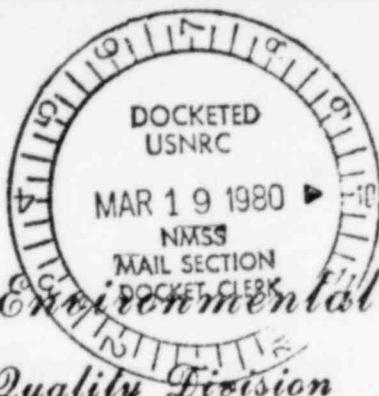


PDR



THE STATE OF WYOMING



Department of Environmental Quality  
Water Quality Division

HATHAWAY BUILDING

CHEYENNE, WYOMING 82002

TELEPHONE 307 777-7781

M E M O R A N D U M

40-8745

TO: Files  
FROM: A. J. Mancini *Water Quality (WQD)*  
DATE: January 29, 1980  
SUBJECT: Bison Basin Project In-Situ Uranium Mine, Ogle Petroleum Inc,

The supportive information document indicates that the influence of geologic faults is expected to be minimal, but no information is provided to substantiate this belief. In fact, the information that is provided indicates that faults are not barriers to the movement of fluid in the subsurface (Fig's. 9-46 and 8-2).

If faults are not barriers, it will be extremely difficult to control the movement of lixiviant in the subsurface. This aspect of the proposed operation has not been investigated and evaluated, based on information which has been provided, in sufficient detail to indicate that a commercial operation in the northern and other parts of the project area can be controlled. Additional information should be requested and submitted concerning geology and hydrology in the vicinity of faults which cut the orebody. Information which has already been provided should be corrected for consistency (i.e., the faults on Fig. 8-1 should correspond with faults shown on Fig. 8-2 and vice versa).

The possibility of movement along faults (earthquakes), resulting from "lubrication" by injected fluids, should be evaluated, and the results reported in the application. Perhaps this should be covered under a new section, "Seismic Hazards".

The discharge (injection) operation is not described. Will injection be by gravity or induced pressure? What is the basis for placing monitor wells 400 feet from the orebody and 600 feet from each other? Without reasons, the monitor well spacing appears too arbitrary and ineffectual.

An additional number of shallow monitor wells may be required, in the vicinity of fault traces across the orebody. The possible influence of faults on the proposed operation has not been reported in the application.

Section 14 is Appendix "D-11", Baseline Water Quality. It is stated that baseline monitoring was conducted in June of 1977 and in late 1978. Data apparently were collected from 4 holes, 3 of which were in very close proximity to each other on the edge of the demonstration test well field area, and the fourth in the approximate center of the northwest-southeast trending orebody. A total of six samples were collected from these four holes.

8004020064

FEE EXEMPT

15783.  
Add'l info

Baseline quality was also collected from the "D" sand aquifer, from ten additional wells in the Demonstration Area; five of these wells were monitor wells. The data are reported in "groups" and not for individual wells and samples. Data were also collected from one well for a shallow aquifer in the Demonstration Area.

Table 14-5 gives baseline concentrations for wells of Tables "2.10-1", "2.10-2" and "2.10-3". The identities and locations of these wells are uncertain.

Baseline water quality data are very important, but the data of this application cannot be adequately interpreted. The locations of all sampling points should be identified, and each value should be reported.

Section 17 implies that groundwater in the uranium host unit outside the orebody is unsuitable for drinking water, everywhere in the project area. This observation cannot be verified with the information provided in the subject document.

The groundwater restoration program will be based on an evaluation of all data once it has been submitted as part of the supporting documentation.

Ogle Petroleum

1/30/80

All analyses indicate high TDS, high Sulfate, and high radium. Not certain that locations of baseline sampling points are adequate for analysis and classification, because they don't know locations of wells of Table 14-5. Need data for groundwater away from ore bodies.

Excepting for radium, water would be suitable for livestock use in vicinity of sample points (discounting pH). Need enough data to be able to tell where variations in control parameters (such as radium) occur.

(Ammonia is also slightly high, for domestic water).

MEMORANDUM



TO: Ogle Petroleum, TFN 1 1/149, Commercial Uranium In Situ, Fremont County, District III

FROM: Frank Putman, Hydrologist *FP* *Land Quality (LQD)*

DATE: February 8, 1980

SUBJECT: First Hydrologic Review

I. Summary:

The application is incomplete in many aspects of hydrology. These deficiencies are detailed below. A great deal of the comments may be addressed by supplementing the application with data that Ogle probably has, however, some additional drilling, testing, and sampling will be required. Ogle has not permitted an application with DEQ recently and this may have led to many of the incomplete items addressed below.

Most of the data submitted by Ogle applies to Mining Unit 1 and Ogle may want to apply the comments below to that unit initially and to address problems in other areas of the permit area at a later date. This may be acceptable, provided Ogle can demonstrate that mining in Unit 1 will not affect the other mining units.

II. Appendix D-5. TOPOGRAPHY AND GEOLOGY. Section 8, pages 31-48, Figures 8.1 - 8.13.

- A. Figures 8.1 and 8.2 should agree on the location of faults. For example, Figure 8.1 shows drill hole OP45 to the south of a fault in Section 25, while Figure 8.2 shows hole OP45 to the north of the fault. In addition, Figure 8.2 shows two faults between holes OP45 and OP93, while Figure 8.1 shows only one hole.
- B. Figure 8.2 should indicate the vertical and horizontal displacement of all faults. The holes used to define the faults between drill holes OP45 and OP93 should be shown. In addition, hole CEX105 shown on Figure 8.1 should also be shown on Figure 8.2.
- C. The "A", "B", "C", and "D" units shown on Figures 8.4 through 8.10 should also be shown on Figure 8.2.

- D. Recharge and discharge areas for the aquifers of the Laney member and for other potential aquifers above and below the Laney member should be shown on Figure 8-1.
- E. Clear, legible geophysical logs should be provided for all cross-section drill holes. These logs should have a vertical scale of about 1" = 25'. Figure 8.10, on page 41, shows submitted logs, which are difficult to read.
- F. The hydrologic effects of the faults must be clearly defined by using pump tests. Available data (Figures 9-21 and 9-28, (pages 75 and 82) show apparent leakage. These data cannot be fully analyzed due to the scale of the figures and lack of tabulated drawdown data. This matter is more fully addressed in Part III, HYDROLOGY, of this review.
- G. Does the ore zone outlined on Figure 8.8 show the mineralized sands only or does it show the fully areal extent of the sand? The extent of the non-mineralized sand should be shown to the degree that is known.
- H. Figure 8.13 does not provide convincing information to show that the sands underlying the ore zone sands (D unit) are not in communication through interbedding and fractures. The map shows variable sand channels and layers that may or may not be hydraulically connected. These beds could form a potential aquifer or a means of transporting pollutants over a wide area. A pump test of these sands is suggested, with monitor wells in the ore zone and in the underlying sands at a substantial distance from the pumped well. In addition, some drill holes, particularly in the first area to be mined, may not be deep enough to contact the deeper underlying sands. If these sands prove continuous, hydrologic and geochemical characterization will need to be submitted.
- I. The possibility of movement along fault lines induced by pumping pressure should be addressed as suggested to the memo from the Water Quality Division (paragraph 3).

III. Appendix D-6, HYDROLOGY, pages 49-109.

A. Ground Water Hydrology. Section 9.1, page 49.

1. Local. Section 9.1.2., pages 49-51.

- a. The water table aquifer and the "A", "B", "C", and "D" units shown in the geologic cross-sections should have their areal

extent defined on geologic cross-sections and on plan views. Plan maps should have topographic contours to better show the exact extent of these potential aquifers. The rationale and data used to classify these units as hydrologically important or unimportant should be discussed. Hydrologically important units should be characterized hydraulically and chemically. Data points should be spread throughout the permit area, not in the ore zone area only.

Piezometric levels should be presented for each unit and labelled data points should be shown on a map.

- b. Pump tests should have tabulated values of time, drawdown or recovery, pumping rate, and other information which has a bearing on evaluating the test results. Drawdown graphs should have all parameter values used in the hydraulic equations shown on the graph itself. This especially includes all match point values. Land surface elevation, measuring point elevation, screened intervals, completion formations, date of water level measurement, and well size should be shown for all wells used as data points.

All pump tests which require type curves should be presented on a scale which permits the reviewer to match the presented figure with a commonly available type curve (e.g. Lohman, 1972, USGS Prof. Paper 708) or should be accompanied by the appropriate match curve on the same scale. Methods of analysis should be fully referenced.

- c. A pump test is suggested to determine leakage of the sands underlying the "D" unit (see point II.H., GEOLOGY). An initial test could consist of three piezometers completed in all three underlying sands and a pumping well in the R & D area. The three piezometers should be placed in the northeast, central, and southwest portions of Mining Unit 1 (see Figure 15.7, page 177). Barometric pressure should be monitored before and during the test to eliminate questions on minor water level fluctuations. If these tests do not show that communication between the "D" unit and the underlying sands are minor or absent, it will be necessary to obtain complete hydrologic and chemical data on these sands and to place excursion monitor wells in them. Restoration commitments for these sands may also be necessary.

2. Aquifer Tests 1, 2, 3. (Sections 9.1.3., 4., 5.), pages 51-86.
  - a. The purposes and results of the pressure buildup tests mentioned on page 53 should be discussed.
  - b. The method of evaluating well efficiency using the step-drawdown tests should be referenced and the statements concerning the development of wells OP-95C, OP-136, and OP-133 should be discussed.
  - c. Data for well 303-6-M3 should be presented. This well monitors the "B" unit above the ore zone and is presented as evidence of fluid confinement to the ore zone.

3. Influence of Faults. (Section 9.1.7., page 105).

- a. All faults should be clearly placed on all hydrologic maps and should be defined hydrologically as barriers or recharge areas. Any faults showing that they act as highly transmissive areas should have special well operation procedures designed for them in order to eliminate movement of fluids outside the ore zone. Details of these plans should be presented.
- b. How accurately can the material balance calculations referred to on page 105 be performed and what is the minimum detectable leak that can be found using this technique?

- B. Surface Water Hydrology. (Section 9.2, pages 105-107).

1. Drainage area of W. Alkali Creek above the permit area should be stated, as should basin relief, and average stream slope.
2. Any measures necessary to mitigate the effect of the site facilities on surface drainage in the permit area should be discussed and all ditches, culverts, etc., should be shown on a map. Design calculations should accompany these structures.

- IV. Baseline Water Quality. (Appendix D-11, pages 155-169, Section 14; and pages 140-142, Section 13).

- A. Tabulated data for each analysis for each well should be presented with cation-anion balances. This data should be separated into ore zones and monitor zone wells. Wells with anomalous values (e.g. 303-6-P-31) should receive special treatment. Wells OP-140-TC and

303-6-P-31 were used in the statistical summary for Ra-226 on page 141. These wells plus wells 303-6-P-7, 16, 19, and 22 gave a mean Ra-226 level of 104 pCi/l. If OP-140-TC, and P-31 were not used, the mean Ra-226 level should be 12 pCi/l. Section 13.1.1. on pages 140-141 clearly shows that there are two groups of wells in the R & D area. If restoration to a background of 104 pCi/l were set, it would leave many wells at 5 to 10 times the pre-mining level of Ra-226.

- B. The Th-230 data presented in Section 13.1.2. on page 141 was taken after push-pull tests in these wells. There is no way of knowing if this data is representative of pre-mining conditions until pre-push-pull data is presented.
- C. There is a very heavy concentration of data in the R & D area, and very little data outside this area. Data must be collected for the ore zone throughout the area to be mined, for the monitor zone areas, and for any significant aquifers or water transmitting units which are found in the course of further hydrologic studies.
- D. Manganese levels in well M-3 in the "B" sand appear highly anomalous. These values should be evaluated further (see page 163).
- E. The Water Quality section should be clarified as to exactly which wells are referred to at a specific time and in each table.
- F. Only one complete water quality sample has been collected to date for each surface water monitoring station. Several more samples should be collected at each station to represent the range of values that can be expected.

V. Mine Plan. Section 15, pages 170-192.

A. Restoration. Section 15.3., page 173.

The application states that restoration was achieved on September 14, 1979. It should be noted that, while restoration results look extremely good, the final stability monitoring program will not be complete until March, 1980, and that Land Quality has not yet made a declaration of restoration.

B. Well Field Design and Operation. Section 15.5., pages 175-180.

1. Is the average injection rate of lixiviant to be 6 gpm per pattern or 6 gpm per well?
2. Anticipated well field patterns should be submitted for all Mining Units at this time. These patterns may be changed later with Land Quality Division approval.



3. Ogle proposes to place monitor wells at a distance of 400 feet from the ore zone and that these wells will be 400 to 600 feet apart. Figure 8.13 shows that the ore body is well defined in most places and that monitor well placement 100 feet from the ore body and about 300 feet apart is feasible. This is recommended. At least four water quality samples should be collected from each monitor well and used to define excursion control limits.

At least three monitor wells are recommended for the "B" sand above the ore zone in Mining Unit 1. Other sands may need to be monitored; based on the results of the hydrologic testing.

C. Well Construction. Section 15.6, pages 180-181.

The methods used to check casing for leakage should be detailed. These methods should take operational injection pressures into account. Casing should be checked before the well is put into operation and after operations such as under-reaming that may damage the casing.

D. Process Description. Section 15.7.2, pages 181-189.

1. What chemicals will be stored in the chemical Storage Area shown on Figure 15.10 (page 183)? Have provisions been made to control runoff from this area?
2. Runoff control ditches should be placed around the topsoil and subsoil storage areas shown on Figure 15.10. These ditches should be periodically cleaned.

E. Mill Wastes and Effluents. Section 15.8, pages 189-192.

1. The number, size, location, and exact design plans should be submitted for all evaporation and effluent ponds. The leak detection system should be fully shown for each pond. Is there sufficient capacity in the system to pump water from a leaky pond to the remaining ponds?
2. Specific levels of radioactivity should be set up to determine the method of disposal of contaminated solid wastes.

VI. Environmental Monitoring and Reporting. Section 16, pages 193-202.

A. Ground Water Monitoring. Section 16.1, pages 193-198.

1. Monitor Well Spacing. See IV.B.3. The density of monitor wells (1 per 2 acres of well field) in the overlying and underlying sands is acceptable.
2. Restoration monitoring wells, locations and data for Mining Unit 1 should be approved by DEQ before mining begins. Subsequent Mining Units should have locations and data submitted in advance of mining, perhaps in annual reports.
3. Four rounds of samples for all monitor wells, each with the full Guideline 4 analysis list, are recommended (see page 194). DEQ should approve this data before injection.
4. Specific provisions for notifying DEQ in case of an evaporation pond leak should be included in Section 16.1.3, page 196. Corrective actions should also be discussed.
5. The groundwater restoration sampling program should include a six month stability monitoring program as was done for Ogle's R & D. If final samples do not show a return to baseline, more sampling or restoration effort may be required.
6. Excursions.
  - a. Upper Control Limits set at 20% above the highest parameter value for a well may be too high and may allow more contaminate spread than is necessary. Specific limits are suggested for each well as follows:

|              |  |
|--------------|--|
| Conductivity | $\bar{x} + 2s$ (mean plus 2 standard deviations) |
| pH           | $\bar{x} + 2$ units                              |
| Alkalinity   | $\bar{x} + 2s$                                   |
| Chloride     | $\bar{x} + 2s$                                   |
| Uranium      | $\bar{x} + 1$ mg/l                               |
| Sodium       | $\bar{x} + 2s$                                   |
| Sulfate      | $\bar{x} + 2s$                                   |

Any two UCL exceedances for two successive days constitute an excursion and DEQ should be notified verbally within 24 hours. A written report should follow within 7 days. These notification procedures are the In Situ Regulations approved by the Environmental Quality Council. If baseline is well defined, these criteria give much less than a 1% change of calling a false excursion.

- b. The corrective actions for excursions listed on page 198 should have definite time intervals specified for each. An excursion must be controlled within 60 days of confirmation.

B. Surface Water Monitoring. Section 16.2, pages 198-199.

1. Baseline Water Quality. Section 16.2.1. See III.F.

In addition to data from W. Alkali Creek, several rounds of samples for Grassy Lake and the two ponds in SW $\frac{1}{4}$ , NE $\frac{1}{4}$ , Section 31, T.27N., R.96W., and W $\frac{1}{2}$ , NW $\frac{1}{4}$ , Section 32, T.27N., R.96W. These ponds intercept runoff from the permit area. Much of the runoff from Section 25 does not reach W. Alkali Creek but does reach the ponds (see Fig. 15.3).

VII. Reclamation and Restoration. Section 17, pages 203-211.

A. Restoration Standards.

Ogle has not committed to any specific restoration standard, but to "acceptable state and federal standards" (page 205). Data available to DEQ from Ogle's R & D restoration indicate that Ogle had done an excellent job in returning to baseline water quality. This standard (background) is recommended for the commercial application.

B. Surface Reclamation.

1. Reclamation of disturbed streams, culverts, and ditches may need to be addressed, depending on the extent of the disturbance.
2. Final contours of the reclaimed evaporation ponds may need to be shown depending on the size and location of these ponds. This data is not yet available.

VIII. Miscellaneous.

Pertinent points of the Wyoming Game and Fish Department's letter of January 3, 1980, have been addressed in this memorandum.

FP:lv

cc: District III  
Roger Peterson  
Jake Strohman, WQD ✓  
Gary Beach

*Department of Environmental Quality*

## LAND QUALITY DIVISION

HATHAWAY BUILDING

TELEPHONE 307-777-7756

CHEYENNE, WYOMING 82002

February 5, 1980

TO: Commenters and Interested Persons

RE: Proposed Land Quality Division In-Situ Mining Regulations, Chapter XIV

Dear Sir/Madame:

Provided as attachments to this letter are the Division's analysis of written and oral comments that were received as part of the record for the proposed In Situ Mining Regulations, Chapter XIV (dated July 2, 1979). This analysis along with revised regulations, Appendix 'D', were presented to the Environmental Quality Council on January 23, 1980, for final rulemaking. Since it is intended that Appendix 'A' and 'B' will become part of the administrative record, certain parts of the analysis have been modified to reflect the Council's intent and recommendations with respect to the final version of the rules and regulations.

A modified "Statement of Reasons" is currently being drafted and will be adopted along with the regulations and become part of the record. I appreciate your expressed concerns and recommendations and hope that the staff properly interpreted these concerns while assessing and considering your comments. If there are questions, feel free to contact myself or Gary Beach at this office.

Sincerely,

A handwritten signature in cursive script, appearing to read "W. C. Ackerman".

Walter C. Ackerman  
Administrator

WCA:dlw

cc: Rick Lewis  
R.E. Sundin  
Gary Beach

TABLE. LIST OF COMMENTERS AND FOOTNOTE NUMBER

| <u>COMMENTER'S NAME</u>                          | <u>FOOTNOTE NUMBER</u> |
|--|------------------------|
| ARCO COAL COMPANY                                | (1)                    |
| ARIZONA PUBLIC SERVICE COMPANY                   | (2)                    |
| CLEVELAND-CLIFFS IRON COMPANY                    | (3)                    |
| ENVIRONMENTAL PROTECTION AGENCY                  | (4)                    |
| ENVIRONMENTAL QUALITY (SOLID WASTE MANAGEMENT)   | (5)                    |
| ENVIRONMENTAL QUALITY (WATER QUALITY DIVISION)   | (6)                    |
| a) August 28, 1979                               |                        |
| b) December 6, 1979 (N/A)                        |                        |
| EXXON MINERALS COMPANY, U.S.A.                   | (7)                    |
| FMC CORPORATION                                  | (8)                    |
| a) September 21, 1979                            |                        |
| b) November 20, 1979                             |                        |
| c) November 21, 1979                             |                        |
| HOMESTAKE MINING COMPANY                         | (9)                    |
| NUCLEAR REGULATORY COMMISSION                    | (10)                   |
| OGLE PETROLEUM, INCORPORATED                     | (11)                   |
| PEABODY COAL COMPANY                             | (12)                   |
| PUBLIC LANDS & FARM LOANS (Robert Johnson)       | (13)                   |
| ROCKY MOUNTAIN ENERGY COMPANY                    | (14)                   |
| UNC TETON EXPLORATION DRILLING CO., INCORPORATED | (15)                   |
| WYOMING FARM BUREAU                              | (16)                   |
| WYOMING MINERAL CORPORATION                      | (17)                   |
| a) November 21, 1979                             |                        |
| b) November 26, 1979                             |                        |
| WYOMING MINING ASSOCIATION                       | (18)                   |
| a) September 25, 1979                            |                        |
| b) September 26, 1979                            |                        |
| c) November 19, 1979                             |                        |
| WYOMING OUTDOOR COUNCIL                          | (19)                   |
| SHEILA ARNOLD - STATE REP. FROM ALBANY COUNTY    | (20)                   |
| LEROY BUGGEMAN - GILLETTE/CAMPBELL COUNTY        | (21)                   |
| ROBERT HAUN - NEAGLEY DEVELOPMENT ASSOCIATION    | (22)                   |
| WILLIAM VOLLMAN - DOUGLAS                        | (23)                   |
| WAYNE MOORE - PUMPKIN BUTTES AREA                | (24)                   |
| POWDER RIVER BASIN RESOURCE COUNCIL              | (25)                   |

APPENDIX "A"

Subject: Analysis of Comments - Response to General Comments on "Statement of Reasons" and Proposed Regulations, Chapter XIV

Date: January 28, 1980

Several comments were made on the narrative of the proposed "Statement of Reasons" which accompanied the proposed Land Quality Division In Situ Regulations, Chapter XIV. One comment from Administration was received on the last sentence of the first paragraph of the statement, which stated that the Land Quality Division is the "exclusive authority" in matters concerning applications for in situ mining. Although the title of W.S. 35-11-427 implies that the Land Quality Division has exclusive authority, the controlling language of the section implies that the Division is to function more as a principle or lead agency for the Department on matters pertaining to permit processing and approval. The statement will be corrected to reflect this role.

