Inspections of tailings or waste retention systems must be conducted daily during  
1161 operations, or at an alternate frequency approved by the Department for other conditions. Such

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1162 inspections shall be conducted by, or under the supervision of, a qualified engineer or scientist, and  
1163 documented. The licensee shall retain the documentation for each inspection as a record for three years  
1164 after the documentation is made. The Department must be immediately notified of any failure in a tailings  
1165 or waste retention system that results in a release of tailings or waste into unrestricted areas, or any  
1166 unusual conditions (conditions not contemplated in the design of the retention system) that if not  
1167 corrected could indicate the potential or lead to failure of the system and result in a release of tailings or  
1168 waste into unrestricted areas.

1169 **Criterion 9.**

1170 Criterion 9A. These criteria relating to ownership of tailings and their disposal sites became effective on  
1171 November 8, 1981, and apply to all licenses terminated, issued, or renewed after that date.

1172 Criterion 9B. Any uranium or thorium milling license or tailings license must contain such terms and  
1173 conditions as the ~~U.S. Nuclear Regulatory Commission~~NRC and Department determine necessary to  
1174 assure that prior to termination of the license, the licensee will comply with ownership requirements of this  
1175 criterion for sites used for tailings disposal.

1176 Criterion 9C. Title to the byproduct material licensed under this Part 18 and land, including any interests  
1177 therein (other than land owned by the United States or by the State), which is used for the disposal of any  
1178 such byproduct material, or is essential to ensure the long-term stability of such disposal site, must be  
1179 transferred to the United States or the State in which such land is located, at the option of such State. In  
1180 view of the fact that physical isolation must be the primary means of long-term control, and Government  
1181 land ownership is a desirable supplementary measure, ownership of certain severable subsurface  
1182 interests (for example, mineral rights) may be determined to be unnecessary to protect the public health  
1183 and safety and the environment. In any case, however, the applicant/operator must demonstrate a  
1184 serious effort to obtain such subsurface rights, and must in the event that certain rights cannot be  
1185 obtained, provide notification in local public land records of the fact that the land is being used for the  
1186 disposal of radioactive material and is subject to either a ~~U.S. Nuclear Regulatory Commission~~NRC or  
1187 Department general or specific license prohibiting the disruption and disturbance of the tailings. In some  
1188 rare cases, such as may occur with deep burial where no ongoing site surveillance will be required,  
1189 surface land ownership transfer requirements may be waived with the approval of the Department and  
1190 ~~U.S. Nuclear Regulatory Commission~~NRC. For licenses issued before November 8, 1981, the  
1191 Department and ~~U.S. Nuclear Regulatory Commission~~NRC may take into account the status of the  
1192 ownership of such land, and interests therein, and the ability of a licensee to transfer title and custody  
1193 thereof to the United States or the State.

1194 Criterion 9D. If the ~~U.S. Nuclear Regulatory Commission~~NRC, or the Department if title is held by the  
1195 State, subsequent to title transfer determines that use of the surface or subsurface estates, or both, of the  
1196 land transferred to the United States or to a State will not endanger the public health, safety, welfare, or  
1197 environment, the ~~U.S. Nuclear Regulatory Commission~~NRC, or the Department if title is held by the State,  
1198 may permit the use of the surface or subsurface estates, or both, of such and in a manner consistent with  
1199 the provisions provided in these criteria. If the ~~U.S. Nuclear Regulatory Commission~~NRC, or the  
1200 Department if title is held by the state, permits such use of such land, it will provide the person who  
1201 transferred such land with the right of first refusal with respect to such use of such land.

1202 Criterion 9E. Material and land transferred to the United States or the State in accordance with this  
1203 Criterion 9 must be transferred to the United States or the State without cost other than administrative or  
1204 legal costs incurred in carrying out such transfer.

1205 Criterion 9F. The provisions of this part respecting transfer of title and custody to land and tailings and  
1206 wastes do not apply in the case of lands held in trust by the United States for any Indian tribe or lands  
1207 owned by such Indian tribe subject to a restriction against alienation imposed by the United States. In the  
1208 case of such lands which are used for the disposal of uranium or thorium byproduct material, as defined  
1209 in Part 1, the licensee shall enter into arrangements with the ~~U.S. Nuclear Regulatory Commission~~NRC  
1210 as may be appropriate to assure the long-term surveillance of such lands by the United States.

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1211 **Criterion 10.**

1212 Secondary ground-water protection standards required by Criterion 5 of this Appendix are concentration  
1213 limits for individual hazardous constituents. The following list of constituents identifies the constituents for  
1214 which standards must be set and complied with if the specific constituent is reasonably expected to be in  
1215 or derived from the radioactive material and has been detected in ground water. For purposes of this  
1216 Appendix, the property of gross alpha activity will be treated as if it is a hazardous constituent. Thus,  
1217 when setting standards under paragraph 5B(5) of Criterion 5, the Department will also set a limit for gross  
1218 alpha activity. The Department does not consider the following list imposed by 40 CFR Part 192 to be  
1219 exhaustive and may determine other constituents to be hazardous on a case-by-case basis, independent  
1220 of those specified by the U.S. Environmental Protection Agency in Part 192.

