40-8745

ALTAIR RESOURCES INC.

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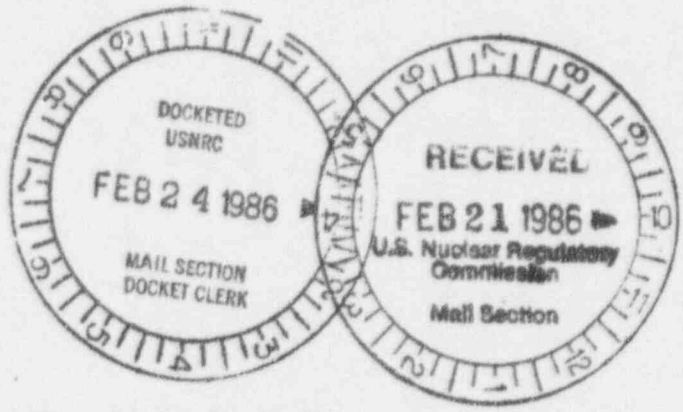
Casper, Wyoming 82609

February 19, 1986



Mr. Roger Shaffer
Administrator
Land Quality Division
Department of Environmental Quality
Herschler Building - Third Floor
122 West 25th Street
Cheyenne, WY 82002

RE: Bison Basin Mine
Permit to Mine #504

Subject: Draft Decommissioning Plan

Dear Mr. Shaffer:

In accordance with our earlier discussions, enclosed please find two copies of the draft decommissioning plan for the Bison Basin mine.

Please feel free to get in contact with me if you have any questions concerning the draft decommissioning plan.

Sincerely,

ALTAIR RESOURCES INC.

Glenn J. Catchpole
President and General Manager

GJC:csg

Enclosure

cc: George Pangburn, NRC, Denver, w/encl. (2 copies)
Mark Moxley, LQD, Lander, w/encl.
Tony Mancini, WQD, Cheyenne, w/encl.
R. H. Hall, Jr., Western Fuel, w/encl.
Harold Bloomenthal, w/encl.

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DRAFT

DECOMMISSIONING PLAN

for the

BISON BASIN IN-SITU

URANIUM MINE

Department of Environmental Quality
Permit To Mine No. 504

NRC Source Material License No. SUA-1396
Docket No. 40-8745

FREMONT COUNTY, WYOMING

FEBRUARY 19, 1986

340

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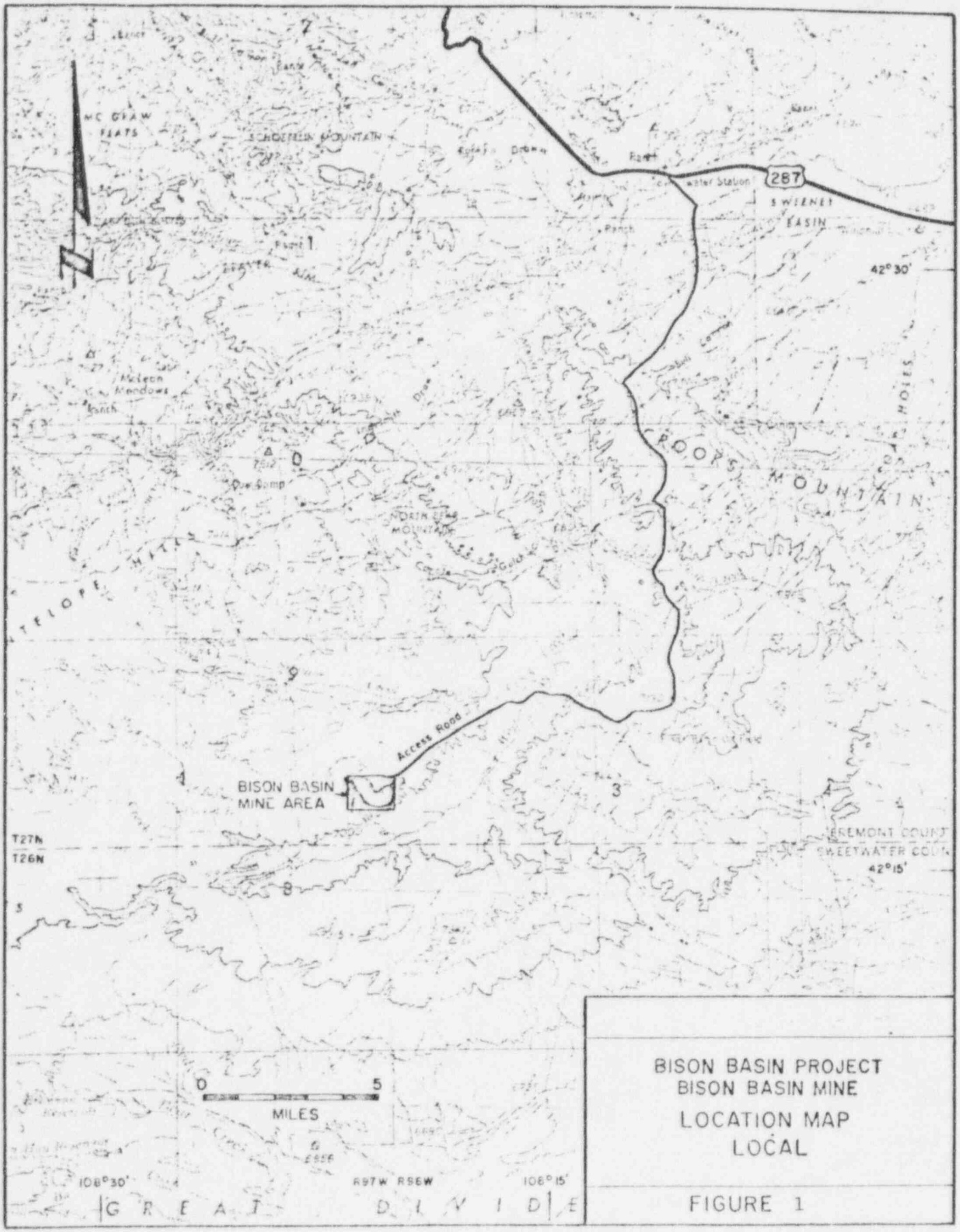
INTRODUCTION