Another commenter felt that the purpose for the regulations, as found in the second paragraph of the "Statement of Reasons" was vague and nonspecific. The commenter requested greater definition of the new threats "to the public health and safety as well as the quality of the environment" posed by in situ mining be contained in the statement. The commenter also noted in the third paragraph the statement that "The disturbance to the surface involves the construction of wells and surface processing facilities, and are minor. The primary concern is the pollution of underground waters by removing fluid or any resulting subsidenc. ." The commenter questions, on the basis of this statement, the need for the elaborate data requirements of the surface resources as required in Section 2(b)(2) through (6). The threats posed by in situ mining to the public's health, safety, welfare and to the environment are not totally dissimilar from those occurring from other types of surface and underground mining. However, the types and intensity of impact resulting from in situ mining may cause dissimilar effects upon the general public's safety and welfare. This was recognized by the legislature, and specific types of information and specific performance standards were established to control the adverse effects of in situ mining. These included groundwater restoration procedures and subsidence control, which are in addition to other general performance standards for reclamation, disposal of waste, assessment of off-site impacts, and protection of waters of the State. Without adequate standards and controls for water pollution, reclamation, disposal of waste, subsidence control, and impacts to renewable and non-renewable resources and property the public's health, safety and welfare would be at jeopardy. The regulations, which implement the In Situ Mining Act, require information and set performance objectives which should provide mechanisms for minimizing or preventing adverse impacts to adjacent lands and waters and should assure, after a mining operation terminates, that all land and water affected by the operation shall be returned to a condition where the resources of the land are available for future uses which the

land did or could have supported before the temporary mining use. The commenter's concern that the requirements of Section 2(b)(2) through (6) exceed the types of information necessary for the reduced surface disturbance characteristics of in situ mining has been addressed in Appendix "B", Chapter XIV, Section 2.b.(2) through (6). (12) \*

The following is a response to comments on the proposed regulations (Chapter 1 and Chapter XIV) that were not directed at any specific subsection or paragraph but were general in nature, either applying to the whole regulation or a whole section of the regulation:

(1) One commenter recommended that the requirements of Section 2, Permit Application Requirements, should be expanded to require an assessment of the potential impacts of the mining operation beyond the permit area and adjacent lands. It appeared from the comments that impacts to water rights and human, animal and plant resources were of particular concern to the commenter. The commenter also suggested that mitigative measures should be employed so that off-site impacts would be minimized. The Division has, to the extent justifiable, proposed regulations that will provide for the assessments of and the collection of information necessary for the staff and public to become familiar with the potential impacts before a proposed mining operation is granted a permit or license. In many cases, language of the In Situ Act limits the amount of the assessment and information that can be required of the operator to the permit area and adjacent lands ( $\frac{1}{2}$  mile outside the permit area). However, for certain types of information where the Division anticipates that the affects of mining may extend beyond the adjacent lands the Division has included proposed regulations that would allow the administrator to require such information of an applicant. A specific example is the listing and mapping of wells and water rights for a three mile distance outside the permit area (Section 2.b. (7) and (10)). The application for a mining permit or license should contain sufficient information and assessments so that potential impacts can be perceived by an adjacent landowner and the operator's mitigative measures understood. If the individual is not satisfied he may request a hearing under the Environmental Quality Act or the individual can take action through other legal means. (16)

(2) One commenter was concerned that, considering the technology, the regulations did not provide protection to adjacent mineral leases. The Division believes that information and plans presented in an application to satisfy the proposed requirements of Section 2 shall be sufficient to assess potential impacts on adjacent minerals. Also all adjacent owners of record to within  $\frac{1}{2}$  mile of the permit area shall receive notice of proposed operations. (13)

---

\* Footnote number of commenter(s).

(3) One commenter expressed concern that the proposed regulations were aimed at controlling the effects of uranium in situ mining and would create an undue burden on in situ mining of minerals which pose minimal threats. The Division has recognized this potential problem and believes that by the addition of the phrase "consistent with the applicable in situ technology" in the controlling language of Sections 2.b.c. and d. that sufficient flexibility can be provided for those sites where application of a regulation may be inappropriate as a result of the site conditions or the technology. (8)\*

(4) Several commenters were concerned that proposed regulations dealing with discrete above ground solid waste resulting from processing facilities associated with in situ mining operations where the mineral being mined was uranium or thorium could cause the unnecessary problem of burdening the operator with dual regulatory requirements. Also there was a concern that applicable requirements of the Division could be inconsistent with the requirements of the Nuclear Regulatory Commission (NRC). After consultation with the Attorney General's Office on the NRC jurisdictional question, the Division has formulated regulations that leave control of radioactive hazards of discrete above ground solid wastes in the hands of the NRC. No regulations pertaining to radioactive hazards are proposed. However, with respect to nonradioactive hazards of discrete above ground process waste the Division has proposed regulations requiring plans for the handling and disposal of acid forming and toxic wastes in accordance with the general provisions of the Act. Radioactive materials, other than uranium and thorium, that may be encountered in the leaching process and associated with mining operations shall be regulated under the general applicable provisions of the Act. It is possible that this proposal will result in some dual regulations of discrete above ground process wastes; however, in view of the fact that these regulations do not impose standards but merely require plans the Division does not feel that operators will be unnecessarily burdened with duplicative regulations. Moreover, anticipated cooperation between the Department and the NRC should further resolve any other areas of unwarranted regulatory duplication. (10) (14)

(5) There was considerable concern expressed by numerous commenters that there was insufficient coordination and cooperation between the Water Quality Division and the Land Quality Division in the regulations being proposed for in situ mining operations. One commenter suggested that the Administrator of the Division be required by regulation to consult with the Administrator of the Water Quality Division. Many commenters felt that the proposed regulations of the separate Divisions would result in duplicative and burdensome reviewing of a proposed operation, and was clearly not intended by the Act (W.S. 35-11-427). The Division has responded to these comments and to the directive of the Council in the following way:

---

\* Footnote number of commenter(s).



(a) In accordance with proposed Land Quality Division (LQD) regulations, Chapter XIV, Section 1.b., a single application shall be submitted to the Administrator of LQD. Copies of the permit application shall be forwarded to the Water Quality Division (WQD) upon receipt. The format and contents of the application shall be in accordance with joint LQD/WQD forms and guidelines.

(b) Following submittal of an application the two agencies shall concurrently review the application in accordance with Section 1.c. of Chapter XIV. Comments from WQD's review shall be forwarded to the LQD and the Administrator of LQD shall, within 90 days, respond to the applicant pursuant to the findings of both the WQD and LQD reviews. Once the application is complete and the Administrators of both the WQD and LQD recommend approval, a single permit or license will be issued to the operator.

This procedure will functionally make the LQD the principle or lead agency during permit review and approval, thus enhancing coordination and cooperation among the two principle Divisions which have regulatory responsibilities over in situ operations. Although there will be separate permit application requirements, Chapter XIV, Section 2 and 4 of LQD regulations and Chapter IX, Section 6.b. and c. of WQD regulations basically require the same information such that a single application can be easily prepared to satisfy both Division's regulations. A comparison of the permit application requirements is contained in the attached table. The Division believes that this approach should alleviate the concerns that were expressed by the commenters. (25) (14) (17) (20) (7) (18) (2)

TABLE 1

Comparison of Permit Application Requirements of  
Revised Land Quality Division (Chapter XIV)  
and Water Quality Division (Chapter IX) Regulations

I. Special Process Discharges

| <u>WQD</u> | <u>LQD</u>  | <u>COMMENT</u>   |
|------------|---|--|
| 6.b.(1)    | 2.a.  | LQD refers to W.S. 35-11-406 (a)(i) and (vi).  |
| 6.b.(2)(a) | 2.c.(2)   |  |
| 6.b.(2)(b) | 2.c.(9),(10),<br>and (11)                         | WQD requires construction and engineering details; LQD requires the design of impoundments and diversions and typical proposed well completions. |
| 6.b.(2)(c) | 2.c.(1) and (3)                                   |  |
| 6.b.(3)    | 2.b.(8),(9),(12),<br>and (13)                     | WQD limits requirements to "receiver".   |
| 6.b.(4)    | 2.b.(1),(10),<br>and (11)                         | LQD asks for past, present and proposed water uses.  |
| 6.b.(5)    | 2.b.(14)  |  |
| 6.b.(6)    | 2.c.(15) and 3.b.,<br>c. and d.                   | Discharge monitoring requirements are covered in LQD annual report section.  |
| 6.b.(7)    | 2.c.(5),(16) and<br>(18) and 2.b.(10)<br>and (11) |  |
| 6.b.(8)    | 2.c.(6)   |  |
| 6.b.(9)    | 2.c.(6),(13) and (16)<br>and 2.d.(1)              |  |

II. Miscellaneous Discharges

| <u>WQD</u> | <u>LQD</u>             | <u>COMMENTS</u>   |
|------------|------------------------|---|
| 6.c.(1)    | 4.                     | LQD refers to W.S. 35-11-431.   |
| 6.c.(2)    | 4. and 4.b.(2) and (3) | LQD Section 4. refers to W.S. 35-11-431.  |
| 6.c.(3)    | 4., 4.b., and 4.b(4)   | LQD Section 4. refers to W.S. 35-11-431 (general groundwater hydrology and geology including production zone) |
| 6.c.(4)    | 4.                     | LQD refers to W.S. 35-11-431 (description of nature and scope of testing activity)                            |
| 6.c.(5)    | 4.b.(4)                |   |
| 6.c.(6)    | 4.                     | LQD refers to W.S. 35-11-406 (nature and scope of testing activity)   |
| 6.c.(7)    | 4.                     | LQD refers to W.S. 35-11-406  |

III. Definitions

| <u>WQD</u> | <u>LQD</u> | <u>COMMENTS</u>  |
|------------|------------|--|
| 2.a.       | (17)       |  |
| 2.b.       |            | Corresponds to LQD permit area and adjacent lands.                 |
| 2.c.       | (79)       |  |
| 2.g.       |            | Corresponds to LQD "production zone" defined in W.S. 35-11-103(f). |
| 2.l.       | (22)       | Not identical, but difference is not substantive.                  |
| 2.z.       | (9)        | Not identical, but difference is not substantive.                  |

APPENDIX "B"

Subject: Analysis of Comments - Section Specific Response to Land Quality Division  
In Situ Mining Regulations, Chapter XIV

Date: January 28, 1980

Chapter I, Section 2.(22)

One commenter felt that the definition of "groundwater" given in the existing Land Quality Division Rules and Regulations is too general for application to in situ mining because it includes waters of very poor quality. It was suggested that the definition be limited to those waters which have a quality suitable for common water uses.

The Division recognizes that there are areas where the groundwater quality is so poor that it cannot be used without treatment. However, it is not recommended that the definition of "groundwater" be changed to exclude these water bodies because: 1) in some cases, the study of poor quality groundwater is essential to understanding the hydrologic system and protecting potable groundwater in the area, and 2) the proposed regulations already show water use to be an important consideration in both baseline studies (Section 2.b.(1)) and aquifer restoration (Section 2.c.(1) and (2)). (8)\*

Chapter I, Section 2.(9)

One commenter suggested that the definition of "subsidence" be altered to imply that subsidence be measured by nominal surveying techniques, arguing that insignificant lowering of the ground surface would not tend to degrade its utility.

The Division agrees that centimeters of change in the land surface may not constitute a degradation, however, it recommends that no change be made in the definition on the basis that: 1) the language of the provisions which contains the term "subsidence" allows for this type of reasonable judgment, 2) the Act speaks of mitigating significant subsidence, § 35-11-428(a)(iii) and 3) the addition of "nominal survey techniques" to the definition may limit the techniques that may be superior for monitoring subsidence in the substrata. (8)

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\* Footnote number of commenter(s).

Chapter I, Section 2.(63)

A comment was received suggesting that the definition of "monitor well" be broadened to include wells used to obtain physical data other than the measurement of static water levels and the collection of samples.

The Division agrees and recommends the following change to the definition of "monitor well":

"Monitor Well" means a well construction or utilized to measure water levels or to obtain liquid, solid, or gaseous analytical samples OR OTHER PHYSICAL DATA THAT WOULD BE USED for controlling the operations or to indicate potential circumstances that could affect the environment. (8)

Chapter I, Section 2.(66)

One commenter has asked for the difference between the definitions of "receiving strata" in the proposed regulations and "production zone" in the Act (W.S. Section 35-11-103(f)(v)) and suggested that the definition of "receiving strata" may be superfluous.

By definition, the production zone is the zone which will be mined. The receiving strata is the geologic unit in which the production zone is contained. The Division feels it is important to specifically define "receiving strata" because this is the interval in which horizontal excursions will occur. To alleviate some confusion, however, it is recommended that the definition of "receiving strata" be reworded to read:

"Receiving Strata" means for the purpose of in situ mining, the geologic unit WITHIN WHICH THE PRODUCTION ZONE IS CONTAINED. (6)

Chapter I, Section 2.(69)

A typographical error was noted in the definition of "recovery well". The sixth word of the definition should be "purposes". (9)

Chapter I, Section 2.(69)

This proposed term "Uses for which the water was suitable", provides additional definition of the minimum level of groundwater restoration that must be achieved by an in situ operation. See Definition of "groundwater restoration", W.S. 35-11-103(f)(iii). An applicant is required by the proposed regulations to demonstrate in accordance with Section 2.d.(1) that if he cannot achieve a level of restoration that approaches pre-mining conditions he can achieve something within the definition of "groundwater restoration". The applicant must demonstrate that, at a minimum, he had the technical capabilities to return the affected groundwater to a quality of use equal to and consistent with the uses for which the water was suitable prior to the commencement of the operation" (Section 2.d.(1)(b)).

Many commenters expressed a concern with having the following words or phrases included in the definition; "potential", "which are or could have reasonably been developed" and "criteria and recommendations". Arguments supporting removal of the phrases "potential" and "which are or could have reasonably been developed" include: 1) that they do not appear in the Act (Definition of "groundwater restoration", W.S. 35-11-103(f)(iii)), 2) they are broad and vague and may imply that uses for groundwater which were not suitable in their natural state may potentially be made to be consistent with the Act (W.S. 35-11-102). However, one commenter argued that "potential" should remain in the definition because without it the definition would allow for degradation of water which could be economically treated to provide a higher use. There were also numerous arguments that "criteria and recommendations" should be deleted on the basis that it is not clear what they represent and by including them introduces an element of doubt into the definition. One commenter also recommended that "quality" should be removed where it occurs at the end of the first sentence. The commenter felt that water quality was only one factor of useability and that other parameters such as location, depth and yield would have a bearing on the realistic use of water. Also, several commenters felt that "established water quality standards", as the phrase occurs in the first sentence of the definition, should be preceded by "legally". This would qualify the term by limiting the standards to those legally adopted.

Based upon these expressed concerns, the Division recommends that "potential" and "criteria and recommendations" be deleted. Contrary to the comments, "potential" adds nothing to the definition. In response to the commenter that recommended that potential remain in the definition to allow for consideration of economical treatment, the Division believes this type of consideration is inherent in the phrase "those uses of the

premining groundwater which are or could have reasonably been developed". This same phrase qualifies that consideration of any treatment must be reasonable in assessing suitable use. The recommendation that "beneficial" be substituted for "potential" was not accepted as beneficial uses, in accordance with the Act (W.S. 35-11-102), are listed in the second line of the definition. The phrase "which are or could have reasonably been developed" is recommended to remain in the term as it is a key to defining the term itself. This phrase provides that actual uses and potential uses that could reasonably be developed considering ambient water quality conditions and related standards which imply suitable uses of water are the basis for making a judgment as to the uses for which the water is suitable. The Division agrees and recommends that the phrase "criteria and recommendations" should be deleted, and established standards used as the basis for judging suitable use. Standards of Water Quality Division's Chapter VIII, Quality Standards for Groundwaters of Wyoming, shall function as the basis for classifying groundwaters, however, the Division sees no need to add "legally" to the term "established water quality standards". The Division does not recommend that the last "quality" of the first sentence of the definition be deleted. In the context of its use, water quality standards for suitable use are compared to the pre-mining water quality conditions where the emphasis here is on ambient water quality condition and not on use. The commenter's concern that factors other than water quality influence use would be an inherent consideration of the phrase "which are or could have reasonably been developed" of the definition. (11, 25, 15, 17, 18)

Chapter I, Section 2 (new definition)

Chapter XIV, Section 2.b.(2) requires a soil inventory as part of a permit application. A low intensity soil survey is required for the entire permit area and a high intensity survey may be required for the affected lands.

A comment was received suggesting definitions of "low intensity" and "high intensity" soil surveys. Both surveys were to be defined as "a general textural description of the soils on the affected lands, based upon visual inspection."

Land Quality accepts the suggestion of defining low and high intensity soil surveys. However, several commenters suggested changes to Chapter XIV, Section 2.b.(2), wherein the term "low intensity" was deleted and "high intensity" was substituted for "detailed". The Division recommends the following definition for "detailed soil survey":

(70) "Detailed Soil Survey" means a soil survey where each soil is defined and delineated into mapping units based upon taxonomic characteristics.

Chapter XIV, Section 1. (General Comment)

This section contains a listing of general requirements applicable to all in situ mining operations. One commenter was concerned that the State did not have right of entry without notice so as to assure compliance. The Act authorizes the Director to designate authorized officers, employees or representatives of the Department to enter and inspect (W.S. 35-11-409(a)(vi)). This same commenter was concerned about quality assurance with respect to sampling and recommended a regulation which would authorize sample splitting. Such authority is now being proposed within the Solid Waste Management amendment to the Act to satisfy compliance with the Resource Conservation and Recover Act. The Division recommends no change to the regulations. (4)

Chapter XIV, Section 1.a.

This section of the proposed regulations references several other chapters of the Land Quality Division and Water Quality Division regulations as being applicable to the in-situ mining operations. Applicable referenced regulations include definitions (Chapter I); land use evaluation and restoration, (Chapter II, Section 1.b.); surface preparation and performance standards for handling topsoil, subsoil, overburden and refuse (Chapter II, Sections 3. and 4.); revegetation (Chapter II, Section 5.); standards and application requirements for the diversion of surface water, impoundment of water and tailings impoundments, (Chapter III, Sections 1., 2., 6., and 7.); reclamation schedule (Chapter IV); standards and application requirements for roads, railroad spurs, facilities, archaeological and paleontological resources, disclosure of unanticipated conditions, filing and advertising, and county cooperative agreements (Chapter VIII); permit revisions (Chapter XI); self bonding (Chapter XII); and bond release (Chapter XIII). One commenter expressed a concern that these referenced requirements may not be applicable to the types of disturbance and conditions that exist on in situ mines. The commenter argued that the In Situ Act (W.S. 35-11-428(a)) recognized that surface disturbance may not be comparable to those disturbances associated with surface mining and suggested that information request and performance standards should be consistent with the nature and extent of the in situ technology. The commenter requested that the referenced regulations be reviewed in light of this suggestion. One commenter also expressed concern with the performance standard for topsoil removal (Chapter II, Section 4.a.(1) and upon cessation of operations the two year reclamation schedule (Chapter IV, Section 2.).



The Division has reviewed the referenced regulations in light of the commenter's concerns and recommends that the following also be excluded from the in situ regulations: Chapter II, Section 4.c. and d. (overburden, spoil and refuse; and acid-forming and toxic material of surface coal mining operations); Chapter III, Sections 7 through 11. (tailings impoundments and standards for surface coal mining operations); Chapter VIII, Section 6. (county cooperative agreements); and Chapters XII and XIII (self bond and bond release for surface coal mining operations). These recommended deletions are made on the basis that the referenced regulations were felt to not be directly applicable to the in situ technology and adequately covered in the proposed regulations, or are applicable only to surface coal mining operations. In situ coal operations must also comply with applicable regulations for surface coal mining operations, however, these requirements shall be covered in the regulations being developed to satisfy the State Program for surface coal mining operations.