1221 **PART 18 - CRITERION 10 HAZARDOUS CONSTITUENTS**

- 1222 - Acetonitrile (Ethanenitrile)
- 1223 - Acetophenone (Ethanone, 1-phenyl)
- 1224 - 3-(alpha-Acetylbenzyl)-4-hydroxycoumarin and salts (Warfarin)
- 1225 - 2-Acetylaminofluorene (Acetamide, N-(9H- fluoren-2-yl)-)
- 1226 - Acetyl chloride (Ethanoyl chloride)
- 1227 - 1-Acetyl-2-thiourea (Acetamide, N- (aminothioxomethyl)-)
- 1228 - Acrolein (2-Propenal)
- 1229 - Acrylamide (2-Propenamide)
- 1230 - Acrylonitrile (2-Propenenitrile)
- 1231 - Aflatoxins
- 1232 - Aldrin (1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a,8b-hexahydro-endo,exo-1,4:5,8-  
1233 Dimethanonaphthalene)
- 1234 - Allyl alcohol (2-Propen-1-ol)
- 1235 - Aluminum phosphide
- 1236 - 4-Aminobiphenyl ([1,1-Biphenyl])-4-amine)
- 1237 - 6-Amino-1,1a,2,8,8a,8b-hexahydro-8-(hydroxymethyl)-8a-methoxy-5-methyl-carbamate  
1238 azirino(2,3:3,4)pyrrolo(1,2-a]indole-4,7-dione,(ester) (Mitomycin C) (Azirino[2,3:3,4]pyrrolo(1,2-  
1239 a]indole-4,7-dione,6-amino-8-[(amino-cabonyl)oxy)methyl]-1,1a,2,8,8a,8b-hexahydro-8a  
1240 methoxy-5-methyl-)
- 1241 - 5-(Aminomethyl)-3-isoxazolol (3(2H)-Isoxazolone, 5-(aminomethyl)-4-Aminopyridine (4-  
1242 Pyridinamine)
- 1243 - Amitrole (1H-1,2,4-Triazol-3-amine)
- 1244 - Aniline (Benzenamine)

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- 1245 - Antimony and compounds, N.O.S. <sup>3</sup>
- 1246 - Aramite (Sulfurous acid,2-chloroethyl-,2-(4-(1,1-dimethylethyl)phenoxy)-1-methylethyl ester)
- 1247 - Arsenic and compounds, N.O.S. <sup>3</sup>
- 1248 - Arsenic acid (Orthoarsenic acid)
- 1249 - Arsenic pentoxide (Arsenic (V) oxide)
- 1250 - Arsenic trioxide (Arsenic (III) oxide)
- 1251 - Auramine (Benzenamine,4,4-carbonimidoylbis (N,N-Dimethyl-,monohydrochloride)
- 1252 - Azaserine (L-Serine, diazoacetate (ester))
- 1253 - Barium and compounds, N.O.S. <sup>3</sup>
- 1254 - Barium cyanide
- 1255 - Benz(c)acridine (3,4-Benzacridine)
- 1256 - Benz(a)anthracene (1,2-Benzanthracene)
- 1257 - Benzene (Cyclohexatriene)
- 1258 - Benzenearsonic acid (Arsonic acid, phenyl-)
- 1259 - Benzene, dichloromethyl-(Benzal chloride)
- 1260 - Benzenethiol (Thiophenol)
- 1261 - Benzidine ([1,1-Biphenyl]-4,4 diamine)
- 1262 - Benzo(b)fluoranthene (2,3-Benzofluoranthene)
- 1263 - Benzo(j)fluoranthene (7,8-Benzofluoranthene)
- 1264 - Benzo(a)pyrene (3,4-Benzopyrene)
- 1265 - p-Benzoquinone (1,4-Cyclohexadienedione)
- 1266 - Benzotrichloride (Benzene, Trichloromethyl)
- 1267 - Benzyl chloride (Benzene, (chloromethyl)-)
- 1268 - Beryllium and compounds, N.O.S. <sup>3</sup>
- 1269 - Bis(2-chloroethoxy)methane (Ethane,1,1-(methylenebis(oxy))bis[2-chloro-])
- 1270 - Bis(2-chloroethyl) ether (Ethane, 1,1-oxybis (2-chloro-))
- 1271 - N,N-Bis(2-chloroethyl)-2-naphthylamine (Chlornaphazine)
- 1272 - Bis(2-Chloroisopropyl) ether (Propane, 2,2-oxybis[2-chloro-])