The Bison Basin in-situ uranium mining facility is located in Southern Fremont County approximately 50 air miles south of Riverton, Wyoming. Access to the site is by the Bison Basin road which extends approximately 28 miles southward from U.S. highway 287 near Sweetwater Station (see figure 1). The permit area consists of all of section 25, T27N, R97W and the approximate west 1/4 of section 30, T27N, R96W.

A licensed research and development project was conducted in the permit area in 1979. The R & D test consisted of a 25 GPM plant circulating lixiviant through the uranium orebody within a one acre test area. The lixiviant used for the R & D test was sodium carbonate/bicarbonate, and the oxidant was oxygen injected down hole. The test work was successful in demonstrating the suitability of the orebody for both mineral extraction and aquifer clean-up using in-situ mining and restoration technology. NRC and DEQ approval of the R & D restoration effort is a matter of public record.

Following the successful completion of the R & D testing a commercial DEQ permit and NRC license were prepared and submitted to the respective agencies. In August, 1980 the Wyoming DEQ issued permit to mine No. 504 for the Bison Basin operation and in May, 1981 the NRC issued Source Material License No. SUA-1396 clearing the way for construction and start-up of a commercial sized facility. Solution mining pursuant to the above mentioned permit and license started in September, 1981 and continued for about one year with shutdown occurring in September, 1982 because



BISON BASIN PROJECT
BISON BASIN MINE
LOCATION MAP
LOCAL

FIGURE 1

of the depressed uranium market. During the approximate one year of operation using sodium carbonate/bicarbonate and oxygen, only mining unit No. 1 was operated.

Since shutdown in September, 1982 the plant and ancillary equipment have been maintained in a high state of readiness. The mine site has been manned 24 hours a day, 7 days a week since shutdown, and the plant and wellfield are in a condition that they can be placed in operation in 30 to 60 days, weather permitting. There has been no removal of critical equipment from the site. All required regulatory monitoring and reporting have been performed during the shut-down period.

SUMMARY

The decommissioning of the Bison Basin mine which consists principally of groundwater restoration, site and equipment decontamination, and surface reclamation should be performed in accordance with the approved reclamation and restoration plan contained in chapter 17 of the DEQ permit to mine, and in accordance with license condition 80 of the NRC Source Material License. The sequence of decommissioning activity as presented in Reference 8 should be as follows:

1. Groundwater Restoration
2. Wellfield Decommissioning and Decontamination
3. Plant and Ancillary Facilities Decommissioning and Decontamination
4. Evaporation Pond Decommissioning and Decontamination
5. Site Reclamation

The restoration of the mining unit No. 1 wellfield should consist of clean water recycle with the possible use of a reduc-

tant to help reduce heavy metal concentrations. Water treatment should be performed with a reverse osmosis (R.O.) unit or other agency approved equipment. Restoration water quality criteria should be the target values stated in the DEQ Permit to Mine and the NRC Final Environmental Statement (FES, NUREG-0687). These target values as well as stability period information and monitoring requirements are stated later in this plan.

The clean-up and disposal of equipment and structures should be in accordance with "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct or Source Materials" dated September, 1984 (Reference No. 7). Generally speaking the above document has an acceptable surface contamination level for natural uranium and decay products of 5000 dpmα/100 cm^2 fixed and 1000 dpmα/100 cm^2 removable. In accordance with EPA regulations, soils contamination cannot exceed 5 PiC/gram above background for the first 15 cm of depth and cannot exceed 15 PiC/gram above background below 15 cm in depth.

After groundwater restoration has been achieved and approved the permit specifies a six month stability period during which time the water quality must remain at or below the target values. Following the successful completion of the stability period the decommissioning of the evaporation ponds can start. Water in the ponds should be allowed to evaporate, and perhaps treatment and surface discharge should be utilized to expedite the dry out process. The radioactive residue remaining in the ponds, and the pond liners may then be shipped off site to an approved and NRC

licensed low level waste depository (tailings pond). The final decisions on disposal of contaminated material off-site as compared to safe on-site burial should be made later based on the availability of a disposal site within a reasonable distance of the mine, and the total amount of funds available for decommissioning. After pond site decontamination is complete the berms should be pushed into the depressions, recontouring to natural form should take place, topsoil should be replaced, and the area should be seeded with the approved reclamation seed mixture.

Salvageable equipment that can be decontaminated should be sold and removed from the site. Decontaminated equipment that cannot be sold should be buried on site or sold to an NRC licensed facility. Equipment that cannot be decontaminated should be shipped to another NRC licensed facility for use or disposal.

Site reclamation should consist of properly abandoning and plugging wells, disposing of all equipment and structures, and reestablishing natural vegetation on all affected lands. This action should return the land to its pre-mining use of wildlife and livestock grazing.

GROUNDWATER RESTORATION

General Plan

Groundwater restoration activity at the Bison Basin mine should consist of returning the affected water in mining unit No. 1 to its approximate pre-mining condition. The restoration should be accomplished by applying best practical technology in

the form of groundwater sweep, clean water recycle and/or possible use of reductants to reduce restoration parameters to the target restoration values (see table 1) stated in the DEQ Permit to Mine and the NRC FES.