With respect to the topsoil removal requirement of Chapter II, Section 4.a.(1), the Division has evaluated the commenter's concern that there may be operations associated with in situ mining which do not require topsoil removal. The Division agrees that there may be certain activities where surface disturbance is minimal and soil conditions are such that topsoil removal may not be necessary. However, the In Situ Act does reference the provisions on topsoil removal (W.S. 35-11-406(b)(viii)) which implies that standards for topsoil removal and segregation are applicable to in situ operations. The Division believes that under the definition of "affected land" (W.S. 35-11-103(e)(xvi)) allowances may be given for departure from the topsoil removal standard of Chapter II, Section 4.a.(1) where there will be insignificant disturbance to the natural state of the land surface. To allow this flexibility in the regulations, the Division recommends that the following phrase be added to the introductory language of Section 2.b. "consistent with the extent and nature of the proposed surface disturbance."

A commenter argued that the two year time schedule following cessation of operations (Chapter IV, Section 2.) was too rigid of a time period to allow for revegetation and groundwater restoration to be accomplished. They argued that revegetation may not take place until groundwater restoration is completed and groundwater restoration could itself take two years. The Division concurs with the commenter's concern and recommends the addition of language to Section 1.a. which will modify the requirement of Chapter IV, Section 2, by requiring the completion of reclamation within two years after groundwater restoration has been completed. (17)

Chapter XVI, Section 1.c.

Many commenters argued that the In Situ Act granted the Administrator authority to authorize well field construction prior to granting a permit (W.S. 35-11-427) and that the proposed regulation unconditionally limited the intent of the Act. The Division agrees that a waiver to allow an operator to collect baseline data, which he is required to collect before mining, poses an inconsistency in the regulations. The intent of the regulations have been to allow construction of wells which would serve for the collection of baseline data and could also be used for production. However, because no legislative history exists and because of the possible inconsistency the Division recommends that this subsection be deleted from the proposed regulations and the Administrator shall rely on the statutory language on a case-by-case basis. (17, 18, 15, 11, 9)

Chapter XIV, Section 1.d.

This subsection reiterates the statutory burden placed upon the Administrator to review and respond to the applicant within 90 days from submittal of an application. It further states that a rejection of an application by the Administrator on the grounds that it is incomplete must be supported by written findings.

One commenter did not want the requirements for a high intensity soil survey as may be required by Section 2.b.(2) to be justification for incompleteness under this requirement. The Division advises against this recommendation on the basis that all elements required for an application must be contained in the application prior to its being considered complete. If requirements are precluded, the documents will go to public notice and review missing elements required by statute or regulation, elements which may be important to the public's review.

Another commenter wanted a statement added which would imply that once noted deficiencies have been corrected the application is complete. The Division rejected this recommendation because: 1) it is an unnecessary expansion of the statutory language, and 2) many times the Division cannot provide a comprehensive listing of comments resulting from an initial review because the application lacks basic information necessary to allow a complete analysis. (12, 9)

Chapter XIV, Section 1.e.

This section requires that an operator having a permit or license which was issued prior to the In Situ Mining Act and this Chapter shall show compliance with the requirements of the Chapter prior to May 25, 1980. This requirement was based upon the statutory provision of the In Situ Mining Act, W.S. 35-11-436.

Many commenters argued that the Act contemplated a reasonable period of time to attain compliance and that due to the delay in getting these regulations promulgated, the time remaining may be physically impossible to meet. There was also concern with the term "comply" and a commenter suggested that to be consistent with the Act, the term "show compliance" should replace "comply".

The Division believes that the Act clearly contemplated that all existing operations should be in substantial compliance with the Act by May 25, 1980 (one year following enactment). The Division agrees that to show compliance with the regulations by May 25, 1980, when in fact the regulations could conceivably not be promulgated before the date would cause an undue hardship on the operation. On this basis, the Division recommends that the following language be adopted, which will satisfy the intent of the Act and provide diligent compliance with these regulations after they are promulgated:

Operators having an in situ mining permit or license issued before the effective date of these regulations shall, by no later than May 25, 1980 present evidence demonstrating compliance with the requirements of W.S. 35-11-426 through W.S. 35-11-436. The Administrator shall review such evidence and shall as soon as practicable advise the operator in writing of such additional information or procedures necessary to satisfy the provisions of this Chapter and of W.S. 35-11-436. (3, 11, 7, 15, 17, 18)

Chapter XIV, Section 1.f.

This section requires the operator to report any excursion to the Administrator within 24 hours and to submit within seven days a written report detailing the procedures for controlling the excursion. The Administrator may terminate or modify the mining operation if an excursion is not controlled within 60 days.

Several comments were received on this section and will be addressed collectively.

1) It was suggested that the 24 hour time limit for reporting an excursion be extended because it may not be possible to contact the Administrator during a holiday, and because excursions are not critical events by their nature.

Experience has shown that some excursions may potentially be critical events. The Division cannot begin to protect the environment or the health and safety of the people in the area until it is informed that the excursion has occurred. The Division believes that 24 hours is ample time for notification to be made and that procedural difficulties with notification outside of working hours can be easily resolved using the Department's 24 hour telephone. (17, 7, 15, 11, 18)

2) The comment was made that the operator should only be required to report excursions once they have been verified. In some cases, a laboratory analysis may be in error, thus triggering a false alarm.

The Division agrees that verification should be a factor in determining whether an excursion has occurred. However, to avoid time delays in the control of an excursion, the Division feels that details of the procedures and time schedules to be used for excursion verification must be included in the permit application. The Division recommends that the first line of Section 1.f. be modified to read, "The operator shall report any confirmed excursion to the Administrator within 24 hours, ..." and that the following sentence be added to the end of Section 2.c.(15):

Details shall be included of the procedures and time schedules used to confirm excursions.

3) One commenter asked that a definition be given of the detection level of recovery fluid by a monitor well that constitutes an excursion.

Detection levels, constituents to be monitored, and even the monitoring method depend on the type of in situ operation, the mineral being extracted and site specific conditions. The Division recommends against any attempt to precisely define these parameters for all in situ operations in general. These can more easily and effectively be spelled out in each permit application. (5)

4) Several commenters have recommended deleting the requirement for a seven day written report or extending the time limit to thirty days. It was argued that since the permit application must contain a description of actions to be taken in the event of an excursion, a report detailing these actions within seven days after an excursion occurs would be redundant.

It is the Division's experience that at the time a permit application is prepared, actions to be taken in the event of an excursion can only be outlined in a general way. The written report within seven days after the excursion is the only record the Division will have detailing the excursion location, direction of movement, probable cause, and specific mitigating measures. Prompt receipt of this report is essential for the Division to ensure that the problem is being adequately handled; therefore, no change in the regulation is recommended. (17, 15, 11, 18)

5) Several commenters suggested that the 60 day time limit after which the Administrator may terminate or modify the mining operation be deleted. Suggested alternatives include no time constraints, time constraints specified in the permit, and allowing termination or modification only if the excursion is uncontrolled and clearly endangering the public health and safety.

The In Situ Act authorizes the Administrator to terminate or modify the mining operation if an excursion cannot be controlled or mitigated within the constraints specified in the permit (W.S. 35-11-429(a)(ii)). The Division feels that a standard time limit established by regulation is necessary to maintain fair and consistent enforcement of excursions that may occur on all in situ operations. It should be noted that the Administrator is not obligated by this proposed regulation to terminate or modify the operation at 60 days after confirmation. The Division believes that the regulation as written is flexible enough to allow for differences in site conditions and technologies and is a reasonable time period to attain control. No change is recommended. (17, 15, 11, 18)

Chapter XIV, Section 2.

The introductory language of proposed Section 2., entitled Permit Applications, places a burden upon the applicant to "...demonstrate that the mining operation is designed to minimize, to the extent safe and practicable, disturbance and adverse impacts of the operation on human or animal life, fish, wildlife, plant life and related environmental values."

One commenter argued that by the use of the term "demonstrate" an undue burden may be placed upon the applicant and suggested the terminology of the Act be utilized.

The Division agrees that not all application requirements of the Section require a demonstration on behalf of the operator that impacts will be minimized, however, it must be realized that it is clearly the policy and purpose of the Act that impacts and pollution of air, land and water should be minimized to the extent practicable. The Division agrees that this particular language serves little purpose, may create misinterpretation and recommends that it be deleted. (17)

Chapter XIV, Section 2.b.

The introduction to subsection b. requires "a description of the land, geology and groundwater hydrology". The subsection goes on to describe the type of information necessary to satisfy this description.

Many commenters expressed a concern that certain information requirements of this subsection would not be limited to the nature of the surface disturbance typical of in-situ technologies. The intent of the Act to so limit it is reflected by W.S. 35-11-428(a)(i). The Division agrees with many commenters that by adding to the introductory language the phrase, "Consistent with the extent and nature of the proposed surface disturbance", subsections b.(2), (3), (5), (6) and (7) may be modified to be consistent with the types of disturbance that may occur considering the applicable in situ technology. (1),(15),(17),(18)

Chapter XIV, Sections 2.b.(2) through (6)

The referenced paragraphs contain information gathering requirements for soils, natural radioactivity, vegetation, and wildlife in accordance with the requirements of W.S. 35-11-428(a)(i). Many commenters expressed concerns that the requirements of the proposed regulations go beyond what is needed for the type of surface disturbance resulting from the applicable in situ mining technology.

One commenter recommended that the high intensity soil survey which may be required by paragraph (2) be limited to those areas where the potential for significant subsidence exists. The Division advises against this change because it is felt that such detailed descriptions are necessary in areas where excavation and fills will occur or where there may be substantial surface disturbance. This type of information is necessary to describe the "topsoil" that will be separately removed and preserved for reclamation. The term "low intensity" was removed from the proposed paragraph to allow greater latitude in the type of information generally required and the term "high intensity" was substituted with "detailed" to provide terminology consistent with that used in Chapter VI, Section 5.b.

One commenter recommended changes to the requirement for topsoil removal (paragraph (3)). The commenter's argument was that some affected lands may not require topsoil removal because disturbance shall be minimal. The Division recommends no change to the language of the paragraph because it only requires a description of the nature and depth of topsoil that will be removed. Consistent with the narrative of Section 1.a. of this analysis and the changes to Section 2.b., there is latitude to allow topsoil to be left in place where disturbance will be minimal. An approved mining and reclamation plan will show where topsoil will or will not be removed.

There were several comments on paragraph (4), which requires a description of the natural radioactivity of the lands where radioactive materials may be stored. However, the State Attorney General's analysis of the Atomic Energy Act, as amended, grants the Nuclear Regulatory Commission (NRC) exclusive jurisdiction over radioactive hazards associated with uranium or thorium licensed facilities. On this basis the paragraph is being deleted from the proposed regulation so as to not be inconsistent with similar NRC requirements.

Many commenters expressed a concern that vegetation studies required by paragraph (5) were not warranted or necessary for the minimal amounts of surface disturbance resulting from in-situ activities. Of particular concern was the required productivity studies. The Division recommends that no change should be made to the proposed regulation on the basis that:

- 1) Pre-mining vegetation conditions must be established as a control which can later be used to determine when the affected lands have been revegetated.
- 2) Reclamation of surface disturbance is measured on the basis of restoring a vegetative cover that stabilizes the ground surface and facilitates a post-mining land use equivalent to the "highest previous use", and
- 3) The three elements; cover, species diversity, and productivity are necessary measurements to objectively assess the success of revegetation and restoration of the post-mining land use.

The Division believes that by limiting these studies to the "affected lands" the requirement is consistent with the Act, and the nature and extent of surface disturbance associated with in situ mining.

One commenter was concerned with the word "potential" in combination with the phrase "habitats for endangered species" of paragraph (6), arguing that any site could be potential habitat. The Division agrees that the word potential could be deleted but points out the normal surveys for endangered species habitat usually include consideration of "potential". (7)(11)(12)(17)(18)(15)

Chapter XIV, Section 2.b.(7)

This section requires a description and map of all surface water rights within and adjacent to the permit area. Commenters pointed out that "adjacent to" is not defined in the Act, while "adjacent lands" is (W.S. 35-11-103(c)(vii)) as recommended that the latter term be used.

The Division agrees that to maintain consistency with the Act, the term "adjacent lands" should be substituted for "adjacent to". The Council felt that water rights existing on lands adjacent to the permit area and adjacent lands should be provided as information in an application. Thus, the proposed regulation was modified to require a description of surface water in the permit area and adjacent lands and information on water rights within the permit area and to a distance of three miles outside the permit area should be provided. (11)(15)(7)(18)

Chapter XIV, Section 2.b.(8)

This section requires a detailed description of baseline site geology.

One commenter observed that the detail of information required relating to aquifers might not be appropriate for operations where an aquifer is not involved.

The Division agrees that the information required in this Section is too specific to allow the flexibility required to apply these regulations to operations without aquifers. It is recommended that Section 2.b.(8) be simplified and rewritten as follows:

A description of the geology, supported by maps, cross-sections, and supporting geologist, drillers, and geophysical logs, which identifies formations and aquifers, geologic features that could influence aquifer properties, and the areal and stratigraphic position of the production zone in relation to other geologic features. (8)

Chapter XIV, Section 2.b.(10) and (11)

Section 2.b.(10) requires information on existing water wells and Section 2.b.(11) requires information on abandoned wells and drill holes within the permit area and for a three mile area adjacent to the permit area. This information is required to the extent it is available from public records and a reasonable inspection of the property.



The comments received on these sections requested that: 1) "a reasonable inspection of the property" be deleted because "reasonable" is not defined, and 2) "a three mile area adjacent to the permit area" be replaced by "adjacent lands" because the Act does not suggest any basis for the three mile area, while it does define "adjacent lands"

"Adjacent lands" is defined in the Act (W.S. 35-11-103(e)(vii)) as a one-half mile area adjacent to the permit boundary. The Division agrees that in most cases this area will be sufficient to provide adequate environmental protection in light of the slow movement of groundwater and the extensive monitoring systems that will be required. The Division recognized, however, that instances may arise with developing in situ technologies, such as in situ coal gasification, where the potential clearly exists for pollutants to migrate past the one-half mile boundary over a very short period of time. In cases such as this, information on water wells within three miles of the permit area may be necessary information for assessing impacts. Preparation of such a map would require minimal time and expense, yet it would benefit both the public and the Division by clearly showing the extent to which wells are currently being used, and may be impacted, in the vicinity of the proposed operation. The Council ruled that the information in Section 2.b.(11) should be restricted to "adjacent lands", but that Section 2.b.(10) be modified to read:

Locations and present owners of all water wells in use within the permit area and on adjacent lands, including a description of well completion data, producing interval(s), and variations in water level to the extent such information is available in the public records and from a reasonable inspection of the property. The Administrator will require a mapping of all wells to a distance of three (3) miles outside the permit area.

The Division feels that an inspection of the property is essential to locate any wells or holes that have not been documented on public records, but which may provide a conduit for the flow of recovery fluid out of the production zone. The word "reasonable" has been included for the purposes of limiting the level of detail required in such an inspection. The mapping of well locations within 3 miles of the permit area includes those of public record or as a result of inspection (8)(9)(11)(15)(17)(18)(16)(21)(7)(25).

Chapter XIV, Section 2.b. (12) and (13)

Section 2.b.(12) requires a static water level map for all aquifers which may be affected by mining. Section 2.b.(13) requires aquifer characteristics for saturated portions of the receiving strata and overlying aquifers and the extent of hydraulic connection between the receiving strata and overlying and underlying aquifers.

1) Several commenters felt that the drilling and completion of wells necessary to determine aquifer characteristics and water levels in overlying and underlying aquifers is not justified because these aquifers will be monitored.

The Division believes that the required information is necessary and justifies the time and expense involved on the basis that: 1) in most cases, the monitoring wells installed in overlying and underlying aquifers for excursion detection will be sufficient for gathering the information required in this section, and 2) the information required in this section will aid in the detection and control of vertical excursions and the determination of the potential impact of an excursion. (17)(11)(15)(18)

2) It was suggested that only the determination of hydraulic connection between the receiving strata and immediately overlying and underlying aquifers be required.

The Division agrees that in most cases, only the immediately overlying and underlying aquifers will be affected by hydraulic communication with the receiving strata. However, instances may arise where a series of leaky aquifers or improperly abandoned drill holes may result in substantial hydraulic communication between the receiving strata and an aquifer that is not immediately adjacent to the receiving strata. The Division seeks to maintain the flexibility to ask for a detailed determination of the extent of communication between the receiving strata and an aquifer that is not immediately adjacent to it if a special case, such as one of those mentioned above, should arise. It should be recognized that Section 2.b.(13) does not specify the methods or level of detail required to determine hydraulic connection. The Division expects the extent of communication between the receiving strata and immediately overlying and underlying aquifers to be determined in great detail; while in most cases a simple geologic argument will probably be sufficient to determine communication with other aquifers. To maintain the flexibility for addressing special cases, the Division recommends against modifying "overlying and underlying" aquifers" with the word "immediately". (17)(15)(18)(11)(7)

3) One commenter remarked that because of certain site conditions, such as an aquifer occurring at great depth, it may not be possible to obtain all of the information required in Section 2.b.(13).

The Division agrees that increase flexibility is necessary for this section to be reasonably applied to all hydrologic situations and recommends the following modification to Section 2.b.(13):

Aquifer characteristics...which may include, but is not limited to,... (8)

4) One commenter suggested that the phrase "direction of preferred flow under hydraulic stress" is confusing because there might be more than one preferred direction depending on the variability in aquifer characteristics.

The Division agrees with this observation and recommends that "direction" be changed to "direction(s)". (4)

Chapter XIV, Section 2.b.(14)

This section requires geologic logging data, core analyses, and other test data necessary to substantiate geologic and hydrologic interpretations.

Several comments were received that the terms in this definition are vague and that it is unnecessary and burdensome, for both the applicant and the agency, to require such a large amount of raw data.

The Division agrees with this comment and recommends that Section 2.b.(14) be deleted. Past experience has shown, however, that geologist, drillers, and geophysical logs are necessary to show the kind of detailed geologic information that cannot be included on a cross-section. In order to limit the type of geologic data required of these categories and for the specific purpose of defining the geology, the Division recommends that Section 2.b.(8) be modified as follows:

A description of the geology, supported by maps, cross-sections and supporting geologist, drillers, and geophysical logs.... (6)(11)(15)(17a)(18)

Chapter XIV, Section 2.b.(15)

Section 2.b.(15) requires a tabulation of baseline groundwater quality analyses.

A comment was received that this section does not give any requirements for number and location of wells, sampling frequency, or time frames for baseline characterization.

The Division feels that these requirements should not be specified in the in situ regulations because of the number of different and changing technologies to which these regulations must apply. The Division believes that both flexibility and consistency in monitoring requirements between operations can more easily be maintained through the in situ guideline. For this reason, the Division recommends that the last sentence of Section 2.b.(15) be modified to read:

Sampling to characterize the pre-mining groundwater quality and its variability shall be conducted in accordance with established Department guidelines.

Chapter XIV, Section 2.c.

One commenter recommended that the reference to W.S. 35-11-406(b)(viii) should be deleted because by referencing it the requirement of segregating and protecting the topsoil was not consistent with the extent and nature of surface disturbance, associated with in-situ technology.

The Division does not concur with the recommendation as the In-Situ Act also references this section thus implying intent for operators to comply with the provision. In this same section, the Division recommends the addition of reference to W.S. 35-11-406(b)(xiii) as being consistent with the Act, and deletion of reference to W.S. 35-11-406(b)(xvii) and (xviii), provisions which are limited to surface coal mining operations and which will be covered in the proposed regulations of the State Program for Surface Coal Mining Operations.

Chapter XIV, Section 2.c.(1)

Section 2.c.(1) requires a description of the method of operation including injection pressures and volume and type of recovery fluid to be used.

It was suggested that the word "rate" is more appropriate than "volume" and that the word "proposed" be included since exact specifications may have to be changed in response to mining conditions.

The Division agrees and recommends the following wording for Section 2.c.(1):

A description of the proposed method of operation to include injection pressures, injection rate, and type of recovery fluid to be used. (11)(15)(17)(18)

Chapter XIV, Section 2.c.(2) and (3)

The proposed paragraphs (2) and (3) require maps showing activities of the operation, sequence of mining, and reclamation and relationship of the permit area to existing structures, dwellings, roads, etc., not associated with the operation. Several commenters recommended that "proposed" be injected into these paragraphs as a modifier since activities can only be predicted at the onset and minor changes may occur as the operation commences and progresses. The Division concurs with these recommendations. (17)(18)(15)

Chapter XIV, Section 2.c.(4)

This section requires a description of the procedures used to verify that excursion monitoring wells are in hydraulic communication with injection and recovery wells.