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- 1273 - Bis(chloromethyl) ether (methane,oxybis[chloro-])
- 1274 - Bis(2-ethylhexyl) phthalate (1,2-Benzenedicarboxylic acid, bis(2-ethylhexyl) ester)
- 1275 - Bromoacetone (2-Propanone, 1-bromo-)
- 1276 - Bromomethane (Methyl bromide)
- 1277 - 4-Bromophenyl phenyl ether (Benzene, 1-bromo-4-phenoxy-)
- 1278 - Brucine (Strychnidin-10-one, 2,3-dimethoxy-)
- 1279 - 2-Butanone peroxide (Methyl ethyl ketone,peroxide)
- 1280 - Butyl benzyl phthalate (1,2-Benzenedicarboxylic acid, butylphenylmethyl ester)
- 1281 - 2-sec-Butyl-4,6-dinitrophenol (DNBP) (Phenol,2,4-dinitro-6-(1-methylpropyl)-)
- 1282 - Cadmium and compounds, N.O.S. <sup>3</sup>
- 1283 - Calcium chromate (Chromic acid, calcium salt)
- 1284 - Calcium cyanide
- 1285 - Carbon disulfide (Carbon bisulfide)
- 1286 - Carbon oxyfluoride (Carbonyl fluoride)
- 1287 - Chloral (Acetaldehyde, trichloro-)
- 1288 - Chlorambucil (Butanoic acid, 4-(bis(2-chloroethyl)amino)benzene-)
- 1289 - Chlordane (alpha and gamma isomers)4,7-Methanoindan, 1,2,4,5,6,7,8,8-octachloro-3,4,7,7a-  
1290 tetrahydro-) (alpha and gamma isomers)
- 1291 - Chlorinated benzenes, N.O.S. <sup>3</sup>
- 1292 - Chlorinated ethane, N.O.S. <sup>3</sup>
- 1293 - Chlorinated fluorocarbons, N.O.S. <sup>3</sup>
- 1294 - Chlorinated naphthalene, N.O.S. <sup>3</sup>
- 1295 - Chlorinated phenol, N.O.S. <sup>3</sup>
- 1296 - Chloroacetaldehyde (Acetaldehyde, chloro-)
- 1297 - Chloroalkyl ethers N.O.S. <sup>3</sup>
- 1298 - p-Chloroaniline (Benzenamine, 4-chloro-)
- 1299 - Chlorobenzene (Benzene, chloro-)
- 1300 - Chlorobenzilate (Benzeneacetic acid, 4-chloro-alpha-(4-chlorophenyl)-alpha-hydroxy-,ethyl ester)

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- 1301 - p-Chloro-m-cresol (Phenol, 4-chloro-3-methyl)
- 1302 - 1-Chloro-2,3-epoxypropane (Oxirane, 2-(chloromethyl)-)
- 1303 - 2-Chloroethyl vinyl ether (Ethene, (2-chloroethoxy)-)
- 1304 - Chloroform (Methane, trichloro-)
- 1305 - Chloromethane (Methyl chloride)
- 1306 - Chloromethyl methyl ether (Methane, chloromethoxy-)
- 1307 - 2-Chloronaphthalene (Naphthalene, betachloro-)
- 1308 - 2-Chlorophenol (Phenol, o-chloro-)
- 1309 - 1-(o-Chlorophenyl) thiourea (Thiourea, (2-chlorophenyl)-)
- 1310 - 3-Chloropropionitrile (Propanenitrile, 3-chloro-)
- 1311 - Chromium and compounds, N.O.S. <sup>3</sup>
- 1312 - Chrysene (1,2-Benzphenanthrene)
- 1313 - Citrus red No. 2 (2-Naphthol, 1-((2,5-dimethoxyphenyl)azo)-)
- 1314 - Coal tars
- 1315 - Copper cyanide
- 1316 - Creosote (Creosote, wood)
- 1317 - Cresols (Cresylic acid) (Phenol, methyl-)
- 1318 - Crotonaldehyde (2-Butenal)
- 1319 - Cyanides (soluble salts and complexes), N.O.S. <sup>3</sup>
- 1320 - Cyanogen (Ethanedinitrile)
- 1321 - Cyanogen bromide (Bromine cyanide)
- 1322 - Cyanogen chloride (Chlorine cyanide)
- 1323 - Cycasin (beta-D-Glucopyranoside, (methyl-ONN-azoxy)methyl-)
- 1324 - 2-Cyclohexyl-4,6-dinitrophenol (phenol, 2-cyclohexyl-4,6-dinitro-)
- 1325 - Cyclophosphamide (2H-1,3,2-Oxazaphosphorine (bis(2-chloroethyl)amino)-tetrahydro-, 2-oxide)
- 1326 - Daunomycin (5,12-Naphthacenedione, (8S-cis)-8-acetyl-10-((3-amino-2,3,6-trideoxy)-alpha-L-lyxo-hexopyranosyl)oxy)7,8,9,10-tetrahydro-6,8,11-trihydroxy-1-methoxy-)
- 1327
- 1328 - DDD (Dichlorodiphenyldichloroethane)(Ethane, 1,1-dichloro-2,2-bis(p-chlorophenyl)-)