The only groundwater that is affected by the solution mining activity that took place at the Bison Basin mine is within the production zone aquifer in mining unit No. 1. Figure 2 is a diagram of mining unit No. 1 showing monitor wells and restoration sampling wells locations. Mining unit No. 1 was the only mining unit that operated at the Bison Basin mine. Wells were installed in mining unit No. 2 but that wellfield was never operated; therefore, groundwater restoration activity will be restricted to the mining unit No. 1 production zone aquifer.

Site Description

The mining unit No. 1 wellfield covers an area of approximately 11 acreas and contains some 210 injection and recovery wells on about a 50 to 55 foot spacing in a 5-spot type pattern. The production aquifer in mining unit No. 1 average 380 feet below the land surface and is approximately 15 feet thick. The aquifer is under confined conditions with about 250 to 300 feet of head under natural conditions. It has a sustained yield of about 12 GPM and is very responsive to pumping in terms of drawdown at observation wells. Details on site specific geology and hydrogeology are contained in the DEQ permit and the NRC FES (References 11 and 9, respectively).

TABLE 1

TARGET RESTORATION VALUES
(Units: Mg/l Unless Otherwise Indicated)

PARAMETER	BASELINE RANGE[1]	LIVESTOCK CRITERIA[2]	DOMESTIC CRITERIA[2]	TARGET RESTORATION VALUES[3]
pH (pH Units)	8.09 to 11.4	6.5 to 8.5	6.5 to 8.5	6.5 to Baseline
TDS	1330 to 1812	5000	500	Baseline
Ammonia (as N)	0.07 to 2.9		0.5	Baseline
Nitrate (as N)	0.01 to 0.39	10.0	10.0	10.0
Nitrite (as N)	-0.01	1.0	1.0	1.0
Bicarbonate	0 to 190			500[4]
Carbonate	10 to 48			(Total Carbonate)
Calcium	12 to 62			500[4]
Chloride	9 to 52	2000	250	250
Boron	0.26 to 0.38	5.0	0.75	Baseline
Fluoride	0.66 to 1.2		1.4 to 2.4	Baseline
Magnesium	0 to 8			250[4]
Potassium	4.9 to 16			Baseline
Sodium	320 to 495			Baseline
Sulfate	725 to 1100	3000	250	Baseline
Aluminum	- 0.1	5.0		Baseline
Arsenic	-0.04	0.2	0.05	Baseline
Barium	-0.05		1.0	1.0
Cadmium	-0.02	0.05	0.01	Baseline
Chromium	-0.01	0.05	0.05	Baseline
Copper	-0.01	0.50	1.0	Baseline
Iron	0.01 to 0.13		0.30	Baseline
Lead	-0.05	0.10	0.05	Baseline
Manganese	-0.01		0.05	Baseline
Mercury	-0.001	0.00005	0.002	Baseline
Nickel	-0.05			Baseline
Selenium	-0.02	0.05	0.01	Baseline
Zinc	-0.01	25	5	5

Revised 03/24/80
Revised 05/20/80

TABLE 1
TARGET RESTORATION VALUES
Page Two

PARAMETER	BASELINE RANGE[1]	LIVESTOCK CRITERIA[2]	DOMESTIC CRITERIA[2]	TARGET RESTORATION VALUES[3]
Molybdenum	-0.05			Baseline
Vanadium	- 0.1	0.10		Baseline
Uranium (as U_3O_8)	0.001 to 0.04	5.0[5]	5.0[5]	5.0[5]
Radium 226 (pCi/1)	2.2 to 419.3	5.0[6]	5.0[6]	Baseline Plus Statistical Error

NOTES:

- means not detected at level indicated.

Underlined number means restoration value is higher than expected background concentration.

1. Based on existing data collected from nine wells completed in the mineralized portion of the ore zone aquifer (Well Nos. OP-140-TC, OP-141-TC, OP-135, OP-136, 303-6-P 7, 303-6-P 16, 303-6-P 19, 303-6-P 22, and 303-6-P 31).

2. Based on water quality standards presented in Appendix A of the DEQ Staff Analyses of Comments dated January 14, 1980 (Table I). Blank space means no criteria established.