Comments received on this regulation pointed out that only monitor wells completed in the receiving strata should be in hydraulic communication with injection and recovery wells. Furthermore, it was observed that monitor wells cannot be in hydraulic communication when mining evaporites or other non-aquifer deposits.

In light of these comments, the Division recommends that Section 2.c.(4) be modified to read:

The procedures utilized to verify that the injection and recovery wells are in communication with monitor wells completed in the receiving strata and employed for the purpose of detecting excursions.

The word "hydraulic" has been deleted from the regulation to give a broader meaning to the word "communication". Hydraulic communication is implied where the receiving strata is saturated. Where the receiving strata is a non-aquifer, a demonstration must still be made that monitor wells will be placed in such a fashion that an excursion will be detected, should one occur. Communication in this case may be verified by demonstrating that the production horizon is continuous to and including the monitor wells. (17)(11)(15)(7)(8)(18)

Chapter XIV, Section 2.c.(6)

Section 2.c.(6) requires a schedule and procedures for periodically checking injection and recovery wells for leakage.

Several commenters felt that periodic checking for leaks is unwarranted in light of the time and money required because excursions will be picked up by the monitoring system. It was argued that only suspect wells should be tested and only in the case of an excursion.

One commenter observed that this regulation does not require the use of tubing for leak protection in injection wells and that it is unclear whether injection wells must be tested for mechanical integrity before use. These requirements are part of the proposed EPA Underground Injection Control Regulations.

The Division feels that because of the newness and variation in in situ technology, tubing or specific casing requirements should not be imposed. It is essential, however, that injection wells be checked for mechanical integrity and leakage before they are used. The Division believes that periodic testing of injection wells during use is necessary until some knowledge is gained about how the various casing materials stand up under the stresses of in situ mining. It is not a given that leaking fluid will always be picked up by the monitoring system, particu-

larly where several overlying aquifers are present. The Division feels that the proposed regulation allows a great deal of flexibility with regard to scheduling and should be adaptable to changing knowledge and technology.

To emphasize the need for testing before the use of injection wells and to maintain consistency with UIC requirements for periodic testing, the following modification of section 2.c. (6) is recommended:

A schedule and procedures to check for mechanical integrity of injection wells prior to injection and at a minimum of every five (5) years during use. (14)(11)(15)(9)(17)(18)

Chapter XIV, Section 2.c.(8)

This paragraph requires an evaluation of the effects of subsidence on land and water resources and establishes a standard for subsidence control. One commenter argued that the standard (second sentence of paragraph) implies that total nondegradation and overall perfection is expected. The commenter recommended that "significant" be added prior to "degraded" to alleviate this implication.

The Division believes in the context of the language of the second sentence, that the standard implies that the uses must not be degraded. This does not mean that any change in the land surface or groundwater conditions would constitute degradation but rather changes as a result of subsidence which adversely affected the use of the land surface or groundwater resource would constitute degradation. The Division does not recommend changes in the proposed language as it believes sufficient flexibility is provided by the proposed language. (17)

Chapter XIV, Section 2.c.(9)

Section 2.c.(9) requires a description of the typical proposed well completion for each type of well utilized.

One commenter pointed out that an inconsistency exists between the detail required in this section and that required in the annual report in Section 3.c. A typographical error was also noted.

The Division agrees that the two sections are inconsistent as proposed. Completion details required in the annual report for new monitor wells are basic information which should be provided for all monitor wells to aid in the interpretation of monitoring data. The Division feels that both Sections 2.c.(9) and 3.c. should be written in more general terms to allow the flexibility required to regulate a changing technology. It is therefore, recommended that Section 2.c.(9) be rewritten as follows:

Completion details for all monitor wells and a detailed description of the typical proposed well completion for injection and recovery wells. (7)

Chapter XIV, Section 2.c.(10)

This paragraph requires information on the design, construction, and monitoring of impoundments which may or may not contain process wastes. Many commenters were concerned about the detailed construction and design plan that would have to be submitted to satisfy the requirement. There were numerous arguments also that this requirement was redundant to similar requirements and responsibilities of the Water Quality Division, State Engineer and the Nuclear Regulatory Commission. There was also a concern that such detailed engineering plans would pose an unnecessary economic burden on the applicant with no assurance that he would receive a permit.

The Division is mandated by statute to assess impoundments associated with mining operations on the basis of environmental protection and reclamation. The State Engineer assesses impoundments on the basis of water appropriations. Water Quality Division assesses impoundments on the basis of protection to surface water and groundwater quality. The Nuclear Regulatory Commission assesses impoundments on the basis of radioactive hazards and under the recent Uranium Mill Tailings Radiation Control Act, the non-radioactive hazards. There is obvious overlap where water and waste impoundments exist. However, although this multiple agency review exists, the objections of each agency review are generally different, each designed to achieve their independent statutory responsibilities.

Generally, the detailed design that is submitted to the State Engineer will satisfy the Division's requirements and the monitoring and contingency plan are consistent with the plan needs of Water Quality Division. Thus, the only hardship imposed is producing several copies and arranging the material in a format for each reviewing agency. In accordance with the comments and for the purpose of clarity, the Division does recommend the following language be substituted for that proposed:

A description of and design plan for all impoundments and for those impoundments containing wastes, a leakage monitoring plan. For impoundments holding toxic or acid forming material, contingency plans to control unanticipated leakage shall be provided.

Reference to "radioactive material" was deleted since control of these types of materials falls under the exclusive jurisdiction of the NRC. (11)  
(7)(8)(17)(15)(18)

Chapter XIV, Section 2.c.(11)

This paragraph requires a description of the construction and design details for temporary and permanent diversions. Several commenters argued that this requirement was redundant to the State Engineer's responsibilities and that the requirement was not necessary since Chapter III, Section 1 and 2 (Diversion of unchannelized surface water and streams) had been included in the regulations by reference in Section 1.a.

Although the State Engineer may require similar detailed designs of diversion, his review and approval concentrates on water appropriations. Dissimilarly, the Division reviews diversions on the basis of environmental protection. So, as many commenters suggested, there is overlap but the statutory responsibilities are different. As noted by a commenter, referenced Chapter III contains regulations on diversions. These regulations set out standards for diversions and are not application requirements. On the basis of the comments, the Division recommends the following language be substituted for that proposed:

"A description of all temporary and permanent surface water diversions in accordance with Chapter III, Sections 1 and 2 of these regulations". (15)(18)(1)(7)(8)

Chapter XIV, Section 2.c.(13)

This paragraph requires a description of procedures that will be employed to insure that acid forming, toxic and radioactive materials will be properly disposed of. One commenter suggested that these materials should be limited to mine process wastes because wastes resulting from worker activities are subject to regulation by the Solid Waste Program of DEQ. The Division concurs with this suggestion and believes that the phrase "encountered during or created by the mining process" in the proposed regulation limits the applicability of this requirement. It should be noted that "radioactive" is deleted on the basis that control of radioactive material falls under NRC jurisdiction. (5)

Chapter XIV, Section 2.c.(14)

Section 2.c.(14) requires a description of chemical reactions that may occur during injection and that may change groundwater quality in the receiving strata or other aquifers.

A comment was received that a description of chemical reactions in other aquifers should not be required because excursions outside of the receiving strata will be detected by monitoring wells and controlled.



The intent of Section 2.c.(14) is to obtain a description of the chemical reactions which are expected to occur in the production zone. This information would be used to determine the degree to which groundwater outside of the production zone would be impacted by a potential excursion. The Division recognizes that the current wording is unclear and recommends that Section 2.c.(14) be rewritten as follows:

A description of chemical reactions that may occur during mining as a result of recovery fluid injection. (11)

Chapter XIV, Section 2.c.(15)

This section requires details of and time schedules for a continuous monitoring program from pre-mining through release of bond.

Several comments were received suggesting that the word "continuous" be defined or replaced with the word "periodic" because, taken literally, a "continuous" monitoring program would be quite excessive.

The Division agrees that a continuous monitoring program, in the literal sense, is excessive. It is recommended that the word "continuous" be dropped from the regulations. (3)(6)(11)(14)(17)(18)

Chapter XIV, Section 2.c.(16)

Section 2.c.(16) requires a description of all measures employed to prevent an excursion.

One commenter felt that the word "all" should be deleted on the basis that such absolute wording could preclude the use of effective measures which were not contemplated at the time of the application.

The Division sees no problem with making such a change since it is to the company's advantage to describe all anticipated measures in the application. It is recommended that the word "all" be deleted. (7)

Chapter XIV, Section 2.d.

This introductory sentence to the section d. (reclamation plan requirements) references several informational requirements of the Act. One commenter felt that W.S. 35-11-406(b)(ii) should not be referenced because the information required by that section was not consistent with the nature and scope of surface disturbance associated with the in situ technology. W.S. 35-11-406(b)(ii) requires a plan for recontouring the surface to a configuration consistent with the post-mining land use. Although the surface disturbance is for the most part minimal there will be excavations and fills associated with most operations. Discussions are necessary con-

cerning the recontouring of these areas. Also, the reference in the regulations is consistent with the reference in the In-Situ Act, W.S. 35-11-428(a)(iii). The addition of the phrase "consistent with the applicable in situ technology to this language" should also allow a certain degree of flexibility. The Division recommends no change.

Chapter XIV, Section 2.d.(1)

This proposed paragraph requires that an applicant applying for an in situ mining permit demonstrate that "groundwater restoration" can be achieved. Groundwater restoration is defined by the Act as:

The condition achieved when the quality of all groundwater affected by the injection of recovery fluids is returned to a quality of use equal to or better than, and consistent with the uses for which the water was suitable prior to the operation by employing the best practicable technology.

The requirement of this proposed section states that demonstration must consist of a showing that by employing the best practicable technology the operator will attain a return of groundwater conditions to those that existed before mining (Section 2.d.(1)(2)) or if this cannot be achieved, employ the best practicable technology to restore the uses for which the water was suitable (Section 2.d.(1)(b)) and in no case by employing the best practicable technology would the water be left at a quality level which would endanger public health and safety (Section 2.d.(1)(c)).

Numerous comments were received on this requirement, as it represents further definition of the term "groundwater restoration" and it places a burden upon the operator to demonstrate why levels of restoration higher than the minimum cannot be achieved. Comments on this paragraph range from concern that: 1) A commercial scale operation may be authorized before an affirmative demonstration has been made that the operator has the technological capabilities to restore the groundwater, 2) The restoration requirements of Section 2.d.(1)(a) were not physically and economically achievable, and 3) The Division had weakened the spirit and intent of the In Situ Act by the proposed regulations of Section 2.d.(1)(c).

The regulations were drafted on the concept that for the Director to permit for a commercial scale in situ operation an applicant must be able to demonstrate that the proposed operation will be conducted in accordance with the provisions of the Act. For those cases where an operator is not sure because of the newly developing in situ technology, that he can meet the performance required for a commercial scale operation (W.S. 35-11-428 through W.S. 35-11-430), the Act contains a special licensing procedure specific for testing the technology to determine its mineability, workability and to develop the necessary reclamation techniques. The Act clearly contemplates that all operations, both commercial and testing, must

be conducted in accordance with the provisions of the Act. However, the Act reduces the requirements for a research and development operation to allow such operations to physically test their methodology. As an example, an application for a testing license must include a reclamation plan which describes the... "method for groundwater restoration" (W.S. 35-11-431(a)(iv)) whereas a permit application must include a mining and reclamation plan containing... "procedures for groundwater restoration". (W.S. 35-11-428(a)(iii)(14)). "Method" implies only a process for attaining a goal where "procedure" implies a particular proven way of accomplishing an act. On this basis, the Division believes that the Act intended an affirmative demonstration before an operator can be granted a permit to mine at a large commercial scale. If such demonstration cannot be made for a permit, the operator can test the technology and develop the necessary information for such demonstration under a testing license.

Numerous commenters argued that the requirement of Section 2.d.(1)(a) was not physically and economically achievable with today's technology. It was further argued that this requirement was inconsistent with the definition of "groundwater restoration" as described above in this analysis of comments section. The Division believes that the proposed language of Section 2.d.(1)(a) and (b) presents a fair reconstruction of the groundwater restoration requirements and provides more definitive guidance to an application. The In Situ Act clearly contemplates that groundwater clean-up should be at target levels which will restore groundwater quality to a level as closely approximating pre-mining conditions as possible by the application of state-of-the-art technology; however, the Act recognizes that even state-of-the-art technology may not be realistically capable of restoring pre-mining conditions. Consequently, flexibility exists to authorize "groundwater restoration" to a condition achievable through the employment of "best practicable technology". In no event, however, is the statutory requirement of "groundwater restoration" satisfied by post-mining conditions where the quality of use of the water will be less than or inconsistent with the uses for which the water was suitable before mining. The proposed regulations of Section 2.d.(1) enforce this scenario by requiring operators to show that higher levels of restoration are not achievable or practicable. Thus, the Division does not recommend changes in Section 2.d.(1)(a) other than that necessary to develop language consistent with similar restoration standards contained in the Water Quality Divisions regulations, Chapter VIII.

One commenter argued that this paragraph should be deleted and the Division should rely solely upon the language in the Act. As previously noted, the Division believes with respect to developing a plan for groundwater restoration that the proposed regulations provide greater clarity than contained in the Act and recommends that the paragraph, as revised, be retained in the regulations.

Many commenters recommended that subparagraph (c) of this section be deleted as it tended to weaken the spirit and intent of the In Situ Act. The Division agrees that the subparagraph may allow groundwater restoration to a level where the uses for which the water was suitable no-longer exist and recommends this subparagraph be deleted. The Division also recommends, for the purpose of consistency and clarification, that reference to "employment of the best practicable technology" be included in the controlling language of subparagraph (a) and (b). (6)(7)(11)(17)(14)(18)(19)(23)(24)(20)(25)(16)(15)(1)(4)

Chapter XIV, Section 2.d.(2) and (3)

Section 2.d.(2) requires the information necessary to demonstrate that the operation will not adversely affect the uses for which the groundwater outside of the production zone was suitable. Section 2.d.(3) requires the applicant to demonstrate that the techniques used to achieve groundwater restoration are appropriate for the recovery fluid used and the properties of the receiving strata.

Several commenters argued that the word "demonstrate" is too strong and may be interpreted to mean "conclusively prove". The commenter felt that these sections should require a description of the appropriateness of proposed restoration techniques and the program to mitigate adverse affects on the groundwater.

Upon review of these Sections, the Division feels that they are unnecessary. Section 2.d.(1) requires a demonstration that groundwater restoration will be possible and Section 2.d.(4) requires a description of the condition to which the groundwater will be restored and the procedures used to achieve this restoration. Therefore, the Division recommends that Sections 2.d.(2) and (3) be deleted. It must be acknowledged that the Act places a burden upon the operator to comply with the provisions of the Act. If the operator cannot make such a showing, then the permit may be denied. Thus, the Division believes that the use of the term "demonstrate" is appropriate and consistent with the intent of the Act. (8)(17)

Chapter XIV, Section 2.d.(4)

Section 2.d.(4) asks for the standards and procedures used to achieve a condition of groundwater restoration.

One commenter suggested that "standards" be removed from this section since the In Situ Act does not reference specific water quality standards in regard to restoration.

The Division agrees with this comment. The intent of Section 2.d.(4) is to obtain a commitment to restore the groundwater to a specific quality and a description of the procedures that will be used to achieve this quality. In order to clarify this section, the following wording is recommended:

In accordance with subsection (1) of this Section, the condition of groundwater restoration and the procedures to achieve such restoration. (11)

Chapter XIV, Section 2.d.(6)

This paragraph requires a postmining contour map of the affected lands. Many commenters argued that even though lands may be affected, the actual surface disturbance may be so minimal that no changes to the premining contours would occur. The Division agrees that in these cases the postmining contour map would be no different than the premining contour map. The Division recommends that this requirement be limited to those affected lands where the pre-mining contours may be substantially altered. (11)(15)(12)(17)(18)

Chapter XIV, Section 2.d.(10)

This paragraph requires a description of procedure for the removal and disposal of building and structures erected during the operation. Several commenters are concerned that this requirement would not allow an operator to leave a structure that may be of value to the surface owner. In accordance with the Chapter VIII, Section 3., the Administrator can allow structures to be left which are of a beneficial use (this regulation is referenced in Section 1.a. of Chapter XIV). On the basis of this referenced regulation the commenter's concern should be satisfied. The Division would recommend that "all" be deleted from the proposed regulation so as to be consistent with the standards of Chapter VIII, Section 3. (7)(15)(18)(17)

Chapter XIV, Section 2.d.(12)

This paragraph requires a description of post-mining radiological surveys to assure decontamination. Many commenters recommended that the survey should be limited to a gamma survey to be consistent with the Act (W.S. 35-11-428(a)(i)). The Act specified gamma survey for pre-mining determinations but in accordance with W.S. 35-11-428(a)(iii)(G) does not limit the post-mining radiological evaluation to one of a gamma survey. Regardless of the expressed concerns, the Division recommends that the paragraph be deleted not on the basis of the comments, but on the basis of NRC's exclusive jurisdiction over radioactive hazards associated with license uranium milling operations. (15)(11)(17)(18)

Chapter XIV, Section 2.d.(15)

This paragraph requires a time schedule for achieving reclamation. This would include recontouring and revegetation, and groundwater restoration. Many commenters argued that an application can only contain a proposed schedule and that the schedule will change with time as the operation progresses. Changes in the schedule shall be reported and evaluated on an annual basis in accordance with the Annual Report (W.S. 35-11-411). The Division concurs with the commenter's concern and recommends that "proposed" be injected into the language of the requirement. (15)(17)(18)

Chapter XIV, Section 2.d.(16)(a)

This subparagraph requires a cost analysis for removal and disposal of structures which is used to assess a bond. Similar to the comments on Section 2.d.(10) of this Chapter, one commenter was concerned that the requirement did not allow for leaving any structures. To remove any inconsistency between this requirement and the requirements of Chapter VIII, Section 3., the Division recommends that all be deleted. (7)

Chapter XIV, Section 3.a.(1) and (2)

These paragraphs require maps showing the progress of groundwater restoration and mining. The requirements require the operator to show the areas which will be mined and restored in the forthcoming year. Many commenters argued that because this was a prediction, the word "expected" should be added to phrase requesting such future assessments. The Division concurs with the recommendation. (17, 15, 18)

Chapter XIV, Section 3.b.

Section 3.b. asks for the total quantity of recovery fluid injected and the total quantity of recovery fluid extracted during the reporting period.

One commenter claimed that the quantities of recovery fluid that were injected and extracted is process/operational data and does not fall in the category of either environmental protection or reclamation information; therefore, this requirement should be deleted.

The Division feels that the information required in this section is important from an environmental standpoint. A comparison of the quantities of recovery fluid injected and extracted will function as an important check on loss of fluid from the mine area. This type of mass balance is a quick and easy way to determine the extent to which recovery fluid has been controlled during the reporting period. The Division recommends that this section be retained. (17)

Chapter XIV, Section 3.c.

Section 3.c. requires the annual report to include monitoring results for the reporting period and well completion details for monitoring wells installed during the previous year.

Several comments pointed out a typographical error and stated that this section is unclear. One commenter requested that only a summary of monitoring results be required rather than the large amount of data which is already required to be maintained on site.

The Division has found in the past that summary reports are not adequate to determine the extent to which an operation is affecting the environment. Often raw data will indicate a trend long before it is considered serious enough to be mentioned in a summary report. The data itself must be reviewed each year and must be available to the public as part of the annual report record.

Upon review of this Section, the Division feels that although excursion detection is a major function of the monitoring program it should be emphasized that details of any excursions that have occurred during the reporting period should be included in this section of the annual report.

In order to clarify Section 3.c. and maintain consistency with Section 2.c.(9), the Division recommends the following change in wording:

Monitoring program results pursuant to Section 2.c.(15) of this Chapter including a map and a description of all excursions, their location, and extent during the reporting period. Completion details shall be included for all monitor wells installed during the previous year. (6, 7, 15, 18, 17, 6)

Chapter XIV, Section 3.d.

Section 3.d. requires an updated piezometric surface map to be included in the annual report for all aquifers that may be affected by mining.

Comments were received that the usefulness of such a map is limited because it will represent only an instantaneous surface and cannot be extrapolated over time and distance.

The Division recognizes that any piezometric surface map represents only a point in time, as does any other type of non-continuous measurement. The value of annually updated piezometric maps is that they will indicate any groundwater mounding or other signs that the operation may be adversely affecting the hydrologic system. Water level monitoring is required as part of the groundwater monitoring program; consequently the only additional work required by this Section is to plot and contour the data points. For these reasons, the Division recommends that Section 3.d. be retained. (8, 15, 17a, 18)

Chapter XIV, Section 3.e.

Section 3.d. requires that the annual report contain supporting data for areas where groundwater restoration has been achieved during the previous year.