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- 1329 - DDE (Ethylene, 1,1-dichloro-2,2-bis(4-chlorophenyl)-)
- 1330 - DDT (Dichlorodiphenyltrichloroethane) (Ethane, 1,1,1-trichloro-2,2-bis (p-chlorophenyl)-)
- 1331 - Diallylate (S-(2,3-dichloroallyl)diisopropylthiocarbamate)
- 1332 - Dibenz(a,h)acridine(1,2,5,6-Dibenzacridine)
- 1333 - Dibenz(a,j)acridine(1,2,7,8-Dibenzacridine)
- 1334 - Dibenz(a,h)anthracene (1,2,5,6-Dibenzanthracene)
- 1335 - 7H-Dibenzo(c,g)carbazole (3,4,5,6-Dibenzcarbazole)
- 1336 - Dibenzo(a,e)pyrene(1,2,4,5-Dibenzpyrene)
- 1337 - Dibenzo(a,h)pyrene(1,2,5,6-Dibenzpyrene)
- 1338 - Dibenzo(a,i)pyrene(1,2,7,8-Dibenzpyrene)
- 1339 - 1,2-Dibromo-3-chloropropane (Propane, 1,2-dibromo-3-chloro-)
- 1340 - 1,2 Dibromoethane (Ethylene dibromide)
- 1341 - Dibromomethane (Methylene bromide)
- 1342 - Di-n-butyl phthalate (1,2-Benzenedicarboxylic acid, dibutyl ester)
- 1343 - o-Dichlorobenzene (Benzene, 1,2-dichloro-)
- 1344 - m-Dichlorobenzene (Benzene, 1,3-dichloro-)
- 1345 - p-Dichlorobenzene (Benzene, 1,4-dichloro-)
- 1346 - Dichlorobenzene, N.O.S. <sup>3</sup> (Benzene, dichloro-N.O.S. <sup>3</sup> )
- 1347 - 3,3-Dichlorobenzidine ([1,1, Biphenyl]-4,4-diamine, 3,3-dichloro-)
- 1348 - 1,4-Dichloro-2-butene (2-Butene, 1,4-dichloro-)
- 1349 - Dichlorodifluoromethane (Methane, dichlorodifluoro-)
- 1350 - 1,1 Dichloroethane (Ethylidene dichloride)
- 1351 - 1,2 Dichloroethane (Ethylene dichloride)
- 1352 - trans-1,2-Dichloroethene (1,2-Dichloroethylene)
- 1353 - Dichloroethylene, N.O.S. <sup>3</sup> (Ethene, dichloro-N.O.S. <sup>3</sup> )
- 1354 - 1,1-Dichloroethylene (Ethene, 1,1-dichloro-)
- 1355 - Dichloromethane (Methylene chloride)
- 1356 - 2,4-Dichlorophenol (Phenol, 2,4-dichloro-)

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- 1357 - 2,6-Dichlorophenol (Phenol, 2,6-dichloro-)
- 1358 - 2,4-Dichlorophenoxyacetic acid (2,4-D), salts and esters (Acetic acid, 2,4-dichlorophenoxy-, salts and esters)
- 1359
- 1360 - Dichlorophenylarsine (Phenyl dichloroarsine)
- 1361 - Dichloropropane, N.O.S. <sup>3</sup> (Propane, dichloro-N.O.S. <sup>3</sup>)
- 1362 - 1,2-Dichloropropane (Propylene dichloride)
- 1363 - Dichloropropanol, N.O.S. <sup>3</sup> (Propanol, dichloro-N.O.S. <sup>3</sup>)
- 1364 - Dichloropropene, N.O.S. <sup>3</sup> (Propene, dichloro-N.O.S. <sup>3</sup>)
- 1365 - 1,3-Dichloropropene (1-Propene, 1,3-dichloro-)
- 1366 - 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)
- 1367
- 1368 - 1,2:3,4-Diepoxybutane (2,2,-Bioxirane)
- 1369 - Diethylarsine (Arsine, diethyl-)
- 1370 - N,N-Diethylhydrazine (Hydrazine, 1,2-diethyl)
- 1371 - O,O-Diethyl S-methyl ester of phosphorodithioic acid (Phosphorodithioic acid, O,O-diethyl S-methyl ester)
- 1372
- 1373 - O,O-Diethylphosphoric acid, O-p-nitrophenyl ester (Phosphoric acid, diethyl p-nitrophenyl ester)
- 1374 - Diethyl phthalate (1,2-Benzenedicarboxylic acid, diethyl ester)
- 1375 - O,O-Diethyl O-2-pyrazinyl phosphorothioate (Phosphorothioic acid, O,O-diethyl O-pyrazinyl ester)
- 1376 - Diethylstilbesterol (4,4-Stilbenediol, alpha, alpha-diethyl, bis(dihydrogen phosphate, (E)-)
- 1377 - Dihydrosafrole (Benzene, 1,2-methylenedioxy-4-propyl-)
- 1378 - 3,4-Dihydroxy-alpha-(methylamino)methylbenzyl alcohol (1,2-Benzenediol, 4-(1-hydroxy-2-(methylamino)ethyl))
- 1379
- 1380 - Dilsopropylfluorophosphate (DFP) (Phosphorofluoridic acid, bis(1-methylethyl) ester)
- 1381 - Dimethoate (Phosphorodithioic acid, O,O-dimethyl S-(2-(methylamino)-2-oxoethyl) ester)
- 1382 - 3,3,-Dimethoxybenzidine ((1,1,-Biphenyl)-4,4,-diamine, 3-3,-dimethoxy-)
- 1383 - p-Dimethylaminoazobenzene (Benzenamine, N,N-dimethyl-4-(phenylazo)-)
- 1384 - 7,12-Dimethylbenz(a)anthracene(1,2-Benzathracene, 7,12-dimethyl-)
- 1385 - 3,3-Dimethylbenzidine (1,1-Biphenyl)-4,4,diamine, 3,3-dimethyl-)
- 1386 - Dimethylcarbamoyl chloride (Carbamoyl chloride, dimethyl)