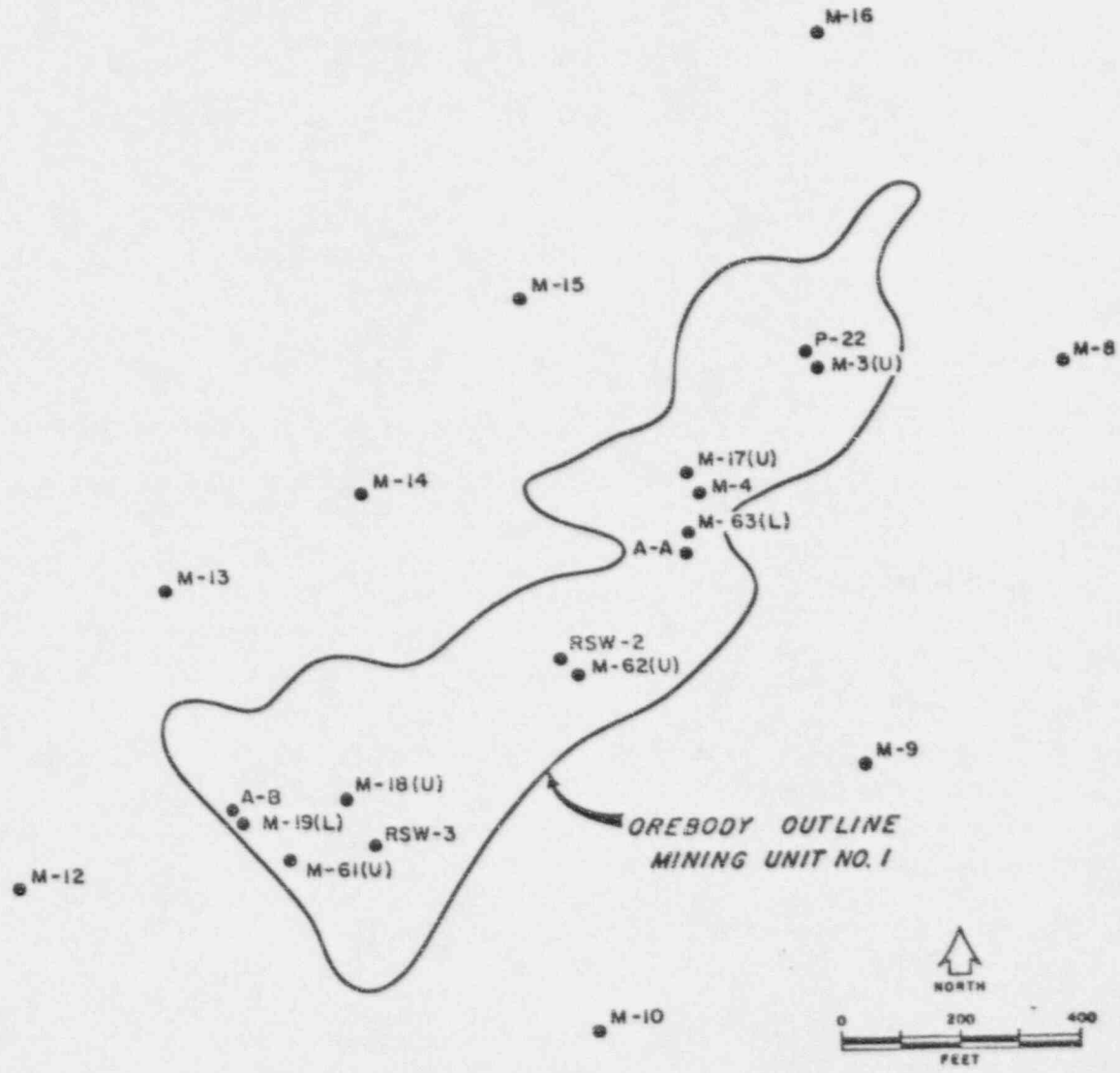
3. Baseline is defined for each parameter for a given mining unit as the highest value obtained from the three rounds of baseline sampling (four rounds if significant variation) collected from the restoration sampling wells within the mining unit. Radium 226, because of its extreme variation from one well to the next, is the one exception to the above described definition of baseline. Baseline for radium 226 will be on a well-by-well basis; therefore, radium 226 baseline is defined for each restoration sampling well as the highest radium 226 value obtained from the three rounds of baseline sampling (four rounds if significant variation). The DEQ reserves the option to go to a restoration sampling well-by-restoration sampling well basis for all parameters if there is significant water quality variation among the restoration sampling wells within a mining unit. In order to achieve restoration of a mining unit the average of the post-restoration values for each parameter (except radium 226) obtained from the restoration sampling wells during a sample round must be equal to or less than the target restoration value given in this Table. Radium 226 restoration is on a restoration sampling well-by-restoration sampling well basis.

4. Criteria based on U. S. Dept. of Commerce publication entitled "Monitoring Groundwater Quality Monitoring Methodology", National Technical Information Service, PB-256 0681, June, 1976, page 142.

5. All uranium data presented in this application are uranium as U_3O_8. Livestock and domestic criteria given in this Table for uranium and the restoration value of 5.0 mg/1 for uranium is on the basis of uranium as U. The conversion factor for converting uranium as U_3O_8 to uranium as U is 0.848.

6. Criteria for combined total of radium 226 and radium 228.

Revised 03/24/80
Revised 05/20/80



LEGEND

Horizontal Excursion Monitor Wells:

M- 8	M-11	M-14
M- 9	M-12	M-15
M-10	M-13	M-16

Upper Aquifer Vertical Excursion Monitor Wells:

M- 3(U)	M-18(U)	M-62(U)
M-17(U)	M-61(U)	

Lower Sands Vertical Excursion Monitor Wells:

M-19(L) M-63(L)

Restoration Sampling Wells:

P-22	RSW-2
M- 4	RSW-3

Additional Wells Completed in Production Zone as Observation Wells for Pump Tests (No Water Quality Baselining Required):

A-A A-B

BISON BASIN PROJECT
BISON BASIN MINE

MONITOR WELL LOCATIONS MINING UNIT NO. 1

DATE: 10/10/80

FIGURE: 2

Baseline Description and R& D Results

The baseline data from the four (4) restoration sampling wells in mining unit No. 1 (see appendix A) document that the water quality in the production zone aquifer is unsuitable for any use other than industrial primarily due to high pH and the high concentration of sulfate, sodium, and radium-226. In order to make the background groundwater in the mining zone suitable for either livestock watering, domestic uses or irrigation, it would be necessary to treat the water.

Restoration with respect to the 25 GPM R & D operation consisted of circulating the purified permeate from an R.O. unit through the mined production zone aquifer. The brine (or waste water) from the R.O. unit was routed to the evaporation pond. Water quality restoration criteria were achieved after circulating six (6) pore volumes of permeate through the aquifer. An additional two (2) volumes of permeate were circulated through the aquifer as an insurance measure bringing the total amount of circulation to eight (8) pore volumes.