One commenter has suggested that a summary report on groundwater restoration be required rather than supporting data on the basis that a summary report would be more readily understandable and would save the agency the burden of storing large amounts of data.

The Division feels that supporting data is essential as a means of judging the success of restoration against the conditions to which groundwater is to be restored, as specified in the permit. Groundwater restoration cannot be demonstrated without providing the facts to back-up summary statements. The requirements of this Section provide the only means by which the Division will be able to determine whether or not restoration has been achieved. It is strongly recommended that Section 3.e. remain unchanged. (17)

#### Chapter XIV, Section 4.

This section of the regulations contains permit application requirements in addition to those listed in W.S. 35-11-431, Research and Development Testing License. There were a variety of comments on this section, some commenters expressing a concern that the regulations did not go far enough with respect to public notice and siting. Other commenters felt the regulations went beyond the intent of the Act by placing too much burden on the operator to demonstrate compliance with the Act or the development of resource information.

Several commenters expressed concerns that the public notice procedures were inadequate, there was no opportunity for a public hearing, and there were no regulations which prohibited testing activities from being too close to residential areas. Public notice procedures are spelled out in the Act (W.S. 35-11-431(a)(vi)) and require that a permit application contain proof of notice to all persons having a valid legal estate of record within one-half mile of the R & D testing license area. The Act certainly envisions the opportunity for objections and a public hearing in accordance with the language of W.S. 35-11-432. Equally, in accordance with W.S. 35-11-432, there may be legitimate grounds for denying a special license to conduct research and development testing where an owner living within one-half mile feels he may be adversely affected by the proposed mining operation.

Several commenters were concerned that the regulations placed an undue burden on the operator or requirement information on activities beyond what contemplated by the Act for testing operations. One commenter argued that the use of the word "demonstrate" in Section 4.a. posed an undue burden on the applicant to conclusively prove compliance, an obligation beyond what was contemplated by the Act. The Division believes that the Act very clearly

places the burden upon the operator to show, before a license or permit is granted, that the proposed operation can be conducted in accordance with the provisions and purpose of the Act. An application for a license that does not demonstrate compliance with the purpose of the Act may not be granted by the Administrator. Section 4.a.(1) through (3) requires that the applicant demonstrate within the application that the operation is designed to evaluate the mineability or workability of the mineral deposit and provide information for developing reclamation techniques for in situ mining (all consistent with the definition of "Research and Development Testing License", (W.S. 35-11-103(f)(viii)), and minimize disturbance to the land, surface water and groundwater. Although the latter provision (minimize disturbance, Section 4.a.(2)) was not specifically contained within the Act, the Division believes this requirement is consistent with the intent of the Research and Development licensing provisions. Considering the above points, the Division does not recommend any changes to subsection 4.a.

With respect to subsection 4.b., one commenter suggested that "vegetative cover" in paragraph (1) of the subsection should be changed to language similar to that of the Act, "statement of the type of vegetation" (W.S. 35-11-431). The commenter was concerned that the use of the term "vegetative cover" would require comprehensive studies including productivity which was not felt to be necessary for the small acreages of land that would be affected by such an operation. Although the Division questions the commenter's interpretations of W.S. 35-11-431, the Division is in agreement that disturbances are usually restricted to several acres and thus comprehensive premining vegetation surveys for these small acreages are not necessary. The Division recommends that the language of Section 4.b.(1) be changed to read: "The land use, vegetation and topsoil characteristics of the affected land" (location and name of surface water and water rights placed in separate paragraph). By this language a description of the vegetation, which may be by methods such as the SCS range site classification system, will suffice where small acreages of affected land will be disturbed. This still allows the Administrator to require greater information where unusually large acreages of land may be disturbed under a license.

One commenter was concerned that the requirement of subsection 4.b.(2) for noting wells from a "reasonable inspection of the property", would create confusion and peril for the operation. The Division acknowledges that many times wells that can be observed in the field will not be reflected on public record. By reasonable inspection, the Division did not intend for an applicant to crawl across the property seeking holes or signs of holes. Equally, if a well were observed and no record could be found with respect to plugging and well completion this information would not be available for the operator to report. The Division believes this inspection requirement is reasonable and may provide valuable information that may not otherwise be attainable from the public record. The Division recommends no change in subsection 4.b.(2). (1, 17, 22, 25)

Chapter XIV, Section 5.

Section 5. contains three prohibitions:

- a. Discharge into an uncased open hole above or below the production zone,
- b. Injection of any substance other than air or clean water between the wall of the hole and casing in the hole except in the production zone, and
- c. Injection of recovery fluid into any zone or interval other than that represented as the production zone in the approve permit or license.

Several comments were received stating that prohibitions "a" and "b" are so broad that they do not allow the use of proper well completion techniques. One commenter felt that prohibition "c" should be deleted because the condition it refers to is that of an excursion. Other parts of the in situ regulations recognize that excursions will occur and makes allowances for their control without penalty.

The Division agrees that prohibitions "a" and "b" are much too broad. The intent is to prohibit the injection of recovery fluid into zones outside of the production zone, which is adequately covered in prohibition "c". Therefore, the Division recommends that prohibitions "a" and "b" be deleted.

Prohibition "c" addressed a situation that is not covered in the statutory definition of "excursion". According to the In Situ Act, an excursion is the unauthorized movement of recovery fluid out of the production zone (W.S. 35-11-103 (f)(ii)). Prohibition "c" addresses the injection of recovery fluid directly into unauthorized zones, rather than the migration of recovery fluid away from the production zone. Recognizing the Division's obligation to prohibit activities that would jeopardize reclamation or protection of any waters of the State (W.S. 35-11-429(a)(iv)), groundwater contamination due to injection into an unauthorized zone is consequently prohibited. The Division recommends that this prohibition be retained. The Division recognized its obligation to enforce this requirement in a reasonable manner. (9)(6)(17)(8)

Chapter XIV, Section 6.

Section 6. requires that all analyses submitted to the Administrator include a description or reference for sample collection, preservation, analysis, and quality control procedures and identification of the laboratory used, job identification number, and date of analysis.

The comment was received that all of this information should be maintained at the mine site rather than submitted with the analysis.

The procedural information and date of analysis required in this section will be used by the Division to confirm the validity of the data. Errors or incorrect procedures used in sample collection, preservation, or analysis may result in analytical data which does not represent the actual quality of the water tested. This should not be a burden on the applicant because if the same procedures are used consistently, they can easily be referenced. If an analysis appears to be in error, the laboratory name and job identification number is needed in order to verify the results with the responsible laboratory. With the large number of samples analyzed and laboratories used by most applicants, matching a particular analysis submitted to the Division with the laboratory and job identification number maintained at the site could become difficult and time consuming. The Division feels it is a simple matter to add this information to each analysis along with the well number and sampling date. On this basis, the Division recommends that Section 6. remain unchanged. (7, 15, 18)

Chapter XIV, Section 7.

This section recognizes that records may be held as confidential if they satisfy the requirements of W.S. 35-11-1101(a). The section also contained a time period wherein confidential records would no longer be held as such unless the permittee renewed his request. The Division had, for administrative purposes, proposed the time period on the basis that records which were confidential upon submittal may not be confidential at a later date due to technology changes, and to make available to the public all information which may not qualify as confidential material in accordance with W.S. 35-11-1101(a).

Several commenters argued that the renewal requirements were burdensome, not intended by the Act, and subjected reevaluation by the agency of the confidential nature of material. There was also concern that too much discretion was left to the Administrator with respect to defining "trade secrets".

The Division believes that this issue is broader than just the in situ regulations and needs to be handled on a Departmental level. Definition of "trade secret", as it applies to Surface Coal Mining Operations, is contained in the proposed regulations of the State Program and may provide general guidance for other types of mining:

"Trade Secret" means, for purposes of surface coal mining or exploration activities:

a) Information pertaining only to the analysis of chemical properties of marketable coal, except information of a mineral or elemental content which is potentially toxic to the environment or of a hydrologic nature;

b) Information pertaining to the coal seam itself, except as to any person who demonstrates to the satisfaction of the Director an interest which is or may be adversely affected by the decision to hold such information confidential;

c) Information which is not on public file pursuant to State law;

d) Information relating to coal exploration operations which concerns privileged commercial or financial information relating to the competitive rights of the person intending to conduct the coal exploration operations.

Until this issue can be more fully evaluated, the Division recommends that the five (5) year renewal period be deleted.

APPENDIX "C"

SUBJECT: List of Changes in January 15, 1980, Revised Land Quality Division In-Situ Regulations, Chapters I and XIV

RE: Chapter I, Section 2. Definitions

| <u>DEFINITION</u> | <u>LOCATION OF CHANGE</u> | <u>COMMENT</u>  |
|-------------------|---------------------------|---|
| (62)              | Page 1, line 3            | Renumbered  |
| (63)              | Page 1, lines 5,6,7,      | Renumbered and modified in response to comments.                              |
| (64)              | Page 1, line 9            | Renumbered. "Piezometric" changed to "potentiometric" for technical accuracy. |
| (65)              | Page 1, lines 12 - 16     | Deleted so as to not be inconsistent with NRC regulations.                    |
| (66)              | Page 1, lines 17, 18, 19  | Renumbered and reworded for clarity.  |
| (67)              | Page 2, line 1            | Renumbered.   |
| (68)              | Page 2, line 4            | Renumbered.   |
| (69)              | Page 2, lines 8 - 11      | Renumbered and modified in response to comments.                              |
| (77)              | Page 2, lines 14, 15      | Added in response to comments   |
| (78)              | Page 2, lines 16, 17, 18  | Added in response to comments.  |
| (79)              | Page 2, lines 19, 20, 21  | Added for consistency with Water Quality Division Regulations.                |

RE: Chapter XIV. In-Situ Mining

| <u>REGULATION</u> | <u>LOCATION OF CHANGE</u> | <u>COMMENT</u>  |
|-------------------|---------------------------|---|
| 1.a.              | Page 1, lines 3 - 9       | Modified as a result of comments and reference to Water Quality Division in-situ regulations.           |
| 1.b.              | Page 1, lines 10 - 20     | Modified to include cooperative role of Water Quality Division.   |
| 1.c.              | Page 2, lines 1 -4        | Deleted as result of comments.  |
| 1.d.              | Page 2, lines 5 - 11      | Modified to clarify the roles of the Land Quality and Water Quality Divisions.                          |
| 1.e.              | Page 2, lines 12 - 18     | Modified as a result of comments, to allow reasonable period of time for compliance.                    |
| 1.f.              | Page 2, lines 19 - 27     | Modified in response to comments, to include the role of the Water Quality Division, and for clarity.   |
| 1.f. (new)        | Page 3, lines 1, 2        | An earlier requirement removed from Section 2.d.(5) and added to this section as a general requirement. |
| 2.                | Page 2, lines 4 - 7       | Deleted as a result of comments.  |
| 2.a.              | Page 3, lines 8, 9, 10    | Modified for clarity and consistency with the Act.  |

Chapter XIV. In-Situ Mining (Continued)

| <u>REGULATION</u> | <u>LOCATION OF CHANGE</u> | <u>COMMENT</u>   |
|-------------------|---------------------------|--|
| 2.b.              | Page 3, lines 11, 12, 13  | Modified for consistency with the Act as a result of comments.   |
| 2.b.(2)           | Page 3, lines 16, 17      | Modified in response to comments.  |
| 2.b.(4)           | Page 3, lines 22 - 25     | Deleted so as to not be inconsistent with NRC regulations.   |
| 2.b.(5)           | Page 4, line 1            | Renumbered for consistency.  |
| 2.b.(6)           | Page 4, lines 3 - 7       | Renumbered, modified based on comments and expanded to include important invertebrate wildlife.  |
| 2.b.(6) (new)     | Page 4, lines 8, 9        | Addition to define required information in accordance with W.S. 35-11-428(a)(i).   |
| 2.b.(7)           | Page 4, lines 11, 12      | Modified in response to comments.  |
| 2.b.(8)           | Page 4, lines 13 - 24     | Modified in response to comments and for simplification.   |
| 2.b.(10)          | Page 5, lines 1 - 9       | Modified in response to comments, to provide clarity, and provide information outside of adjacent lands where groundwater and property rights may be adversely affected. |



Chapter XIV. In-Situ Mining (Continued)

| <u>REGULATION</u> | <u>LOCATION OF CHANGE</u> | <u>COMMENT</u>  |
|-------------------|---------------------------|---|
| 2.b.(11)          | Page 5, lines 12, 13      | Modified in re-<br>sponse to comments.  |
| 2.b.(12)          | Page 5, lines 15, 16, 17  | Modified for clarity.   |
| 2.b.(13)          | Page 5, lines 19 - 27     | Modified in response<br>to comments for clarity<br>and flexibility  |
| 2.b.(14)          | Page 6, lines 1, 2        | Incorporated into<br>2.b.(8) to eliminate<br>broadness, in response<br>to comments.                         |
| 2.b.(15)          | Page 6, lines 3 - 8       | Renumbered for consis-<br>tency, modified in re-<br>sponse to comments and<br>for clarity.                  |
| 2.c.              | Page 6, lines 9, 10, 11   | Modified to provide<br>clarity and be consis-<br>tent with the require-<br>ments of the Act.                |
| 2.c.(1)           | Page 6, lines 12, 13      | Modified in response<br>to comments.  |
| 2.c.(2)           | Page 6, lines 16, 17      | Modified in response<br>to comments.  |
| 2.c.(3)           | Page 6, line 21           | Modified in response<br>to comments.  |
| 2.c.(4)           | Page 6, lines 23, 24      | Modified in response<br>to comments.  |
| 2.c.(5)           | Page 6, line 25           | Modified for clarity.   |
| 2.c.(6)           | Page 7, lines 1, 2, 3     | Modified in response<br>to comments and for<br>consistency with Water<br>Quality Division Regu-<br>lations. |

## Chapter XIV. In-Situ Mining (Continued)

| <u>REGULATION</u> | <u>LOCATION OF CHANGE</u> | <u>COMMENT</u>   |
|-------------------|---------------------------|--|
| 2.c.(8)           | Page 7, lines 6 - 9       | Modified for clarity.  |
| 2.c.(9)           | Page 7, lines 9 - 16      | Modified in response to comments and for simplification.                     |
| 2.c.(10)          | Page 7, lines 17 - 20     | Modified in response to comments.  |
| 2.c.(11)          | Page 7, lines 21, 22, 23  | Modified for clarity.  |
| 2.c.(12)          | Page 7, line 24           | Modified so as to not be limited to waste <u>residues</u> .                  |
| 2.c.(13)          | Page 8, line 1            | Deletion to prevent any potential inconsistencies with NRC regulations.      |
| 2.c.(14)          | Page 8, lines 7, 8        | Modified in response to comments.  |
| 2.c.(15)          | Page 8, lines 9 - 14      | Modified in response to comments and for clarification.                      |
| 2.c.(16)          | Page 8, line 15           | Modified in response to comments.  |
| 2.c.(17)          | Page 8, lines 17 - 21     | Deleted because of redundancy with 2.b.(8) and 2.c.(15).                     |
| 2.d.              | Page 9, lines 1,2,3       | Modified for clarity and as a result of comments.                            |
| 2.d.(1)           | Page 9, lines 4 - 10      | Clarification of scope of subsection, so as to replace Section 2.d.(2).      |
| 2.d.(1)(a)        | Page 9, lines 12, 13      | Modified to be consistent with Water Quality Division restoration standards. |

## Chapter XIV. In-Situ Mining (Continued)

| <u>REGULATION</u> | <u>LOCATION OF CHANGE</u> | <u>COMMENT</u>  |
|-------------------|---------------------------|---|
| 2.d.(1)(b)        | Page 9, lines 14 - 17     | Modified for clarity, consistency with the Act and as a result of comments.       |
| 2.d.(1)(c)        | Page 9, lines 18 - 22     | Deleted as result of comments.  |
| 2.d.(2)           | Page 9, lines 23,24,25    | Deleted because of redundancy with 2.d.(1) & 2.d.(4).                             |
| 2.d.(3)           | Page 10, lines 1 - 6      | Deleted because of redundancy with 2.d.(1) & 2.d.(4).                             |
| 2.d.(4)           | Page 10, lines 7 - 10     | Renumbered and modified in response to comments and for clarity.                  |
| 2.d.(5)           | Page 10, lines 11, 12, 13 | Deleted in this Section and replaced in Section 1 as a general requirement.       |
| 2.d.(6)           | Page 10, lines 14, 15, 16 | Modified as a result of comments.   |
| 2.d.(7)           | Page 10, line 17          | Renumbered for consistency.   |
| 2.d.(8)           | Page 10, line 19          | Renumbered.   |
| 2.d.(9)           | Page 10, lines 21, 22     | Modified so as to not create any potential inconsistencies with NRC requirements. |
| 2.d.(10)          | Page 10, line 23          | Modified as a result of comments.   |
| 2.d.(11)          | Page 10, line 25          | Renumbered.   |
| 2.d.(12)          | Page 11, lines 1 - 5      | Deleted so as to not create any potential inconsistencies with NRC requirements.  |
| 2.d.(13)          | Page 11, line 6           | Renumbered.   |

## Chapter XIV. In-Situ Mining (Continued)

| <u>REGULATION</u> | <u>LOCATION OF CHANGE</u> | <u>COMMENT</u>  |
|-------------------|---------------------------|---|
| 2.d.(14)          | Page 11, line 8           | Renumbered  |
| 2.d.(15)          | Page 11, line 10          | Modified as a result of comments.   |
| 2.d.(16)          | Page 11, lines 11, 12     | Modified to be consistent with authority and requirements of Act.                   |
| 2.d.(16)(a)       | Page 11, line 14          | Modified as a result of comments.   |
| 3.                | Page 11, line 9           | Modified for clarity.   |
| 3.a.(1)           | Page 11, line 24          | Modified as a result of comments.   |
| 3.a.(2)           | Page 11, line 25          | Modified as a result of comments.   |
| 3.b.              | Page 12, lines 2, 3, 4    | Modified as a result of comments.   |
| 3.c.              | Page 12, lines 5 - 8      | Modified in response to comments and for clarity.                                   |
| 3.d.              | Page 12, lines 10, 11, 12 | Modified for clarity.   |
| 3.e.              | Page 12, lines 13, 14, 15 | Modified for clarity.   |
| 4.                | Page 12, lines 17, 18     | Modified for clarity.   |
| 4.b.(1)           | Page 13, lines 3, 4, 5    | Modified as a result of comments.   |
| 4.b.(2) (new)     | Page 13, lines 6, 7       | Requirement originally occurring in previous paragraph is put into a new paragraph. |

Chapter XIV. In-Situ Mining (Continued)

| <u>REGULATION</u> | <u>LOCATION OF CHANGE</u> | <u>COMMENT</u>   |
|-------------------|---------------------------|--|
| 4.b.(2)           | Page 13, line 8           | Renumbered for consistency.  |
| 4.b.(3)           | Page 13, lines 12, 13, 14 | Renumbered, modified for clarity.  |
| 5.                | Page 13, lines 15 - 21    | Modified in response to comments.  |
| 6.                | Page 13, lines 22, 23     | Addition to section to include requirements of the Act, W.S. 35-11-430(b). |
| 6.a.              | Page 14, line 1           | Modified for clarity.  |
| 7.                | Page 14. lines 6, 7       | Deleted in response to comments.   |

## CHAPTER I

## AUTHORITIES AND DEFINITIONS

...

Section 2. Definitions.

...

1. (9) "Subsidence" means the measureable lowering of a portion of the earth's
2. surface or substrata.

...