## RQ

- 1387 - 1,1 Dimethylhydrazine (Hydrazine, 1,1-dimethyl-)
- 1388 - 1,2-Dimethylhydrazine (Hydrazine, 1,2-dimethyl-)
- 1389 - 3,3-Dimethyl-1-(methylthio)-2-butanone, O-[(methylamino) carbonyl] oxime (Thiofanox)
- 1390 - alpha,alpha-Dimethylphenethylamine (Ethanamine, 1,1-dimethyl-2-phenyl-)
- 1391 - 2,4-Dimethylphenol (Phenol, 2,4-dimethyl-)
- 1392 - Dimethyl phthalate (1,2-Benzenedicarboxylic acid, dimethyl ester)
- 1393 - Dimethyl sulfate (Sulfuric acid, dimethyl ester)
- 1394 - Dinitrobenzene, N.O.S. <sup>3</sup> (Benzene, dinitro-N.O.S. <sup>3</sup> )
- 1395 - 4,6-Dinitro-o-cresol and salts (Phenol, 2,4-dinitro-6-methyl-, and salts)
- 1396 - 2,4-Dinitrophenol (Phenol, 2,4-dinitro-)
- 1397 - 2,4-Dinitrotoluene (Benzene, 1-methyl-2,4-dinitro-)
- 1398 - 2,6-Dinitrotoluene (Benzene, 1-methyl 2,6-dinitro-)
- 1399 - Di-n-octyl phthalate (1,2-Benzenedicarboxylic acid, dioctyl ester)
- 1400 - 1,4-Dioxane (1,4-Diethylene oxide)
- 1401 - Diphenylamine (Benzenamine, N-phenyl-)
- 1402 - 1,2-Diphenylhydrazine (Hydrazine, 1,2-diphenyl-)
- 1403 - Di-n-propylnitrosamine (N-Nitroso-di-n-propylamine)
- 1404 - Disulfoton (O,O-diethyl S-(2-(ethylthio)ethyl) phosphorodithioate)
- 1405 - 2,4-Dithiobiuret (Thiomidodicarbonic diamide)
- 1406 - Endosulfan (5-Norbomene, 2,3-dimethanol,1,4,5,6,7,7-hexachloro-cyclic sulfite)
- 1407 - Endrin and metabolites (1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-endo,  
1408 endo-1,4,5,8-dimethanonaphthalene, and metabolites)
- 1409 - Ethyl carbamate (Urethan) (Carbamic acid, ethyl ester)
- 1410 - Ethyl cyanide (Propanenitrile)
- 1411 - Ethylenebisdithiocarbamic acid, salts, and esters (1,2-Ethanediy-biscarbamodithioic acid, salts  
1412 and esters)
- 1413 - Ethyleneimine (Aziridine)
- 1414 - Ethylene oxide (Oxirane)
- 1415 - Ethylenethiourea (2-Imidazolidinethione)

## RQ

- 1416 - Ethyl methacrylate (2-Propenoic acid, 2-methyl-, ethyl ester)
- 1417 - Ethyl methanesulfonate (Methanesulfonic acid, ethyl ester)
- 1418 - Fluoranthene (Benzo[j,k]fluorene)
- 1419 - Fluorine
- 1420 - 2-Fluoroacetamide (Acetamide, 2-fluoro-)
- 1421 - Fluoroacetic acid, sodium salt (Acetic acid, fluoro-sodium salt)
- 1422 - Formaldehyde (Methylene oxide)
- 1423 - Formic acid (Methanoic acid)
- 1424 - Glycidylaldehyde (1-Propanol-2,3 epoxy)
- 1425 - Halomethane, N.O.S. <sup>3</sup>
- 1426 - Heptachlor (4,7-Methano-1H-indene.1,4,5,6,7,8,8-heptachloro-3a,4,7,7a-tetrahydro-)
- 1427 - Heptachlor epoxide (alpha, beta, and gamma isomers) (4,7-Methano-1H-indene, 1,4,5,6,7,8,8-  
1428 heptachloro-2,3-epoxy-3a,4,7,7-tetrahydro-,alpha, beta, and gamma isomers)
- 1429 - Hexachlorobenzene (Benzene, hexachloro-)
- 1430 - Hexachlorobutadiene (1,3-Butadiene, 1,1,2,3,4,4-hexachloro-)
- 1431 - Hexachlorocyclohexane (all isomers) (Lindane and isomers)
- 1432 - Hexachlorocyclopentadiene (1,3-Cyclopentadiene, 1,2,3,4,5,5-hexachloro-)
- 1433 - Hexachloroethane (Ethane, 1,1,1,2,2,2-hexachloro-)
- 1434 - 1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a-hexahydro-1,4,5,8-endo,endo-dimethanonaphthalene  
1435 (Hexachlorohexa-hydro-endo,endo-dimethanonaphthalene)
- 1436 - Hexachlorophene (2,2,-Methylenebis(3,4,6-trichlorophenol)
- 1437 - Hexachloropropene (1-Propene, 1,1,2,3,3,3-hexachloro-)
- 1438 - Hexaethyl tetraphosphate (Tetraphosphoric acid, hexaethyl ester)
- 1439 - Hydrazine (Diamine)
- 1440 - Hydrocyanic acid (Hydrogen cyanide)
- 1441 - Hydrofluoric acid (Hydrogen fluoride)
- 1442 - Hydrogen sulfide (Sulfur hydride)
- 1443 - Hydroxydimethylarsine oxide (Cacodylic acid)
- 1444 - Indeno (1,2,3-cd)pyrene(1,10-(1,2-phenylene)pyrene)