The R & D restoration results clearly indicated that a return to background groundwater quality for all elements is neither technically practicable nor economically reasonable. The restoration requirements thus fall into the category described in the Land Quality Division regulations, Chapter XXI (Reference 10) which states that if a return of all elements (chemical species) to background groundwater quality cannot be achieved, the groundwater should be returned to a condition of pre-mining use suitability. The approved target restoration values (table 1) were developed on the basis of the above regulation.

In view of the poor natural groundwater quality at the Bison Basin mine a restoration target valve of greater than 5 mg/l for uranium is considered appropriate. A restoration target value for uranium corresponding to an industrial use situation would allow for a more optimal use of the limited decommissioning funds.

In accordance with the permit to mine, baseline is defined for each parameter as the highest baseline value obtained from the four (4) rounds of baseline sampling collected from the four (4) restoration sampling wells in mining unit No. 1. Based on the above definition the baseline values for each parameter can be determined for mining unit No. 1 by referral to Appendix A. Restoration for a particular parameter would be deemed successful when the average value for that parameter from the four restoration sampling wells is equal to or less than the target restoration value (see Table 1). For additional information on this subject the reader is referred to the DEQ Permit to Mine No. 504 (Reference No. 11).

Wellfield Operation and Pumping Plan

The wellfield operation and pumping plan is based on experience gained during the mining operations conducted in the mining unit No. 1 orebody aquifer. The number of wells that should be operating at any one time is dependent primarily on the size of R.O. unit (or other effective water treatment device) acquired for the restoration activities. The minimum size of the R.O. unit has been established at 115 GPM; however, a 300 GPM is

considered the most cost effective size assuming the R.O. unit purchased is new and sold at going retail rates. Based on an assumed R.O. unit size of 300 GPM, a total of 137 injection and 70 recovery wells should be used to circulate water through the wellfield with approximately 48% of the recovery wells located on the wellfield perimeter.

Allowing for possible contamination outside of the wellfield boundary the total affected area in mining unit No. 1 is estimated at 13 acres (11.7 acres plus 10%). Using 13 surface acres, one pore volume is calculated to be approximately 19 million gallons of water (13 acres x 43560 ft /acre x 15 ft aquifer thickness x 0.3 porosity x 7.48 gal/ft = 19.06 million gallons). The pore volume calculation of 17 million gallons in the DEQ permit did not include any affected area outside of the wellfield boundary. To circulate 19 million gallons through the wellfield at 300 GPM should take about 44 days. It is estimated that groundwater restoration should be achieved after circulating six (6) pore volumes; however, applying a safety factor of two (2) pore volumes it should take 352 days (about one year) to circulate eight pore volumes and assure successful restoration. Using a 85%/15% average split on permeate to brine ratio the R.O. unit will produce about 22.8 million gallons of waste liquid to discharge to the evaporation ponds. Considering the average evaporation rate (41 inches per year), the ponds surface area (7 acres) and the useable ponds storage volume (9 million gallons), it should be possible to handle about 17 million gallons of waste liquid. In order to accommodate the other 6 million gallons of waste it will be necessary to either increase the evaporation

rate (e.g. spray a mist into the atmosphere) or stop wellfield circulation for about two to three weeks to treat the water in the ponds with the R.O. unit and discharge the permeate on the surface. This action will require a NPDES permit from the Water Quality Division of the DEQ.

Once the target restoration values have been obtained, clean water recycle should be terminated, a final round of water samples should be collected from the four (4) restoration sampling wells and the six month required stability period should commence. If the water in the production zone aquifer remains at or below the target restoration values after the six months of stability the aquifer should be deemed restored and the next phase of decommissioning should commence.

If restoration of heavy metals become a problem the use of a reductant such as hydrogen sulfide should be investigated. Approval of any reductant should be obtained from the DEQ and the NRC prior to introduction of the chemical(s) into the injection stream. At this point based on a review of existing water quality data obtained from the mining unit No. 1 production zone aquifer by the Wyoming DEQ on September 9, 1985 (see appendix B), it does not appear that restoration of heavy metals will be a problem.

Plant and Water Treatment Unit Operation

The existing processing plant and support equipment will be heavily utilized during the groundwater restoration phase of the