3. ~~(62)~~(70) "Injection Well" means, for the purposes of in-situ mining, a well or
4. conduit through which recovery fluid is introduced into the subsurface.
5. ~~(63)~~(71) "Monitor Well" means a well constructed or utilized to measure static
6. water levels or to obtain liquid, solid, or gaseous analytical samples OR OTHER PHYSICAL
7. DATA THAT WOULD BE USED for controlling operations and/or to indicate potential circum-
8. stances that could affect the environment.
9. ~~(64)~~(72) "Piezometric POTENTIOMETRIC Surface" means the surface that coincides
10. with the static level of water in an aquifer. The surface is represented by the
11. levels to which water from a given aquifer will rise under its full head.
12. ~~(65) -- "Radioactive Material" means any liquid or solid which may be naturally~~
13. ~~occurring but have been displaced or concentrated as a result of mining or processing~~
14. ~~and which spontaneously emit ionizing radiation at greater levels than those rep-~~
15. ~~resentative of the premining undisturbed terrestrial environment in the area of~~
16. ~~placement or disposal.~~
17. ~~(66)~~(73) "Receiving Stratum STRATA" means, for the purposes of in-situ mining, the
18. geologic unit in which recovery fluid(s) is injected or extracted WITHIN WHICH the pro-
19. duction zone is contained. ~~within this unit.~~

1.           (67)(74) "Recovery Well" means, for the purposes of in-situ mining, a well or
2. conduit through which a recovery fluid, mineral, or product is produced from the sub-
3. surface.
4.           (68)(75) "Well Field Area" means, for the purposes of in-situ mining, is the
5. surface area containing injection and recovery wells. This area may be all or a
6. portion of the entire area proposed for the injection and production of recovery
7. fluid throughout the life of the mine.
8.           (69)(76) "Uses for Which the Water was Suitable" means, with respect to in-situ
9. mining, those ~~potential~~ uses of the premining groundwater which are or could have
10. reasonably been developed considering established water quality standards ~~criteria-and~~
11. ~~recommendation~~ and the premining groundwater quality conditions. Such uses shall in-
12. clude, but are not limited to, municipal and domestic drinking water, industrial,
13. agricultural and wildlife uses.
14.           (77) "DETAILED SOIL SURVEY" MEANS A SOIL SURVEY WHERE EACH SOIL IS DEFINED
15. AND DELINEATED INTO MAPPING UNITS BASED UPON TAXONOMIC CHARACTERISTICS.
16.           (78) "LICENSE AREA" MEANS, WITH RESPECT TO AN IN-SITU RESEARCH AND DEVELOPMENT
17. TESTING LICENSE, AN AREA DESCRIBED IN THE LICENSE APPLICATION WITHIN WHICH ALL AFFECTED
18. LAND AND WATER IS CONTAINED.
19.           (79) "BACKGROUND" MEANS THE CONSTITUENTS OR PARAMETERS AND THE CONCENTRATIONS
20. OR MEASUREMENTS WHICH DESCRIBE WATER QUALITY AND TRENDS AND WATER QUALITY VARIABILITY
21. PRIOR TO A SUBSURFACE DISCHARGE.

CHAPTER XIV  
IN SITU MINING

1. Section 1. General Requirements.

2. a. In addition to the requirements of this Chapter, Chapter I, Chapter II except-  
3. ing Sections 1.a. ~~and~~ 2, 2,4.c. AND d., Chapter III excepting Sections 3 through 5  
4. AND 7 THROUGH 11, Chapter IV, EXCEPT WITH RESPECT TO SECTION 2, RECLAMATION SHALL  
5. BE COMPLETED WITHIN TWO (2) YEARS FOLLOWING GROUNDWATER RESTORATION, Chapter VIII,  
6. EXCEPTING SECTION 6, AND CHAPTER XI ~~and Chapter XI through XIII~~ of these regulations  
7. shall apply to in-situ mining OPERATIONS. APPLICABLE SECTIONS IN CHAPTERS VIII AND IX,  
8. WATER QUALITY DIVISION RULES AND REGULATIONS SHALL ALSO APPLY TO IN-SITU MINING OPERA-  
9. TIONS.

10. b. ~~Prior to the commencement of an in-situ mining operation, an application~~  
11. ~~shall be filed in triplicate with the Administrator for an In-Situ Mining Permit~~  
12. ~~or a Research and Development Testing License. These applications shall be sub-~~  
13. ~~mitted on forms provided or approved by the Administrator.~~ NO IN-SITU MINING OPERA-  
14. TION SHALL COMMENCE OR BE CONDUCTED UNLESS A VALID MINING PERMIT OR LICENSE HAS BEEN  
15. ISSUED TO THE OPERATOR FROM THE DEPARTMENT. APPLICATIONS FOR AN IN-SITU MINING  
16. PERMIT OR RESEARCH AND DEVELOPMENT LICENSE SHALL BE FILED WITH THE ADMINISTRATOR.  
17. THE APPLICANT SHALL SUBMIT SIX (6) COPIES OF THE APPLICATION TO THE ADMINISTRATOR,  
18. THREE OF WHICH SHALL BE FORWARDED AND FILED WITH THE ADMINISTRATOR OF THE WATER  
19. QUALITY DIVISION. APPLICATIONS SHALL BE MADE ON FORMS AND IN A FORMAT REQUIRED BY  
20. THE DEPARTMENT.



1. ~~er--The Administrator may approve in accordance with W.S. 35-11-404(g) the con-~~  
2. ~~struction and completion of wells to satisfy the requirements of Section 2.(b) of~~  
3. ~~this Chapter prior to the issuance of an in-situ mining permit or a research and~~  
4. ~~development test license.~~

5. -d: c. The administrator THE LAND QUALITY DIVISION AND WATER QUALITY DIVISION  
6. shall review the in-situ mining permit OR LICFNSE application and determine its  
7. completeness in accordance with W.S. 35-11-406(e). If the Administrator rejects  
8. the application because it is incomplete, reasons for the rejection shall be pro-  
9. vided ~~by the Division~~ IN WRITING BY THE ADMINISTRATOR. A SINGLE PERMIT SHALL BE  
10. ISSUED BY THE DIRECTOR UPON THE RECOMMENDATIONS OF THE ADMINISTRATOR OF THE LAND  
11. QUALITY DIVISION AND WATER QUALITY DIVISION.

12. ~~e. d. Any OperatorS who possesses~~ HAVING an in-situ mining permit or license ~~to~~  
13. ~~mine shall comply with the requirements of this Chapter by~~ ISSUED BEFORE THE EFFEC-  
14. TIVE DATE OF THESE REGULATIONS SHALL, BY NO LATER THAN May 25, 1980, PRESENT EVI-  
15. DENCE DEMONSTRATING COMPLIANCE WITH THE REQUIREMENTS OF W.S. 35-11-426 THROUGH W.S. 35-  
16. 11-436. THE ADMINISTRATOR SHALL REVIEW SUCH EVIDENCE AND SHALL AS SOON AS PRACTICABLE  
17. ADVISE THE OPERATOR IN WRITING OF SUCH ADDITIONAL INFORMATION OR PROCEDURES NECESSARY  
18. TO SATISFY THE PROVISIONS OF THIS CHAPTER AND OF W.S. 35-11-426 THROUGH W.S. 35-11-436.

19. -f: e. The operator shall VERBALLY report any CONFIRMED excursion to the Adminis-  
20. trator within 24 hours, and shall submit within seven (7) days, THEREAFTER a written  
21. report to the Administrator OF THE LAND QUALITY DIVISION AND THE WATER QUALITY DIVI-  
22. SION detailing the procedures for mitigating or controlling the excursion. The  
23. Administrator may AFTER CONSULTATION WITH THE DIRECTOR AND ADMINISTRATOR OF THE WATER  
24. QUALITY DIVISION, terminate or modify the mining operation if an excursion is not  
25. controlled within 60 days following the ~~detection~~ CONFIRMATION of the excursion.  
26. An excursion is contolled when the movement of recovery fluid OUT OF THE PRODUCTION  
27. ZONE AND into ~~unwarranted and~~ unauthorized areas has ceased.

1. f. ALL WELLS AND DRILL HOLES RESULTING FROM IN-SITU MINING OPERATIONS SHALL
2. BE ABANDONED IN ACCORDANCE WITH CHAPTER XV OF THESE REGULATIONS AND W.S. 35-11-404.

3. Section 2. Permit Applications.

4. All applications for an in-situ mining permit shall ~~demonstrate that the~~
5. ~~mining operation is designed to minimize, to the extent safe and practicable, dis-~~
6. ~~turbances and adverse impacts of the operation on human or animal life, fish, wildlife,~~
7. ~~plant life and related environmental values. The application shall contain:~~

8. a. All information and materials required pursuant to W.S. Section 35-11-
9. 406(a)(i) through (vi), (viii) through (xiv), AND W.S. Section 35-11-406(b) ~~(xi)~~,
10. (x) THROUGH (xii), and:

11. b. ~~A description of~~ CONSISTENT WITH THE EXTENT AND NATURE OF THE PROPOSED SURFACE
12. DISTURBANCE, A DESCRIPTION OF the land, AND CONSISTENT WITH THE APPLICABLE IN-SITU
13. TECHNOLOGY A DESCRIPTION OF THE geology and groundwater hydrology including:

14. (1) The past, present, and proposed post-reclamation use of the land,
15. groundwater and surface water.

16. (2) A ~~low-intensity~~ soil survey which maps and describes the general
17. distribution of the soils within the permit area. A ~~high-intensity~~ DETAILED soil
18. survey and associated laboratory analysis may be required for soils on the affected
19. lands.

20. (3) A description of the nature and depth of the topsoil that will be re-
21. moved from proposed affected land prior to disturbance by mining activities.

22. ~~(4) A description of the natural radioactivity of lands to be used for~~
23. ~~the storage or radioactive materials or where radioactive contamination may reasonably~~
24. ~~be expected to occur during the mining and/or reclamation operations. The methods used~~
25. ~~to determine natural radioactivity shall be described.~~

1. (10) Locations and present owners of all existing water wells IN USE within  
2. the permit area ~~and-for-a-three-(3)-mile-area-adjacent-to-the-permit-area-with~~ AND ON  
3. ADJACENT LANDS, INCLUDING A DESCRIPTION OF well completion data, producing interval(s),  
4. and variations in water level to the extent such information is available in the public  
5. records and from a reasonable inspection of the property. ~~The-applicant-shall-provide~~  
6. ~~a-description-of-the-well-or-drill-hole-completion-and-plugging-procedures-for-any~~  
7. ~~well-of-public-record-that-penetrates-the-receiving-stratum~~ THE ADMINISTRATOR MAY  
8. REQUIRE A MAPPING OF ALL WELLS FILED WITH THE STATE ENGINEER'S OFFICE TO A DISTANCE  
9. OF THREE (3) MILES FROM THE PERMIT AREA.

10. (11) A tabulation of all abandoned wells and drill holes, giving location,  
11. depth, type of use, condition of casing, plugging procedures and date of completion  
12. for each well or drill hole within the permit area and ~~for-a-three-(3)-mile-area~~  
13. ~~adjacent-to-the-permit-area~~ ON ADJACENT LANDS to the extent such information is  
14. available in public records and from a reasonable inspection of the property.

15. (12) A groundwater ~~piezometric~~ POTENTIOMETRIC surface contour map ~~with-data~~  
16. ~~points-and-static-water-level-measurements~~ for EACH aquifer that ~~exist-in-the-receiving~~  
17. ~~strata-and-all-other-aquifers-which~~ may be affected by the mining process.

18. (13) Aquifer characteristics for the water saturated portions of the  
19. receiving strata and ~~overlying-aquifers-throughout-the-proposed-well-field-area(s)~~  
20. AQUIFERS WHICH MAY BE AFFECTED BY THE MINING PROCESS, WHICH MAY include but IS not  
21. limited to, aquifer thickness, velocity and direction of groundwater movement,  
22. ~~aquifer~~ storage coefficient ~~and/or~~ specific yield, ~~aquifer~~ transmissivity ~~and~~ OR  
23. hydraulic conductivity and THE direction(s) of preferred flow under hydraulic stress  
24. in the saturated zones of the receiving strata. The extent of hydraulic connection  
25. between the receiving strata and overlying and underlying aquifers, and the hydraulic  
26. characteristics of any influencing boundaries in or near the proposed well field  
27. area(s) shall be determined AND DESCRIBED.

1. (14) ~~Geologic logging data, core analyses, and other test data necessary~~
2. ~~to substantiate geologic and hydrologic interpretations.~~
3. ~~(15)~~(14) Tabulated water quality analyses ~~for samples collected from all~~
4. ~~groundwaters in hydraulic communication with the production zone and/or~~ which may be
5. ~~affected by recovery fluid injection~~ THE PROPOSED OPERATION. ~~Numbers of samples and~~
6. ~~frequency of sampling shall sufficiently characterize the premining groundwater quality~~
7. ~~and its variability.~~ SAMPLING TO CHARACTERIZE THE PREMINING GROUNDWATER QUALITY AND
8. ITS VARIABILITY SHALL BE CONDUCTED IN ACCORDANCE WITH ESTABLISHED DEPARTMENT GUIDELINES.
9. c. A mining plan containing all information ~~pursuant to~~ REQUIRED BY W.S. Section
10. 35-11-406(b)(viii), (XIII), (xiv), AND (xvi) ~~through (xviii);~~ and CONSISTENT WITH THE
11. APPLICABLE IN-SITU TECHNOLOGY:
12. (1) A description of the PROPOSED method of operation, ~~to~~ including injection
13. pressures, ~~and volume~~ INJECTION RATE and type of recovery fluid to be used.
14. (2) Contour map(s) which accurately locate and identify the permit area
15. and show the location of any public highways, dwellings, utilities and easements
16. within the permit area and adjacent lands in relation to all PROPOSED affected lands
17. and PROPOSED activities associated with the operation including, but not limited to:
18. plant site, chemical storage areas, well field areas, monitor wells, roads, temporary
19. and permanent drainage diversions, impoundments, stockpiles for topsoil, ore pro-
20. duct and waste, and all processing facilities.
21. (3) A map(s) which shows the PROPOSED sequence for mining and reclamation.
22. (4) The procedures utilized to verify that the injection and recovery
23. wells are in ~~hydraulic~~ communication with monitor wells COMPLETED IN THE RECEIVING
24. STRATA AND employed for the purpose of detecting excursions.
25. (5) The procedure(s) ~~utilized~~ to insure that the installation of recovery,
26. injection, and monitor wells will not result in hydraulic communication between the
27. production zone and overlying stratigraphic horizons.

1. (6) A schedule and procedures to ~~periodically~~ check for ~~leakage-from~~
2. ~~recovery-and~~ MECHANICAL INTEGRITY OF injection wells PRIOR TO INJECTION AND AT A
3. MINIMUM OF EVERY FIVE (5) YEARS OF USE.
4. (7) The procedure(s) used to protect the topsoil from excessive compaction,
5. degradation, and wind and water erosion when stockpiling of topsoil is necessary.
6. (8) A subsidence analysis, using established ~~engineering~~ GEOTECHNICAL princi-
7. ples, which estimates BASED UPON THE PROPOSED MINING OPERATION the effect of subsidence upon
8. the land surface and OVERLYING groundwater aquifers. ~~overlying-the-mineral-as-a-result~~
9. ~~of-the-proposed-mining-operation.~~ Subsidence shall be planned and controlled to the
10. extent that the values and uses of the surface land resources and the groundwater
11. aquifers will not be degraded.
12. (9) COMPLETION DETAILS FOR ALL MONITOR WELLS AND a detailed description of
13. the typical proposed well completion for ~~each-type-of-well-utilized.~~ The description
14. for injection AND recovery and monitor wells. ~~shall-include,-but-is-not-limited-to,-the~~
15. ~~average-minimum-and-maximum-total-depth-expressed-as-elevations,-typical-open-interval~~
16. ~~and-range-expressed-as-elevations,-type-of-completion,-and-casing-specifications.~~
17. (10) A description of all impoundments including ~~construction-and~~ A design
18. PLAN ~~details,-the~~ AND FOR IMPOUNDMENTS CONTAINING WASTES A leakage monitoring PLAN.
19. Repair procedures and contingency plans in the event of leakage for impoundments
20. holding toxic OR acid forming ~~or-radioactive~~ materials SHALL BE PROVIDED.
21. (11) A description of all temporary and permanent ~~diversions-for~~ surface
22. water ~~including-construction-and-design-details~~ DIVERSIONS IN ACCORDANCE WITH THE
23. REQUIREMENTS OF CHAPTER III, SECTION 1. AND 2. OF THESE REGULATIONS.
24. (12) The composition of all known and anticipated wastes ~~residues~~ and pro-
25. cedures for their disposal.

1. (13) Procedures for insuring that all acid forming, OR toxic and radioactive  
2. materials or other materials constituting a fire, health or safety hazard encountered  
3. during or created by the mining process are promptly treated, confined or disposed  
4. of in a manner designed to prevent pollution of surface or subsurface water, de-  
5. gradation of soils and vegetation, or threats to human or animal health safety.

6. (14) A description of chemical reactions that may occur during mining as  
7. a result of recovery fluid injection. ~~and-that-may-change-groundwater-quality-in-the~~  
8. ~~receiving-strata-within-the-outside-the-production-zone-and-in-other-aquifers.~~

9. (15) Details of ~~and-time-schedules-for-a-continuous-monitoring~~ A program TO  
10. MONITOR THE QUANTITY AND QUALITY OF WATERS THAT MAY BE AFFECTED BY THE OPERATION from  
11. premining through release of bond ~~to-detect-pollution-of-the-waters-of-the-State-that~~  
12. ~~may-result-from-any-excursions,-migration-of-by-products-resulting-from-in-situ-chemical~~  
13. ~~reactions-with-recovery-fluids,-or-any-other-mining-and-restoration-activity~~ INCLUDING A  
14. DESCRIPTION OF PROCEDURES AND TIME SCHEDULES USED TO CONFIRM EXCURSIONS.

15. (16) A description of all measures employed to prevent an excursion, and  
16. contingency plans to be implemented in the event of an excursion.

17. (17) ~~The-location-and-depth-of-the-stratigraphic-horizon(s)-which-will~~  
18. ~~be-monitored.--If-the-applicant-proposed-not-to-monitor-the-aquifer(s)-underlying~~  
19. ~~the-production-zone,-it-shall-be-documented-that-underlying-groundwaters-are-pro-~~  
20. ~~tected-by-an-adequate-intervening-thickness-of-strata-yielding-negligible-hydraulic~~  
21. ~~communication-with-the-receiving-stratum.~~

22. (18) An assessment of impacts that may reasonably be expected as a result  
23. of the mining operation to water resources and water rights inside the permit area  
24. and on adjacent lands and the steps that will be taken to mitigate these impacts.

25. (19) Description of the mitigating measures used during mining to mini-  
26. mize disruption of important habitats and migration routes of wildlife.

1. d. A reclamation plan containing all information pursuant to W.S. Section 35-  
2. 11-406(b)(ii), (iv), (xv), (xix), and CONSISTENT WITH THE APPLICABLE IN-SITU TECH-  
3. NOLOGY:

4. (1) The information necessary to demonstrate that the operation will re-  
5. turn all affected groundwater, INCLUDING AFFECTED GROUNDWATER WITHIN THE PRODUCTION  
6. ZONE, RECEIVING STRATA, AND ANY OTHER AREAS, to a condition such that its quality of use  
7. is equal to or better than, and consistent with the uses for which the water was  
8. suitable prior to the operation by employing the best practicable technology. Such  
9. a demonstration shall be made by showing that THROUGH THE EMPLOYMENT OF THE BEST  
10. PRACTICABLE TECHNOLOGY, AS DEFINED IN W.S. 35-11-103(f)(1):

11. (a) The condition and quality of all affected groundwater will be  
12. returned to ~~the quality existing prior to commencement of the operation for all water~~  
13. ~~quality parameters, or~~, BACKGROUND OR BETTER, OR:

14. (b) The requirements of Section 2.d. (1)(a) cannot be achieved, and  
15. ~~that~~ IN THIS EVENT the condition and quality of all affected groundwater will AT A  
16. MINIMUM be returned to a quality of use equal to ~~or better than~~ and consistent with  
17. uses for which the water was suitable prior to the commencement of the operation; ~~or~~

18. ~~(c) The requirements of Section 2.d. (1)(a) and (b) cannot be achieved~~  
19. ~~and that the condition and quality of all affected groundwater will be returned to a~~  
20. ~~quality of use justifiable in terms of what can be achieved through the performance of~~  
21. ~~existing and available technology as related to that condition and quality which is~~  
22. ~~necessary to assure that protection of the public health and safety.~~

23. ~~(2) The information necessary to demonstrate that the operation will not~~  
24. ~~adversely affect the uses for which the groundwater outside of the production zone~~  
25. ~~was suitable.~~

1. ~~(3)~~--Estimates-of-chemical-concentrations-that-will-be-elevated-above-pre-
2. mining-water-quality-conditions-and-that-will-persist-in-the-groundwater-after-mining.
3. The-applicant-shall-identify-in-situ-chemical-reactions-that-may-hinder-or-enhance
4. reclamation-and-demonstrate-that-the-techniques-used-to-achieve-groundwater-restora-
5. tion-are-appropriate-for-the-recovery-fluid-injected-and-are-suitable-when-considering
6. the-known-receiving-stratum-hydraulic-and-geochemical-properties.
7. ~~(4)~~(2) The-standards-and-procedures-used-to-achieve-a-condition-of-ground-
8. water-restoration. IN ACCORDANCE WITH SUBSECTION (1) OF THIS SECTION, THE CONDITION
9. OF THE GROUNDWATER THAT WILL BE ACHIEVED UPON RESTORATION AND THE PROPOSED PROCEDURES
10. TO ACHIEVE SUCH RESTORATION.
11. ~~(5)~~--Procedures-for-plugging, sealing, capping, or the abandonment-of-all
12. wells-associated-with-the-mining-activity-in-accordance-with-Chapter-XV-of-these
13. regulations.
14. ~~(6)~~(3) A contour map showing the approximate post-reclamation surface contours
15. for affected lands and THE immediately surrounding areas IF THE NATURE AND EXTENT
16. OF THE OPERATION MAY SUBSTANTIALLY ALTER THE PREMINING CONTOURS.
17. ~~(7)~~(4) Procedures for reestablishing any surface drainage that may be
18. disrupted by the mining operation.
19. ~~(8)~~(5) Procedures for the reclamation of any temporary diversion ditches or
20. impoundments.
21. ~~(9)~~(6) Procedures for permanently disposing of any toxic OR acid forming or
22. radioactive materials.
23. ~~(10)~~ ( 7 ) Procedures for removing and disposing of all structures used in con-
24. junction with the mining operation.
25. ~~(11)~~ ( 8 ) Procedures for mitigating or controlling the effects of subsidence.