## RQ

- 1445 - Iodomethane (Methyl iodide)
- 1446 - Iron dextran (Ferric dextran)
- 1447 - Isocyanic acid, methyl ester (Methyl isocyanate)
- 1448 - Isobutyl alcohol (1-Propanol, 2-methyl-)
- 1449 - Isosafrole (Benzene, 1,2-methylenedioxy-4-allyl-)
- 1450 - Kepone (decachlorooctahydro-1,3,4-Methano-2H-cyclobuta[cd]pentalen-2-one)
- 1451 - 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)
- 1452
- 1453 - Lead and compounds, N.O.S. <sup>3</sup>
- 1454 - Lead acetate (Acetic acid, lead salt)
- 1455 - Lead phosphate (Phosphoric acid, lead salt)
- 1456 - Lead subacetate (Lead, bis(acetato-O)tetrahydroxytri-)
- 1457 - Maleic anhydride (2,5-Furandione)
- 1458 - Maleic hydrazide (1,2-Dihydro-3,6-pyridazinedione)
- 1459 - Malononitrile (Propanedinitrile)
- 1460 - Melphalan (Alanine, 3-(p-bis(2-chloroethyl)amino)phenyl-L)- Mercury fulminate (Fulminic acid, mercury salt)
- 1461
- 1462 - Mercury and compounds, N.O.S. <sup>3</sup>
- 1463 - Methacrylonitrile (2-Propenenitrile,2-methyl-)
- 1464 - Methanethiol (Thiomethanol)
- 1465 - Methapyrilene (Pyridine, 2-[(2-dimethylamino)ethyl]-2-thenylamino-)
- 1466 - Metholmyl (Acetimidic acid, N-[(methylcarbamoyl)oxy] thio-,methyl ester)
- 1467 - Methoxychlor (Ethane, 1,1,1-trichloro-2,2,-bis(p-methoxyphenyl)-)
- 1468 - 2-Methylaziridine (1,2-Propylenimine)
- 1469 - 3-Methylcholanthrene (Benz[*jj*]aceanthrylene,1,2-dihydro-3-methyl-)
- 1470 - Methyl chlorcarbonate (Carbonochloridicacid, methyl ester)
- 1471 - 4,4-Methylenebis (2-chloroaniline) Benzenamine, 4,4-methylenebis-(2-chloro-)
- 1472 - Methyl ethyl ketone (MEK) (2-Butanone)
- 1473 - Methyl hydrazine (Hydrazine methyl-)

## RQ

- 1474 - 2-Methylacetonitrile (Propanenitrile 2-hydroxy-2-methyl-)
- 1475 - Methyl methacrylate (2-Propenoic acid, 2-methyl-, methyl ester)
- 1476 - Methyl methanesulfonate Methanesulfonicacid, methyl ester)
- 1477 - 2-Methyl-2-(methylthio)propionaldehyde-o-(methylcarbonyl) oxime (Propanal,2-methyl-  
1478 2(methylthio-0-[(methylamino)carbonyl]oxime)
- 1479 - N-Methyl-N,-nitro-N-nitrosoguanidine (Guanidine, N-nitroso-N-methyl-N,-nitro-)
- 1480 - Methyl parathion (0,0-dimethyl 0-(40 nitrophenyl) phosphorothioate)
- 1481 - Methylthiouracil (4-IH-Pyrimidinone, 2,3-dihydro-6-methyl-2-thioxo-)
- 1482 - Molybdenum and compounds, N.O.S. <sup>3</sup>
- 1483 - Mustard gas (Sulfide, bis(2-chloroethyl)-)
- 1484 - Naphthalene
- 1485 - 1,4-Naphthoquinone (1,4-Naphthalenedione)
- 1486 - 1-Naphthylamine (alpha-Naphthylamine)
- 1487 - 2-Naphthylamine (beta-Naphthylamine)
- 1488 - 1-Naphthyl-2-thiourea (Thiourea, 1-naphthalenyl-)
- 1489 - Nickel and compounds, N.O.S. <sup>3</sup>
- 1490 - Nickel carbonyl (Nickel tetracarbonyl)
- 1491 - Nickel cyanide (Nickel (II) cyanide)
- 1492 - Nicotine and salts (Pyridine, (S)-3-(1-methyl-2-pyrrolidinyl)-, and salts)
- 1493 - Nitric oxide (Nitrogen (II) oxide)
- 1494 - p-Nitroaniline (Benzenamine, 4-nitro-)
- 1495 - Nitrobenzene (Benzene, nitro-)
- 1496 - Nitrogen dioxide (Nitrogen (IV) oxide)
- 1497 - Nitrogen mustard and hydrochloride salt (Ethanamine, 2-chloro-,N-(2-chloroethyl)-N-methyl-, and  
1498 hydrochloride salt)
- 1499 - Nitrogen mustard N-Oxide and hydrochloride salt (Ethanamine, 2-chloro-,N-(2-chloroethyl)-N-  
1500 methyl-and hydrochloride salt)
- 1501 - Nitroglycerine (1,2,3-Propanetriol, trinitrate)
- 1502 - 4-Nitrophenol (Phenol, 4-nitro)