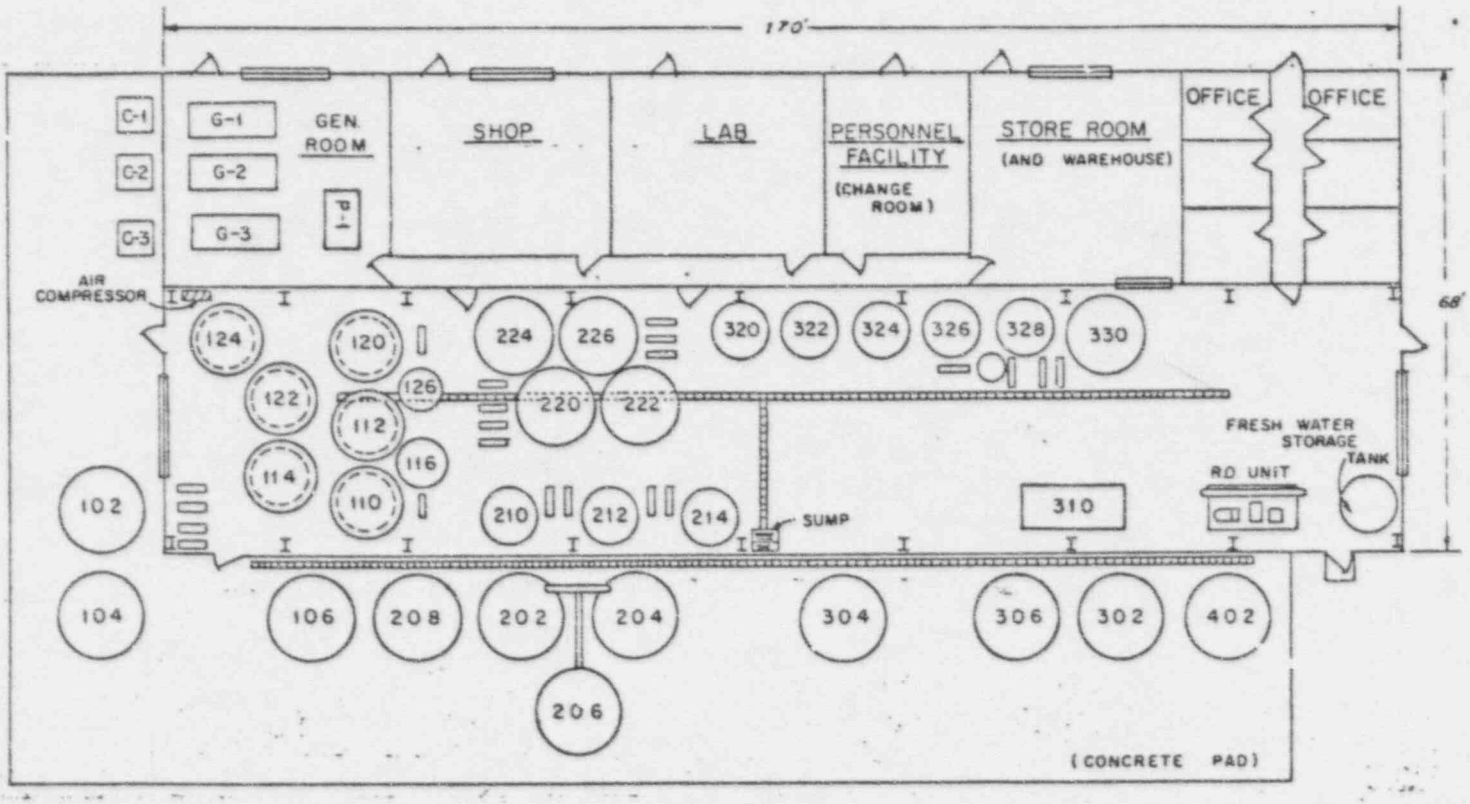
decommissioning activities. A diagram of the plant including tanks, pumps, laboratory, generators, etc. is presented in figure 3. Electrical power will be generated on site and the laboratory will be used to perform assays on water samples from the wellfield.

The solution from the wellfield will be routed to the recovery surge tanks via an 8" pipeline. From the recovery surge tanks the solution should be circulated through the ion exchange columns to remove uranium, and then the solution should be pumped through the sand filters to remove solids. Once the uranium concentration in the solution from the wellfield decreases to about 5 mg/l the solution need no longer be routed through the ion exchange columns. Uranium oxide collected during the restoration process should be precipitated, and placed in storage for ultimate shipment to market in slurry form.

After the solution from the wellfield has been filtered it should be pumped through an R.O. unit or other acceptable water treatment unit to reduce the contamination. The actual size of the water treatment unit may depend on the availability of used equipment; however, the unit should have a minimum capacity of 115 GPM. The clean water (permeate) from the R.O. unit will be returned to the wellfield via an 8" pipeline and injected back into the production zone aquifer. The waste stream (brine) from the R.O. unit will be routed via the buried 4" pipeline to the evaporation ponds.

Restoration Monitoring

The monitoring of groundwater quality for aquifer restora-



102, 104 } PRODUCTION SURGE TANKS

106 ACID TANK (SULPHURIC)

110, 112, 114, 120, 122, 124 } ION-EXCHANGE COLUMNS

116, 126 } ELUANT TRANSFER TANKS

202, 204 } INJECTION SURGE & MAKE-UP TANKS

206 SODA ASH STORAGE SILO

208 FILTER BACK WASH TANK

210, 212, 214 } SAND FILTERS

220, 222, 224, 226 } ELUTION TANKS

302, 304, 306 } PRODUCT STORAGE TANKS (CONE BOTTOM)

310 PRODUCT FILTER PRESS

320, 322, 324, 326, 328 } PRECIPITATION TANKS

330 CAUSTIC STORAGE TANK

402 ACID TANK (HYDROCHLORIC)

P-1 POWER DISTRIBUTION, GENERATOR CONTROL AND PARALLELING PANEL. (WIRED FOR ALL 3 GENERATORS.)

G-1, G-2, G-3 } CAT 350 KW GENERATOR SETS, NATURAL GAS FIRED, (G-1, G-2 INSTALLED, PAD ONLY FOR G-3)

C-1, C-2, C-3 } COOLING FANS FOR GENERATORS (C-1, C-2 INSTALLED, PAD ONLY FOR C-3)

PUMP

BISON BASIN PROJECT

COMMERCIAL PLANT GENERAL ARRANGEMENT

DATE: MAY, 1984

FIGURE: 3

tion purposes will be accomplished by utilizing the restoration sampling wells as stated in the approved mining permit. The restoration sampling wells are pre-selected injection and recovery wells that have been sampled prior to mining for the purpose of establishing area baseline water quality. These same restoration sampling wells will be sampled during the aquifer restoration phase to monitor and evaluate the restoration effort. In mining unit No. 1 the four restoration sampling wells are identified as P-22, M-4, RSW-2, and RSW-4. The locations of these wells are shown on figure 2. The baseline water quality data for the four restoration sampling wells are presented in Appendix A.