## Appendix "D"

1. ~~{12}--Procedures-used-to-conduct-a-postmining-radiological-survey-in-areas~~  
 2. ~~where-radioactive-materials-are-to-be-stored-or-disposed-of,-or-where-radioactive-~~  
 3. ~~contamination-may-occur-during-mining-or-reclamation-operations,-and-a-description~~  
 4. ~~of-decontamination-methods-to-be-used-for-all-areas-where-radioactive-contamination~~  
 5. ~~is-reasonably-expected-to-occur-~~

6. {13} (9) Procedures for ground surface preparation, depth of topsoil replace-  
 7. ment, erosion control and water conservation practices.

8. {14} (10) Procedures for revegetation so as to return the affected lands to  
 9. the proposed postmining land use in accordance with Chapter II, Section 5.

10. {15} (11) A PROPOSED time schedule for achieving reclamation.

11. {16} (12) The estimated cost of reclamation AS COMPUTED IN ACCORDANCE WITH ES-  
 12. TABLISHED ENGINEERING PRINCIPLES, ~~for-the-first-year-of-mining~~ including but not  
 13. limited to:

14. (a) Cost of removing and disposing of all structures.

15. (b) Cost of topsoiling and reseeding all affected lands.

16. (c) Cost of facilities, materials, and chemicals used for  
 17. groundwater restoration.

18. (d) Cost of capping, plugging, and sealing of all wells.

19. Section 3. Annual Report. ~~Operators-of-an~~ In-situ mining OPERATORS shall submit  
 20. annual reports containing all information required by W.S. § 35-11-411, and:

21. a. A map(s) showing the location of all wells installed in conjunction with  
 22. the mining activity and showing all areas where:

23. (1) Groundwater restoration has been achieved, is actively taking place  
 24. and is EXPECTED to commence during the next year.

25. (2) Mining is EXPECTED to commence during the next year.

1.           b. The total quantity of recovery fluid injected and the total quantity of
2. recovery fluid extracted during the reporting period for each well field area ~~and~~
3. ~~the-mechanism-for-determining-these-quantities~~ INCLUDING A DESCRIPTION OF HOW THESE
4. QUANTITIES WERE DETERMINED.
5.           c. Monitoring program results pursuant to Section 2.c. ~~(13)~~ (15) of this
6. Chapter including ~~collar-height, total-depth-and-open-interval-expressed-as-elevations~~
7. A MAP AND DESCRIPTION OF ALL EXCURSIONS, THEIR LOCATIONS AND EXTENT, THAT OCCURED
8. DURING THE REPORTING PERIOD. COMPLETION DETAILS SHALL BE INCLUDED for all monitor
9. wells installed during the previous year.
10.           d. An updated ~~piezometric~~ POTENTIOMETRIC surface map(s) ~~based-upon-recent-site~~
11. ~~specific-measurements-for~~ all aquifer(s) that ARE OR may be affected by ~~mining-activity~~
12. THE MINING OPERATION.
13.           e. Supporting data ~~for-areas-where-groundwater-restoration-has-been-achieved~~
14. ~~during-the-previous-year~~ SUFFICIENT TO DEMONSTRATE GROUNDWATER RESTORATION IN ACCOR-
15. DANCE WITH SECTION 2.d.(4) OF THIS CHAPTER.
16. Section 4. Research and Development Testing License Application. An application
17. for a Research and Development Testing License shall contain all information pursuant
18. ~~to~~ REQUIRED BY W.S. § 35-11-431, and shall:
19.           a. Demonstrate that the operation is designed to:
20.               (1) Evaluate mineability or workability of a mineral deposit using in-
21. situ mining techniques.
22.               (2) Affect the land surface, surface waters and groundwater of the State
23. to the minimum extent necessary.
24.               (3) Provide premining, operational and postmining data, information and
25. experience that will be used for developing reclamation techniques for in-situ mining.

1. b. Contain a general description of the land, geology and groundwater hydrology
2. for the proposed license area including:
3. (1) The LAND USE, ~~vegetative-cover~~, VEGETATION, AND topsoil characteristics
4. ~~location-and-name-of-present-surface-waters;-and-adjudicated-water-rights-for~~ OF THE
5. ~~affected-areas~~ LANDS.
6. (2) LOCATION AND NAME OF SURFACE WATERS AND ADJUDICATED WATER RIGHTS
7. INSIDE AND WITHIN  $\frac{1}{2}$  MILE OF THE LICENSE AREA.
8. ~~(2)~~(3) Locations and present owners of all wells inside and within one-half
9. ( $\frac{1}{2}$ ) mile of the license area to include information concerning plugging and well com-
10. pletion AND producing interval(s) to the extent such information is available in the
11. public record or by a reasonable inspection of the property.
12. ~~(3)~~ (4) Groundwater quality data and ~~piezometric~~ POTENTIOMETRIC surface
13. elevations for aquifers that may be affected by ~~recovery-fluid-injection~~ THE PROPOSED
14. OPERATION.
15. Section 5. Prohibitions. Permittees and licensees shall not INJECT RECOVERY FLUID
16. INTO ANY ZONE OR INTERVAL OTHER THAN THAT DESCRIBED IN THE APPROVED PERMIT OR LICENSE.
17. ~~a. Discharge-into-an-uncased-open-hole-above-or-below-the-production-zone;~~
18. ~~b. Inject-any-substances-other-than-air-or-clean-water-between-the-wall-of~~
19. ~~the-hole-and-casing-in-the-hole-except-in-the-production-zone;~~
20. ~~c. Inject-recovery-fluid-into-any-zone-or-interval-other-than-that-represented~~
21. ~~as-the-production-zone-in-the-approved-permit-or-license;~~
22. Section 6. MAINTENANCE OF RECORDS AND Chemical Analysis. THE OPERATOR SHALL MAINTAIN
23. RECORDS AT THE MINE SITE IN ACCORDANCE WITH W.S. 35-11-430(b) AND all chemical analyses
24. submitted to the Administrator in accordance with a valid permit or license shall in-
25. clude:

January 15, 1980

1. a. A description OF or reference for the procedures and methods used for sample
2. collection, preservation, analysis and quality control.
3. b. The name, address, and telephone number of the laboratory performing the
4. analyses, the job identification number and the date the analyses were performed.
5. Section 7. Confidential Records. Information submitted to satisfy the requirements
6. of this Chapter may be held confidential pursuant to W.S. 35-11-1101(a). ~~provided that~~
7. ~~this request is renewed every five (5) years~~

THE STATE



OF WYOMING

ED HERSCHLER  
GOVERNOR

## *Department of Environmental Quality*

LAND QUALITY DIVISION

HATHAWAY BUILDING

TELEPHONE 307-777-7756

CHEYENNE, WYOMING 82002

February 25, 1980

TO WHOM IT MAY CONCERN:

Attached is a draft copy of the proposed Department Guideline for preparation of a research and development in situ testing license. Eventually this guideline will be expanded to also cover applications for a permit to mine (commercial scale operations). The guideline has been developed by this Division in cooperation with Water Quality Division to be consistent with the final in situ regulations which were promulgated by the Environmental Quality Council on January 23, 1980. I solicit your comments on the draft guideline. Comments should be forwarded to this office by May 1, 1980, to the attention of Gary Beach.

Following consideration of comments and recommendations received, a final draft shall be prepared and made available.

Sincerely,

A handwritten signature in cursive script that reads "W. C. Ackerman".

Walter C. Ackerman  
Administrator

WCA:sh

# DRAFT

WYOMING DEPARTMENT OF ENVIRONMENTAL QUALITY  
LAND QUALITY DIVISION  
GUIDELINE NO. 4

IN-SITU MINING

This document is a guideline only. Its contents are not to be interpreted by applicants or DEQ staff as mandatory. Its preparation is the result of numerous requests from applicants who expressed a need for a check-list to assist them in preparation of a comprehensive application containing all required information.

I. INTRODUCTION

A. The guideline follows the following format:

Part I: Introduction.

Part II: Adjudication File.

Part III: Supportive Information: Research and Development License.

Part IV: Supportive Information: Permit to Mine. (not complete)

Appendices:

Appendix 1: Specialized Information for Uranium Solution Mining.

Appendix 2: Specialized Information for Coal Gasification Operations.  
(not complete)

Appendix 3: Specialized Information for In-Situ Trona Mining.(not complete)

Appendix 4: Specialized Information for Hydraulic Bore Hole Mining.  
(not complete)

Appendix 5: Specialized Information for Oil Shale Projects. (not complete)

B. Supporting Documents.

Prior to resource inventory or development of an in-situ application, the applicant should review the following documents which can be obtained from the Land Quality Division upon request:

1. 1973 Wyoming Environmental Quality Act (as amended).
2. 1978 Land Quality Division Rules and Regulations.

**DRAFT**

3. Land Quality Division Guidelines.

- No. 1 - Soil and Overburden.
- No. 2 - Vegetation.
- No. 3 - Parameters for Determining Soil Suitability.
- No. 5 - Wildlife.
- No. 8 - Hydrology.
- No. 10 - Fencing.

C. Application Format.

A single application (consisting of 6 copies) for a permit to mine or a research and development testing license should be submitted to the Administrator of the Land Quality Division. It should consist of two sections. The Land Quality Division and the Water Quality Division will concurrently review the application and a single permit or license will be granted upon the approval of both Administrators of the two Divisions.

The first section of the application is the adjudication file, containing the "Permit to Mine" and "License to Mine" forms, bonds, notification, receipts, and consent forms, and Appendicies A through C. The adjudication file should be submitted in a loose form and not be bound.

The second section of the application contains supporting information. Data for this section should be submitted in loose leaf ? ring binders to allow easy substitution of pages for revisions or additions. It should be printed on 8½ x 11 inch paper with standard margins and page numbers on all pages. The paper should be about 20 pounds and of good quality. All figures and tables larger than 8½ x 11 inches should be folded to fit into the application and should be physically attached to the appropriate location in the application. All figures and tables should be numbered and referenced in the text.

D. Definitions for Purposes of the Guideline.

1. "Aquifer" A zone, stratum, a group of strata that can store and transmit water in sufficient quantities for a specific use.
2. "Area of Review" The area for which information and analyses will be submitted as part of a groundwater pollution control permit application, and reviewed for issuance of a permit; the extent of the area will never be less than an area within a one-quarter (¼) mile radius of the discharge site. The area of review may coincide with a permit area and adjacent lands, or may be determined by use of a mathematical model and formula which have been developed to describe groundwater hydraulics and flow. (Reference Water Quality Division Rules and Regulations, Chapter IX for the formula).
3. "Background" The constituents or parameters and the concentrations or measurements which describe water quality and water quality variability prior to subsurface discharge.

4. "Best Practicable Technology" A technology based process justifiable in terms of existing performance and achievability in relation to health and safety which minimizes, to the extent safe and practicable, disturbances and adverse impacts of the operation on human or animal life, fish, wildlife, plant life and related environmental values.
5. "Detailed Soil Survey" A soil survey where each soil is defined and delineated into mapping units based upon taxonomic characteristics.
6. "Excursion" Any unwanted and unauthorized movement of recovery fluid out of the production zone as a result of in situ mining activities.
7. "Groundwater Restoration" The condition achieved when the quality of all groundwater affected by the injection of recovery fluids is returned to a quality of use equal to or better than, and consistent with the uses for which the water was suitable prior to the operation by employing the best practicable technology.
8. "Injection Well" A well or conduit through which recovery fluid is introduced into the subsurface.
9. "In Situ Mining" A method of in-place surface mining in which limited quantities of overburden are disturbed to install a conduit or well, and the mineral is mined by injecting or recovering a liquid, solid, sludge, or gas that causes the leaching, dissolution, gasification, liquefaction or extraction of the mineral. In situ mining does not include the primary or enhanced recovery of naturally occurring oil and gas or any related process regulated by the Wyoming Oil and Gas Commission.
10. "License Area" An area described in the license application within which all affected land and water is contained.
11. "Monitor Well" A well constructed or utilized to measure static water levels or to obtain liquid, solid, or gaseous analytical samples or other physical data that would be used for controlling the operation or to indicate potential circumstances that could affect the environment.
12. "Potentiometric Surface" The surface that coincides with the static level of water in an aquifer. The surface is represented by the levels to which water from a given aquifer will rise under its full head.
13. "Production Zone" The geologic interval into which recovery fluids are to be injected or extracted.



14. "Recovery Fluid" Any material which flows or moves, whether semi-solid, liquid, sludge, gas or other form or state, used to dissolve, leach, gasify or extract a mineral.
15. "Recovery Well" A well or conduit through which a recovery fluid, mineral, or product is produced from the subsurface.
16. "Research and Development Testing" Conducting research and development activities to indicate mineability or workability of, and develop reclamation techniques for, an in situ operation.
17. "Subsidence" The measurable lowering of a portion of the earth's surface or substrata.
18. "Well Field Area" The surface area containing injection and recovery wells. This area may be all or a portion of the entire area proposed for the injection and production of recovery fluid throughout the life of the mine.
19. "Uses for Which the Water was Suitable" The uses of the pre-mining groundwater which are or could have reasonably been developed considering established water quality standards and the pre-mining groundwater quality conditions. Such uses shall include, but are not limited to, municipal and domestic drinking water, industrial, agricultural and wildlife uses.

## II. ADJUDICATION FILE

The adjudication file is required for all applications and should be submitted in duplicate to the Division. Form 5 for a Research and Development License, and Form 7 (currently being developed) for an in-situ permit to mine application, contain a listing of the information that should be within this file.

## III. SUPPORTIVE INFORMATION - RESEARCH AND DEVELOPMENT TESTING LICENSE

### A. Introduction.

The following format assumes the operator will be eventually applying for an in situ permit, and that the Research and Development license will be used to justify future techniques proposed for mining and reclamation.

The Research and Development License application should precisely describe all nonresearch aspects of the operation, as requested in Parts III.B. through D. Part III.E. is reserved for the research project; a detailed outline of the proposed research is requested. During the experiments, accurate records of the experiments should be kept by the operator.

Background data collection, Part III.B, should emphasize the site-specific environment of the area of review. Information should be provided to demonstrate that areas outside the area of review will not be affected by the operation.

B. Appendix D - Application Contents.

1. Appendix D-1, Past and Present Land Use of the Area
2. Appendix D-3, Archaeological and Paleontological Resources of the Area
3. Appendix D-4, Climatology

Climatological data from the past year should be obtained from the nearest NOAA station to the license area.

4. Appendix D-5, Geologic Assessment.

- a. The regional geology should be briefly described using published information.
- b. The geology in the area of review should be identified using geologic cross-sections and should be confirmed with geophysical logs. A 1 acre well field may be described with one north/south and one east/west trending section. Guideline 8 (Part IV.A.1. and Part IV.A.5.d.) may be referenced for the information and the level of detail suggested for the cross-sections. The production zone should be identified on the cross-sections. When applicable, the depositional environment should be discussed, and cores should be used to define the percent of clay in the production and confining zones, in addition to chemical analyses.

5. Appendix D-6, Hydrology.

- a. Methods to identify the groundwater system within the area of review and reporting procedures may be referenced in Guideline 8, (Part IV.A.).
- b. Potentiometric surfaces with sufficient data points to define affected aquifers both spatially and temporally should be submitted. Piezometer and well identification methods may be found in Guideline 8 (Part IV.A.5.). The potentiometric surfaces should be superimposed on topographic maps of sufficient scale for analysis.
- c. Groundwater background quality (following the parameter list, collection methods, and reporting procedures of Guideline 8, Part IV.A.4., IV.A.5.c., and Appendix 2) should be thoroughly defined for the area of review. Groundwater quality background data should be collected for a sufficient length of time to identify any important spatial and time variant properties of the affected aquifers, to clearly show the pre-mining hydrogeochemistry of the area, and to identify existing or anticipated impacts of adjacent mines on the groundwater quality within the license area. Consultation with the appropriate regulatory authorities is recommended prior to the beginning of a program.

A representative number of samples should be collected for each affected aquifer. The number of samples necessary to define groundwater quality varies with the area to be studied. For deeper, confined aquifers, a minimum of four sets of split samples per well is recommended. More samples will be necessary for semiconfined aquifers and for shallow, water table aquifers which may react quickly to seasonal changes and to surface affects. Sampling frequency may be reduced once a reasonable description of seasonal changes or long term trends has been achieved. Sampling should be free of field and laboratory error. The reliability of the data should be evaluated as part of the data gathering program.

- d. Multiwell pump tests are encouraged to define aquifer properties. The testing should be designed to define aquifer properties within the affected area, hydrologic boundary conditions, layering effects, directional permeability, and the vertical confinement of the production zone. Transmissivity data should be of sufficient detail to confidently identify axes of directional transmissivities in the production zone. Testing and reporting procedures may be found in Guideline 8 (Parts IV.A.3., and IV.A.5.B). Prior to any pump test, a discharge permit should be obtained from the Water Quality Division.

- e. Water Rights.

A list and a map of all adjudicated water rights inside and within one-half mile of the license area boundary should be provided. The locations and present owners of all wells within  $\frac{1}{2}$  mile of the license area (including plugging and well completion and producing intervals) should be provided.

- f. Surface water quality and quantity should be monitored only if the surface or the alluvial water quality and quantity of the stream could be affected by the mining operations. The contributing drainage area to the license area should be mapped and its acreage identified.

#### 6. Appendix D-7, Soil Assessment.

- a. For surface disturbance of ten acres or less within the license area, the following soils information should be submitted:
  - 1) A soil inventory and suitability map should be provided with soil units and affected lands clearly outlined.
  - 2) Soil mapping unit and profile descriptions should be provided.

- 3) Quantitative estimates of all suitable topsoil should be made for those areas where significant disturbance will occur (i.e. building construction or well field leveling).
  - b. For surface disturbances greater than ten acres within the license area, more detailed soils information should be provided.
7. Appendix D-8, Vegetation Inventory.
    - a. A description of vegetation should be provided. If greater than 80 acres of land will be affected, quantitative measurements should be made as described in Guideline 2.
    - b. Original black and white photos of vegetation should be placed in the application.
  8. Appendix D-9, Wildlife (see Guideline No. 5).
    - a. Actual vertebrate distribution on license area should be described. Habitat affinity of animals on the license area, and an identification of unique habitat types on the area should be submitted.
    - b. The occurrence of rare, threatened, or endangered species or eagles on or within  $\frac{1}{2}$  mile of the license area should be noted.

C. Minerals Extraction Plan

1. Introduction.

A Research and Development License application should include the experimental techniques to be tested and a prediction of the results expected. During mining, on-site data collection should be in sufficient detail so that an analysis may be performed on the predictions made in the application. The experiments and predictions could include: performance of equipment under operating conditions, well completion, well development and boring techniques, excursion prediction and control, lixiviant chemistry, identification of best restoration methods, testing of mining methods, testing waste disposal methods, subsidence research, or any other research topics. The license area should be limited to the minimum acreage possible.

2. General Discussion.

A general discussion and description of the operation should first be written. The discussion should identify the goals of the operation, the life of the project, the mineral to be mined, the mining methods, equipment to be used for mining, and any research and development activities to be tested during the operation. The proximity of mineral, oil, gas or other resources that could be affected by the operation should be identified in this section. A topographic map identifying the license area should be provided.

### 3. Site Preparation Activities.

- a. A location map identifying all areas of surface disturbance should be submitted. The map should be superimposed on a topographic map of sufficient detail to accurately locate topsoil and spoil stockpiles, erosion and sediment control methods, support facilities, ore storage areas, well fields, hydrologic control features (septic systems, diversions, evaporation ponds, culverts, etc.), roads, power and telephone lines, all waste disposal sites, including plans and locations, and fencing or other surface control methods.
- b. A description and a timetable identifying the extent of topsoil removal, the depth of removal, and the quantity of topsoil in each stockpile should be included. Any other surface disturbances, appropriate timetables, and the dimensions of other stockpiles should be described.
- c. Mitigating measures that are to be taken to alleviate impacts to wildlife should be placed in the application.
- d. The designs and engineering of surface water hydrologic control features should be placed within this section. (Reference Guideline 8, Part III). Appropriate permits should be obtained from the Water Quality Division.

### 4. Production Process and Timetables.

- a. Fluid and chemical flow paths.