## RQ

- 1503 - 4-Nitroquinoline-1-oxide (Quinoline,4-nitro-1-oxide-)
- 1504 - Nitrosamine, N.O.S. <sup>3</sup>
- 1505 - N-Nitrosodi-n-butylamine (1-Butanamine,N-butyl-N-nitroso-)
- 1506 - N-Nitrosodiethanolamine (Ethanol, 2,2-(nitrosoimino)bis-)
- 1507 - N-Nitrosodiethylamine (Ethanamine, N-ethyl-N-nitroso-)
- 1508 - N-Nitrosodimethylamine (Dimethylnitrosamine)
- 1509 - N-Nitroso-N-ethylurea (Carbamide, N-ethyl-N-nitroso-)
- 1510 - N-Nitrosomethylethylamine (Ethanamine, N-methyl-N-nitroso-)
- 1511 - N-Nitroso-N-methylurea (Carbamide, N-methyl-N-nitroso-)
- 1512 - N-Nitroso-N-methylurethane (Carbamic acid, methylnitroso-, ethyl ester)
- 1513 - N-Nitrosomethylvinylamine (Ethenamine,N-methyl-N-nitroso-)
- 1514 - N-Nitrosomorpholine (Morpholine,-N-nitroso-)
- 1515 - N-Nitrosomonicotine (Nornicotine,-N-nitroso-)
- 1516 - N-Nitrosopiperidine (Pyridine, hexahydro-,N-nitroso-)
- 1517 - Nitrosopyrrolidine (Pyrrole, tetrahydro-N-nitroso-)
- 1518 - N-Nitrososarcosine (Sarcosine,-N-nitroso-)
- 1519 - 5-Nitro-o-toluidine (Benzenamine, 2-methyl-5-nitro-)
- 1520 - Octamethylpyrophosphoramidate (Diphosphoramidate, octamethyl-)
- 1521 - Osmium tetroxide (Osmium(VIII)oxide)
- 1522 - 7-Oxabicyclo(2,2,1)heptane-2,3-dicarboxylic acid (Endothal)
- 1523 - Paraldehyde (1,3,5-Trioxane, 2,4,6-trimethyl-)
- 1524 - Parathion (Phosphorothioic acid O,O-diethylO-(p-nitrophenyl) ester)
- 1525 - Pentachlorobenzene (Benzene, pentachloro-)
- 1526 - Pentachloroethane (Ethane, pentachloro-)
- 1527 - Pentachloronitrobenzene (PCNB) (Benzene, Pentachloronitro-)
- 1528 - Pentachlorophenol (Phenol, pentachloro-)
- 1529 - Phenacetin (Acetamide, N-(4-ethoxyphenyl)-)
- 1530 - Phenol (Benzene, hydroxy-)

## RQ

- 1531 - Phenylenediamine (Benzenediamine)
- 1532 - Phenylmercury acetate (Mercury acetatophenyl-)
- 1533 - N-Phenylthiourea (Thiourea, phenyl-)
- 1534 - Phosgene (Carbonyl chloride)
- 1535 - Phosphine (Hydrogen phosphide)
- 1536 - Phosphorodithioic acid, O,O-diethyl S-[(ethylthio)methyl]ester (Phorate)
- 1537 - Phosphorothioic acid, O,O-dimethyl O-(p-[(dimethylamino)sulfonyl]phenyl)ester (Famphur)
- 1538 - Phthalic acid esters, N.O.S. <sup>3</sup> (Benzene, 1,2-dicarboxylic acid, esters, N.O.S. <sup>3</sup> )
- 1539 - Phthalic anhydride (1,2-Benzenedicarboxylic acid anhydride)
- 1540 - 2-Picoline (Pyridine, 2-methyl-)
- 1541 - Polychlorinated biphenyl, N.O.S. <sup>3</sup>
- 1542 - Potassium cyanide
- 1543 - Potassium silver cyanide (Argentate(1-),dicyano-,potassium)
- 1544 - Pronamide (3,5-Dichloro-N-(1,1-dimethyl-2-propynyl)benzamide)
- 1545 - 1,3 Propane sultone (1,2-Oxathiolane, 2,2-dioxide)
- 1546 - n-Propylamine (1-Propanamine)
- 1547 - Propylthiouracil (Undecamethylenediamine,N,N-bis(2-chlorobenzyl-),dihydrochloride)
- 1548 - 2-Propyn-1-ol (Propargyl alcohol)
- 1549 - Pyridine
- 1550 - Radium-226 and -228
- 1551 - Reserpine (Yohimban-16-carboxylic acid,11,17-dimethoxy-18-[3,4,5-trimethoxybenzoyl]oxy)-  
1552 methyl ester)
- 1553 - Resorcinol (1,3-Benzenediol)
- 1554 - Saccharin and salts (1,2-Benzisothiazolin-3-one, 1,1-dioxide, and salts)
- 1555 - Safrele (Benzene, 1,2-methylenedioxy-4-allyl-)
- 1556 - Selenious acid (Selenium dioxide)
- 1557 - Selenium and compounds, N.O.S. <sup>3</sup>
- 1558 - Selenium sulfide (Sulfur selenide)