As discussed in the DEQ Permit to Mine (page 197A of Reference 1) and the NRC Source Material License (conditon No. 49), the restoration sampling wells will be sampled once a month and analyzed for the following six (6) UCL parameters:

Specific Conductivity
Total Bicarbonate Plus Carbonate
Chloride
Uranium (as U_3O_8)
Sodium
Sulfate

Once restoration criteria for the UCL parameters are met and water quality appears sufficiently stable, a verification round of samples will be collected from the restoration sampling wells and any other monitor wells previously on excursion. Verification round samples from the restoration sampling wells will be analyzed for all parameters on the long list, and verification round samples from other monitor wells previously on excursion will be analyzed for the six (6) UCL parameters. If analyses of

the verification round samples confirm that restoration criteria have been met then the six month stability period will have started at the time restoration ceased.

During the six month stability period the same wells sampled in the verification round will be sampled monthly and analyzed for the same parameters as the verification round. Additionally, one upper aquifer and one deep sand excursion monitor well will be sampled monthly and analyzed for the six (6) UCL parameters. If the water quality data collected during the six month stability document that the restoration criteria are still met then the mining unit No. 1 aquifer will be deemed successfully restored.

WELLFIELD DECONTAMINATION AND DECOMMISSIONING

All above ground equipment located in the wellfield, all drop pipe and down hole electrical cords and equipment, and all submersible pumps used in mining unit No. 1 should be surveyed for radioactive contamination. Reference 7, the NRC "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct or Source Materials" dated September 9, 1984 will be used for establishing release limit criteria. Wellfield equipment that is not contaminated and wellfield equipment that is decontaminated should either be sold or buried on site. Wellfield equipment that cannot be decontaminated should be transported off-site to an NRC licensed waste disposal facility (tailings pond).

The initial check for contamination of surface and down hole wellfield equipment should consist of an alpha count survey. If

contamination is present a swipe survey should be made to determine the level of activity of removable contamination. Piping that is contaminated should be dismantled or cut into 20 foot lengths and placed in an acid bath for decontamination purposes. Wellheads, water meters, and other service equipment should be taken apart and washed in acid if needed. Submersible pumps should be divided into their component sections; motor and pump ends. Motors are sealed and should require surface cleaning only. The pump ends should either be disposed of off-site at an NRC licensed facility or dismantled and the individual parts acidized. Additional specific procedures to perform the above mentioned cleaning are contained in the Job Safety Analysis, Worksheet No. 13, appendix C.

Prior to release for unrestricted use or for burial all items should be shown on a release form issued by the radiation safety staff. A single form may be used for small items such as a box of fixtures or bundles of pipe; however, each individual item should have been surveyed. Large items should have individual release forms issued by the radiation safety staff. Contaminated materials that leave the site for off-site disposal should be placed inside containers or trailers that should have a release form issued stating that the outside surface of the container or trailer was surveyed and found free of radioactive contamination.

PLANT DECONTAMINATION AND DECOMMISSIONING

All equipment and fixtures in the plant, and the plant floors, walls, and ceilings should be surveyed for radioactive

contamination. Again, the release criteria stated in reference 7 will be used to establish which items are acceptable for release to unrestricted use. Equipment, fixtures, and building materials that are not contaminated and items that are decontaminated will either be sold or buried on site. Equipment, fixtures, and building components that cannot be decontaminated should be transported off-site to an NRC approved waste disposal facility (tailings pond).

The initial check for contamination in the plant should be made by an alpha count survey. If contamination of an item is present a swipe survey should be made to determine the level of activity of removable contamination. It is unlikely that radioactive contamination in the generator room, shop, warehouse, offices, and change rooms will be significant; however, these areas should be surveyed (see figure 3). The main plant floor and the uranium processing equipment will most likely be contaminated and require remedial action. Three principal plant equipment groups have been identified as susceptable to significant contamination. These three equipment groups are identified as follows:

1. Tanks
2. Pipes and Fittings
3. Pumps

The processing tanks represent a large group of items that most likely will need to be decontaminated. Specific procedures for individual tank groups are listed on the Job Safety Analysis Worksheets number 1 through 7, appendix C. The locations of the tanks are shown on Figure 3. In general, the insides of tanks

should be sprayed with acid and rinsed with water. Afterwards a hand held alpha meter should be used to survey the tank surfaces. If contamination is still present a swipe will be taken and if necessary another acid cleaning should be performed.

The decontamination of pipe items should be accomplished by acid bath and swabbing the interior surfaces with a ramrod, (see Job Safety Analysis Worksheet No. 8, appendix C). An acid bath trough should be constructed to accommodate the contaminated items. The trough should be located on the concrete pad outside the plant building. After the acid bath and drying, each interior and exterior pipe joint surface should be surveyed in accordance with section 3 of reference 7. It is not expected that a great deal of alpha activity will be found on PVC pipe surfaces as this material is nonporus. Normally, pipe joints are 20 feet in length or less. Glued joints exceeding 20 feet in length should be cut apart to fit into the acid trough. All fittings should be dismantled or cut to a size that is manageable and then placed in an acid bath. Contamination surveys will be the same as described above using section 3, of Reference 7 as a guide. All decontamination fluids will eventually be discharged to the evaporation ponds.