The anticipated fluid flow paths identifying the fluid volume and composition during the separate stages of the mining operation should be diagrammed and described. The major chemical reactions or physical processes anticipated at each step in the process should be described.

This section should identify the composition and daily average and maximum volume of the recovery fluid to be injected, both prior to its injection and during its recovery. Special process reactions, such as reverse osmosis, burn initiation, or high pressure water injection should also be identified in this section. The anticipated volume and composition of all waste waters or materials generated by the mining operation should be described.

b. Surface hydraulic equipment.

A map locating the typical configuration of the piping planned for the well field area, and a description of the system should be submitted. Pipe and pump specifications should be described. A map should locate pressure relief valves, critical bends, and other fixtures or areas of hydraulic stress. Typical interconnections between cells should be described in a similar manner. Surface piping should be planned to allow access of drilling equipment.

c. Production zone location.

A series of geologic cross-sections (reference Part III.B.5.) should be used to accurately locate the limits of the production zone in three dimensions. Any anticipated geochemical reactions that may occur between the recovery fluid and the production zone should be described.

d. Production zone confinement.

Down hole injection pressures should be identified, including the average and maximum daily injection pressure. The fracture pressure of the production zone and any confining zones surrounding the production zone should be defined. Referencing fracture information and data received from the pump tests, the extent of lithologic confinement of the production zone should be identified. Special techniques that may be used for production zone confinement should also be described. The effect of high injection pressures caused by pressure surge or other accidents on the confinement of the production zone should be identified.

e. Well completion, development, and redevelopment techniques.

Well drilling techniques and equipment should be described; the drilling fluid should be identified and its composition analyzed. The methods and materials to be used for well completion, including casing type, jointing and specifications, grouting methods, and the information requested in Guideline 8 (Part IV.A.5.a.) should be reported for all production and injection wells. Well development methods and any anticipated well redevelopment methods should be thoroughly described.

f. Mechanical integrity of wells.

A schedule and procedures to check the integrity of all injection and production wells should be provided. A yearly review is recommended.

5. Excursions.

a. Introduction.

Excursion detection, control, and cleanup procedures should be identified in this section, considering both horizontal and vertical excursions. The monitoring network should be described and parameters used to detect and confirm excursions should be identified.

b. Monitoring network.

The monitoring network used for excursion detection should be outlined. Piezometers or wells should be installed in aquifers above, within, and below the production zone, and should be used for describing mining techniques and identifying excursions from the production zone. Monitor well spacings should reflect directional transmissivity and other conditions identified through on-site pump tests.

The monitoring network should be superimposed on a topographic map identifying the well field area. Identification of wells and reporting format should follow Guideline 8 (Part IV.A.5.a.). The extent of the ore zone, and faults and other hydrogeologic boundaries should be identified on the map.

c. Parameters.

A parameter set should be developed for the detection of excursions. Excursion parameters are process specific and should be referenced in the appropriate appendix of this guideline.

d. Corrective actions.

The license should describe the actions to be implemented to correct and control an excursion event. The actions should be identified for both horizontal and vertical excursions.

e. Reporting procedures (Reference Rules and Regulations).

In the event of an excursion, the Division should be notified within 24 hours. A plan outlining appropriate corrective actions should be outlined within the license. Record keeping methods and responsibilities should also be described.

6. Subsidence.

An estimate of the amount of subsidence and a monitoring plan should be outlined in the license application, when appropriate for the operation.

7. State Permits.

Copies of appropriate state and federal permits should be placed in the license application.

D. Reclamation Plan.

1. Aquifer restoration.

a. Introduction.

Aquifer reclamation activities, including procedures, chemistry and the expected final water quality should be briefly summarized. The timetables of restoration activities should be discussed.

b. Methodology.

Aquifer restoration procedures should be detailed in this section. Process description and chemistry should be specifically described. Fluid flow paths should be described, and burn temperature and residual matter identified, if applicable. Special process reactions, such as reverse osmosis, should also be described in this section. The anticipated volume and composition of waste generated during reclamation should be identified.

c. Subsidence monitoring.

The subsidence monitoring program initiated during baseline studies should continue until reclamation is achieved, if applicable.

d. Monitoring water quality.

The wells to be used for monitoring and describing final water quality should be identified and mapped. Wells anticipated to be used for monitoring that have not been identified in Part III.B.6. and III.C.4.b. should be identified in this section.

2. Surface Restoration.

a. Post-mining land use.

The proposed post-mining land use should be specified.

b. Disposal of buildings and other facilities.

The plan should include procedures for disposing of buildings and other facilities.



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c. Hazardous wastes.

The procedures for reclaiming hazardous waste disposal areas should be provided in detail.

d. Topography.

The plan should demonstrate that affected lands will blend with adjacent topography and land uses and that drainages will be re-established.

e. Surface preparation.

The plan should indicate any surface preparation to be undertaken before topsoiling. Topsoil replacement methods and schedules should be included. Minimum depth of topsoil replacement should be specified. Any erosion control practices and addition of soil amendments that are planned should be indicated.

f. Revegetation.

The plan for revegetation should include species to be seeded, rate of seeding, and method and time of seeding. If cover crops, mulch, or irrigation will be used, this should be discussed in detail including methods and timing, rates, locations, and water quality.

g. Protection of newly seeded areas.

The plan should include measures and specifications to be used for protecting newly revegetated areas from grazing animals.

3. Reclamation schedule and cost.

The plan should include a schedule for reclamation and costs broken down by different types of disturbance and different phases of reclamation work. Costs should be based on reclaiming the entire affected area after the first year as if the mine were to shut down at that time and be completely reclaimed including the removal of all facilities.

E. Research Section.

1. Introduction.

The research and development license is available to allow testing of new technology or tried technology in a new geologic setting. Therefore, operations under the license should identify procedures to be tested and evaluated.

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The purpose of this section is to identify the research aspects of the research and development license. This section is meant to justify the areas in the license within Parts C and D where exact procedures, timetables, methods, or results cannot be more than generally described.

2. Identification and Description.

A description of each research area proposed in the mine and reclamation plan should be written. The description should define the anticipated techniques to be tested, the expected manner of implementation of the techniques, and the expected results.

3. Records and Reportings.

A plan should outline the records that will be kept by the operator to identify the procedures actually used in the research areas and to identify the precise dates and times those procedures were implemented. For example, record keeping of the chemical composition of fluids, the volumetric water balance, injection pressures and volumes, burn intervals, and other standard operating procedures should be described in an efficient technical manner. The daily logs describing normal operational procedures may be reviewed by Division personnel upon site visitation. In addition, record keeping procedures of specific research tests should be described. At the conclusion of a research program, a report, including the description (written in Part 2, above), instrumentation, procedures, results, and conclusions may be written from these logs. The research logs should be affixed to the reports.

F. Reporting Procedures.

A plan for submitting technical summaries of research results, on-going research, and the present status of the operation should be submitted as described in the license application and Rules and Regulations. At the cessation of operations, the operator should submit a final technical report of all research results, logs, procedures, conclusions, etc., to the Division of those topics identified in Part III.E. and all new research activities described in all modifications or amendments.

G. Confidential Material.

Materials or records requests for confidential status will be reviewed pursuant to W.S. 35-11-1101.

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WYOMING DEPARTMENT OF ENVIRONMENTAL QUALITY  
LAND QUALITY DIVISION  
GUIDELINE NO. 4

APPENDIX 1

SPECIALIZED INFORMATION FOR URANIUM SOLUTION MINING

I. GROUNDWATER QUALITY BASELINE INTERPRETATION (MINE PERMIT ONLY)

A. Introduction.

The information gathered from the groundwater quality background study requires interpretation and analysis. This section assumes that temporal and spatial differences in aquifer units will cause noticeable zones of similar groundwater quality within a single aquifer. Thus, a procedure is introduced to separate continuous aquifer units areally into zones.

B. Removal of Outliers.

1. Introduction.

An outlier is a single value that lies far above or below the rest of the sample values for a single well. The outlier may represent a sampling, analytical, or another unknown source of error. Its inclusion within the baseline data would significantly change the sample results, for the outlier is not typical of the bulk of the samples.

There is no hard and fast method to determine outliers, recognizing that for small sample size their evaluation must be judgemental. However, rules of thumb described below may eliminate some points from further consideration. In any case, all calculations and assumptions made by the applicant in evaluating outliers should be fully explained. When an outlier has been discarded, it may be necessary to take another sample to replace the discarded sample.

2. Procedures.

Quantitative evaluation of outliers is difficult when only a few data points are available. One rule of thumb is to accept any suspicious data which cannot be positively linked to sampling or analytical error. Another method is to accept any value within three standard deviations of the mean. For a normally distributed set of values, three standard deviations encompass 99.7% of all variation in the population. The standard deviation should be calculated without using the suspected outliers. This method is semi-empirical; other documented methods will be considered in the evaluation of outliers.

C. Aquifer Water Quality Zones.

Based on groundwater quality information and geologic and hydrologic interpretation, a distinct picture of the groundwater quality of the single aquifer should emerge. The picture may describe zones of similar water quality within the single aquifer. The zones should be identified on a topographic map for each aquifer that may be affected by mining. The average water quality for each zone and the range of each parameter in the zone should be tabulated.

All parameters identified in Guideline 8, Appendix 2 should be used to delineate the zones. Piper, Stiff, or other diagrams, comparison of means and variance, and parameter ratios are suggested comparative tools for zone identification.

D. Classification of Water Quality Zones.

Final classification of groundwater will be made by the Water Quality Division.

II. EXCURSION STATISTICS

A. Introduction.

The rapid detection of an excursion event and the ability to quickly locate the source of the excursion is desirable from both the operational and environmental points of view. This section introduces the parameters that could be used both to detect excursions and to identify their control. The section also addresses appropriate statistical methods that may be used to identify the excursions.

B. Parameters.

1. Introduction.

The parameter set used to detect excursions should consist of a mixture of both conservative and non-conservative elements so that an excursion may be detected quickly, traced accurately, and the amount of the contamination in the excursion area accurately identified. As a suggestion, five parameters may be placed in this set.

2. Excursion Detection.

The parameters used primarily to detect excursions should be conservative, introduced in the injection fluid in high concentration, and should be present initially in low concentrations in the aquifer. For example, chloride, sulfate, electrical conductivity, bicarbonate, or sodium (depending on site specific information and the lixiviant) may be relatively repeatable and consistent excursion detection parameters. The operator may consider placing a conservative tracer in the recovery fluid and using the tracer as one of the parameters.

An excursion is detected and confirmed following the procedures of Part II.C.4. of this Appendix.

### 3. Excursion Control.

The parameter set should be used to mark the control and conclusion of an excursion event. Thus, the parameter set should include two or more nonconservative elements that would rise in concentration after the initial discovery of the excursion. For example, depending on the operation, uranium, ammonia, or carbonate may be elements in the set.

In addition, toxic elements not included in the parameter set such as selenium, nitrate/nitrite, radium or other parameters should be routinely monitored at a lesser frequency during an excursion. The operator should identify these parameters and the monitoring frequency.

## C. Control Limits.

### 1. Introduction.

This section presents a statistical technique to determine control limits for excursion detection and control parameters. The control limits are numerical values, which, when reached, indicate an excursion is in progress. The statistical technique assumes that a parameter, when sampled, follows a normal distribution with mean ( $\mu$ ) and standard deviation ( $\sigma$ ), which may be approximated by a sample size of "n" with a mean ( $\bar{x}$ ) and standard deviation (s). The technique assumes independence of sampling events.

### 2. Definition.

The mean ( $\bar{x}$ ) and standard deviation (s) of two small samples taken from an infinite population that is assumed to be normally distributed only approximates the actual mean ( $\mu$ ) and standard deviation ( $\sigma$ ) of the infinite population. For this reason, functions were developed for the normal distribution to show how close the estimated mean ( $\bar{x}$ ) and standard deviation (s) are to the real thing. One function, called the Student's "t" distribution, may be used to identify the possible range of values that the true mean ( $\mu$ ) may have. The range is described as a "confidence interval", representing the probability that the true mean ( $\mu$ ) lies within the range.

## 3. Procedures.

- a. To accurately identify the background for each parameter to be used as an excursion indicator, an adequate number of samples should be taken from each of the wells to be used for excursion monitoring over a one year period. For a Research and Development license, it is recommended that twenty samples be split on a quarterly basis. For a permit to mine, the appropriate regulatory authorities should be consulted. Given that there are no temporal variation in the sampled parameter, the mean and the standard deviation of these samples for each well should be calculated.
- b. The Student's "t" distribution should be applied. The derivation and further explanation of the Student's "t" may be found in most introductory statistics texts (one reference is found below Table 1). The control limit is found in the following manner:

$$\text{Control Limit} = \bar{x} \pm t_{n-1;\alpha} (s/\sqrt{n})$$

Where:

$$\bar{x} = (\sum_{i=1}^n x_i) / n, \text{ the mean,}$$

t = random variable (found in Table 1),

$\alpha$  = level of significance,

n = number of samples and,

$$s^2 = \sum_{i=1}^n (x_i - \bar{x})^2 / (n-1)$$

## c. Application.

The 95% confidence interval is suggested to be used to define the control limit. Two potential applications are possible.

- 1) For most parameters chosen as excursion indicators, the control limit should be defined only as the larger value, or as;

$$\bar{x} + t_{m;\alpha} (s/\sqrt{n})$$

Where m = n-1

$$\alpha = (1-0.95) = 0.05$$

- 2) If pH is chosen as an excursion indicator, the 95% confidence limits are defined as being;

$$\bar{x} \pm t_{m;\alpha} (s/\sqrt{n})$$

Where:  $m = n-1$

$$\alpha = (1-0.95)/2 = 0.025$$

The " $\alpha$ " values calculated above are applicable only to a Student's " $t$ " formula integrated as shown on Table 1. Student's " $t$ " tables in other books may use a different " $\alpha$ ".

#### 4. Excursion Occurrence.

If two or more of the excursion detection parameters fall out of the 95% confidence interval, a second sample set for each parameter should be taken within 24 hours. The sample set should be split to detect any analytical error. If the second sample set also falls out of the 95% confidence interval, an excursion has occurred and the Divisions should be notified immediately, following procedures described in the appropriate Rules and Regulations.

Samples should then be taken daily. An excursion may be considered "controlled" when no appreciable increase of excursion indicators are seen over a certain time period. An excursion is concluded when all the parameters of the conclusion parameter set have fallen below or within their upper control limit.

### III. GROUNDWATER QUALITY RESTORATION

#### A. Introduction.

This section introduces groundwater restoration criteria and goals. For both the Research and Development license and the Permit to mine the restoration goal is background water quality. For the Permit to mine only, if background concentration of certain elements cannot be achieved, criteria of restoration are established. The criteria are based on the present or potential economic use of the water by the individual water user.

#### B. Establishment of Restoration Targets.

1. For all operations, the operator should first set attainable targets for groundwater restoration. The restoration target list could be reinforced by precise characterization of the geology, clays, and anticipated chemistry (recommended for the Research and Development license) or by using on-site data that specifically demonstrates those restoration goals (recommended for commercial operations).

2. For all operations, the operator should demonstrate that the operation employs the best practicable technology available to restore groundwater quality to background.
3. For a Permit to mine only, an element by element comparison of the restoration target list and the background groundwater quality should be made for all groundwater quality zones previously identified. The elements of restoration that are of higher concentration than the background elements should be identified.
4. For a Permit to mine, if, when employing the best practicable technology, one or more elements on the restoration target list exceed background, the operator should thoroughly justify the above background concentration. An element which cannot be returned to background or a better quality should be returned to a concentration which will allow the water to be suitable similar to the pre-mining use. Domestic use suitability is determined by ambient water quality, and the technical practicability and economic reasonableness of treating ambient water quality to meet use suitability standards. The following items are recommended restoration targets, dependent on the background groundwater quality.
  - a. Restoration results in a return to background groundwater quality for all elements.
  - b. The background groundwater quality is suitable for domestic use without treatment.
    - 1) If "a" cannot be achieved, the groundwater should be returned to a domestic use suitability.
  - c. The background groundwater quality is suitable for domestic use after the use of economic treatment devices, such as a conventional water softner.
    - 1) If "a" cannot be achieved, the groundwater should be returned to a domestic use suitability consistent with the economic reasonableness of the treatment required for the pre-mining groundwater quality.
  - d. Groundwater is an existing source of supply irrelevant of the quality.
    - 1) If "a" cannot be achieved, the groundwater should be returned to a condition of pre-mining use suitability considering items "b" and "c" above.
  - e. The background groundwater quality does not fall within categories "b" through "d".
    - 1) If "a" cannot be achieved, the groundwater should be returned to a condition of pre-mining use suitability.



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Table 1:  
Percentage Points of the t Distribution\*

| $m \backslash \alpha$ | .25   | .1    | .05   | .025   | .01    | .005   |
|-----------------------|-------|-------|-------|--------|--------|--------|
| 1                     | 1.000 | 3.078 | 6.314 | 12.706 | 31.821 | 63.657 |
| 2                     | .816  | 1.886 | 2.920 | 4.303  | 6.965  | 9.925  |
| 3                     | .765  | 1.638 | 2.353 | 3.182  | 4.541  | 5.841  |
| 4                     | .741  | 1.533 | 2.132 | 2.776  | 3.747  | 4.604  |
| 5                     | .727  | 1.476 | 2.015 | 2.571  | 3.365  | 4.032  |
| 6                     | .718  | 1.440 | 1.943 | 2.447  | 3.143  | 3.707  |
| 7                     | .711  | 1.415 | 1.895 | 2.365  | 2.998  | 3.499  |
| 8                     | .706  | 1.397 | 1.860 | 2.306  | 2.896  | 3.355  |
| 9                     | .703  | 1.383 | 1.833 | 2.262  | 2.821  | 3.250  |
| 10                    | .700  | 1.372 | 1.812 | 2.228  | 2.764  | 3.169  |
| 11                    | .697  | 1.363 | 1.796 | 2.201  | 2.718  | 3.106  |
| 12                    | .695  | 1.356 | 1.782 | 2.179  | 2.681  | 3.055  |
| 13                    | .694  | 1.350 | 1.771 | 2.160  | 2.650  | 3.012  |
| 14                    | .692  | 1.345 | 1.761 | 2.145  | 2.624  | 2.977  |
| 15                    | .691  | 1.341 | 1.753 | 2.131  | 2.602  | 2.947  |
| 16                    | .690  | 1.337 | 1.746 | 2.120  | 2.583  | 2.921  |
| 17                    | .689  | 1.333 | 1.740 | 2.110  | 2.567  | 2.898  |
| 18                    | .688  | 1.330 | 1.734 | 2.101  | 2.552  | 2.878  |
| 19                    | .688  | 1.328 | 1.729 | 2.093  | 2.539  | 2.861  |
| 20                    | .687  | 1.325 | 1.725 | 2.086  | 2.528  | 2.845  |
| 21                    | .686  | 1.323 | 1.721 | 2.080  | 2.518  | 2.831  |
| 22                    | .686  | 1.321 | 1.717 | 2.074  | 2.508  | 2.819  |
| 23                    | .685  | 1.319 | 1.714 | 2.069  | 2.500  | 2.807  |
| 24                    | .685  | 1.318 | 1.711 | 2.064  | 2.492  | 2.797  |
| 25                    | .684  | 1.316 | 1.708 | 2.060  | 2.485  | 2.787  |
| 26                    | .684  | 1.315 | 1.706 | 2.056  | 2.479  | 2.779  |
| 27                    | .684  | 1.314 | 1.703 | 2.052  | 2.473  | 2.771  |
| 28                    | .683  | 1.313 | 1.701 | 2.048  | 2.467  | 2.763  |
| 29                    | .683  | 1.311 | 1.699 | 2.045  | 2.462  | 2.756  |
| 30                    | .683  | 1.310 | 1.697 | 2.042  | 2.457  | 2.750  |
| 40                    | .681  | 1.303 | 1.684 | 2.021  | 2.423  | 2.704  |
| 60                    | .679  | 1.296 | 1.671 | 2.000  | 2.390  | 2.660  |
| 120                   | .677  | 1.289 | 1.658 | 1.980  | 2.358  | 2.617  |
| $\infty$              | .674  | 1.282 | 1.645 | 1.960  | 2.326  | 2.576  |

\* That is, values of  $t_{m,\alpha}$ , where  $m$  equals degrees of freedom and

$$\int_{-\infty}^{t_{m,\alpha}} \frac{\Gamma[(m+1)/2]}{\sqrt{\pi m} \Gamma(m/2)} \left(1 + \frac{t^2}{m}\right)^{-(m+1)/2} dt = 1 - \alpha.$$

From: Guttman, Wilks, and Hunter, (1971). Introductory Engineering Statistics.  
John Wiley and Sons, Inc., 549 pp.

Use of Table: Read " $\alpha$ " value as row and " $m$ " value as column. The desired " $t$ " value is found at the meeting of the two.

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