## RQ

- 1559 - Selenourea (Carbamimidoseleoic acid)
- 1560 - Silver and compounds, N.O.S. <sup>3</sup>
- 1561 - Silver cyanide
- 1562 - Sodium cyanide
- 1563 - Streptozotocin (D-Glucopyranose, 2-deoxy-2-(3-methyl-3-nitrosoureido)-)
- 1564 - Strontium sulfide
- 1565 - Strychnine and salts (Strychnidin-10-one, and salts)
- 1566 - 1,2,4,5-Tetrachlorobenzene (Benzene,1,2,4,5-tetrachloro-)
- 1567 - 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) (Dibenzo-p-dioxin, 2,3,7,8-tetrachloro-)
- 1568 - Tetrachloroethane, N.O.S. <sup>3</sup> (Ethane, tetrachloro-N.O.S. <sup>3</sup>)
- 1569 - 1,1,1,2-Tetrachlorethane (Ethane, 1,1,1,2-tetrachloro-)
- 1570 - 1,1,2,2-Tetrachlorethane (Ethane 1,1,2,2-tetrachloro-)
- 1571 - Tetrachlorethane (Ethene, 1,1,2,2-tetrachloro-)
- 1572 - Tetrachloromethane (Carbon tetrachloride)
- 1573 - 2,3,4,6-Tetrachlorophenol (Phenol 2,3,4,6-tetrachloro-)
- 1574 - Tetraethyldithiopyrophosphate (Dithiopyrophosphoric acid, tetraethyl-ester)
- 1575 - Tetraethyl lead (Plumbane, tetraethyl-)
- 1576 - Tetraethylpyrophosphate (Pyrophosphoricacide, tetraethyl ester)
- 1577 - Tetranitromethane (Methane, tetranitro-)
- 1578 - Thallium and compounds, N.O.S. <sup>3</sup>
- 1579 - Thallic oxide (Thallium (III) oxide)
- 1580 - Thallium (I) acetate (Acetic acid, thallium (I) salt)
- 1581 - Thallium (I) carbonate (Carbonic acid dithallium (I) salt)
- 1582 - Thallium (I) chloride
- 1583 - Thallium (I) nitrate (Nitric acid, thallium (I) salt)
- 1584 - Thallium selenite
- 1585 - Thallium (I) sulfate (Sulfuric acid, thallium (I) salt)
- 1586 - Thioacetamide (Ethanethioamide)

## RQ

- 1587 - Thiosemicarbazide (Hydrazinecarbothioamide)
- 1588 - Thiourea (Carbamide thio-)
- 1589 - Thiuram (Bis(dimethylthiocarbamoyl) disulfide)
- 1590 - Thorium and compounds, N.O.S. <sup>3</sup> when producing thorium byproduct material
- 1591 - Toluene (Benzene, methyl-)
- 1592 - Toluenediamine (Diaminotoluene)
- 1593 - o-Toluidine hydrochloride (Benzenamine, 2-methyl-,hydrochloride)
- 1594 - Toluene diisocyanate (Benzene, 1,3-diisocyanatomethyl-)
- 1595 - Toxaphene (Camphene, octachloro-)
- 1596 - Tribromomethane (Bromoform)
- 1597 - 1,2,4-Trichlorobenzene (Benzene, 1,2,4-trichloro-)
- 1598 - 1,1,1-Trichloroethane (Methyl chloroform)
- 1599 - 1,1,2-Trichloroethane (Ethane, 1,1,2-trichloro-)
- 1600 - Trichloroethene (Trichloroethylene)
- 1601 - Trichloromethanethiol (Methanethiol, trichloro-)
- 1602 - Trichloromonofluoromethane (Methane, trichlorofluoro-)
- 1603 - 2,4,5-Trichlorophenol (Phenol, 2,4,5-trichloro-)
- 1604 - 2,4,6-Trichlorophenol (Phenol, 2,4,6-trichloro-)
- 1605 - 2,4,5-Trichlorophenoxyacetic acid (2,4,5-T) (Acetic acid, 2,4,5-trichlorophenoxy-)
- 1606 - 2,4,5-Trichlorophenoxypropionic acid (2,4,5-TP) (Silvex) (Propionic acid, 2-(2,4,5-  
1607 trichlorophenoxy)-)
- 1608 - Trichloropropane, N.O.S. <sup>3</sup> (Propane, trichloro-, N.O.S. <sup>3</sup> )
- 1609 - 1,2,3-Trichloropropane (Propane, 1,2,3-trichloro-)
- 1610 - O,O,O-Triethyl phosphorothioate (Phosphorothioic acid, O,O,O-triethyl ester)
- 1611 - sym-Trinitrobenzene (Benzene, 1,3,5-trinitro-)
- 1612 - Tris(1-aziridinyl) phosphine sulfide (Phosphine sulfide, tris(1-aziridinyl-)
- 1613 - Tris(2,3-dibromopropyl) phosphate (1-Propanol, 2,3-dibromo-, phosphate)
- 1614 - Trypan blue (2,7-Naphthalenedisulfonic acid, 3,3,-((3,3,-dimethyl (1,1,-biphenyl)-  
1615 4,4,diyl)bis(azo))bis(5-amino-4-hydroxy-tetrasodium salt)

RQ

1616 - Uracil mustard (Uracil-5-[bis(2-chloroethyl)amino]-)

1617 - Uranium and compounds, N.O.S. <sup>3</sup>

1618 - Vanadic acid, ammonium salt (ammonium vanadate)

1619 - Vanadium pentoxide (Vanadium (V) oxide)

1620 - Vinyl chloride (Ethene, chloro-)

1621 - Zinc cyanide

1622 - Zinc phosphide

1623 <sup>3</sup> The abbreviation N.O.S. (not otherwise specified) signifies those members of the general class not specifically listed by  
1624 name in this list.