The pumps located in the plant building should be decontaminated by the use of an acid bath. The pumps should first be dismantled into component parts before bathing in acid (see Job Safety Analysis Worksheet No. 8, appendix C). Pump pedestals and mounts should also be decontaminated if necessary. Pump motors are sealed and therefore decontamination will consist of acid cleaning external surfaces if necessary.

The decontamination of the filter press and laboratory acid hood will be accomplished by the procedures outlined on Job Safety Analysis Worksheets 10 and 11. Other items in the plant, auxiliary areas, or vehicles such as those mentioned on Job Safety Analysis Worksheet 12 will be decontaminated by the process outlined. Contaminated concrete floors and building walls and supports should be washed with acid and rinsed with copious amounts of fresh water. Any items in the plant including floors and walls that cannot be decontaminated should be disposed of off-site at an approved NRC licensed waste disposal site (tailings pond). It is possible that some contaminated processing equipment will be sold to an NRC licensed uranium processing facility for use at that operation. If such sales are made the shipment of items will be in accordance with NRC and DOT regulations.

The buried four inch diameter PVC plant to evaporation ponds discharge pipeline should be decommissioned by flushing with concentrated acid followed by fresh water rinse. The pipeline should then be dug up at three randomly selected locations and surveyed for contamination. If the pipeline at these locations is not contaminated the remainder of the pipeline will be left in place. If the pipeline is contamianted the entire length should be dug up, cut into 20 foot lengths, and either acidized by the method outlined above for decontamination of pipe or disposed of off-site.

It is recognized that certain solid contaminated materials may resist cleanup from repeated acid baths. Some of these

sources may include ion exchange resin, core samples, tank bottom sediments, sand filter media, wood, and fabrics. Every effort will be made to decontaminate these materials but in cases where this is not possible (or there is no reasonable method for surveying the radiological acitivity) the items should be considered contaminated as per section 3 of reference 7, and placed in an approved container for removal to an NRC licensed disposal site (tailings pond).

The equipment from the plant that is not contaminated should be sold and removed from the permit area, or buried on site. The portions of the buildings that are not contaminated and have no salvage value should be buried on site or left standing at the discretion of the surface owner. Following the covering or on-site relocation of the concrete floors, pads, and foundations the land surface in the plant area should be recontoured to the natural topography in preparation for topsoil replacement and seeding. The personnel facilities, fuel storage tanks, and other non-contaminated ancillary equipment should be either sold, or demolished and buried on site.

In the case of both wellfield and plant radiological surveys an Eberline model PAC-6 w/AC24 probe, or a PRM5-3 or equivalent rate counter should be used for determing alpha activity. Removeable alpha contaminates should be determined with swipeable filter paper and counted on an Eberline SAC-4 scintillation counter or equivalent. Gamma/beta activity should be determined with an Eberline model E-530 or equivalent.

EVAPORATION PONDS DECONTAMINATION AND DECOMMISSIONING

Following acceptance of the groundwater restoration effort at the end of the stability period, the evaporation ponds should be allowed to dry out through evaporation. This process may be accelerated by routing the solution in the ponds through the ion exchange columns and water treatment unit, and then surface discharging the permeate subject to a NPDES permit. The contaminated solid residue in the evaporation ponds should be trucked off-site to an NRC licensed waste disposal facility (tailings pond). The liner itself and any contaminated soil under the liner should also be disposed of in the same manner as the residue. The final decisions on disposing of contaminated material off-site as compared to safe on-site burial should be made later based on the availability of a disposal site within a reasonable distance of the mine and the total amount of funds available for decommissioning.

The quantity of contaminated residue to be disposed of off-site is difficult to estimate because of the amount of foreign material that is and will be deposited in the ponds through wind transport. Conservatively, the amount of contaminated residue that may need to be trucked off-site is placed at 500 tons. Depending on the capacity of the transport vehicle, a total of 30 to 50 trips should be necessary to dispose of the contaminated material. A gamma survey of the ponds area should be conducted after liner removal to identify areas of soil contamination. Baseline gamma levels have already been determined.

After the ponds residue, liners and any contaminated soil

have been removed from the ponds site the berms should be pushed back into the depression, overburden should be replaced, and the land surface should be recontoured to blend with the natural topography. Finally, the stored topsoil should be re-applied and the area should be seeded with the approved native seed mix.

WELL ABANDONMENT

Once the DEQ and NRC have accepted the groundwater restoration results at the end of the stability period; all production, injection, and monitor wells should be properly abandoned. The well abondonment procedure should consist of filling the casing with a bentonite based slurry mixture from the bottom of the hole to within about twelve (12) feet of the surface. The bentonite slurry will be applied from the bottom of the hole using pipe. The casing from about twelve feet below the surface to within approximately two feet of the surface should be filled with cement slurry. The casing at a depth of about two feet below the land surface should be cut off and removed. The hole should then be backfilled to the surface, and the land surface around the well should be contoured to blend with the natural topography in preparation for seeding with the approved native seed mix. There are a total of 482 wells that should be abandoned using the above procedure.

SITE RECLAMATION

The reclamation of the land surface as defined in the DEQ Permit to Mine, reference 1, involves returning lands disturbed by mining to their approximate original condition by re-

establishing native vegetation. Additionally, post-reclamation radiological levels in the soils and vegetation must be no more than 5 PiC/gram above pre-mining baseline levels. As expected, the natural topography (surface contour) has not been significantly altered by the in-situ mining operations and for that reason only a U.S.G.S. quadrangle map was submitted for pre-mining contour documentation. The final contour of all disturbed areas should blend with the natural topography following reclamation.

A comprehensive pre-mining description of soils and vegetation in the permit area is contained in the DEQ Permit to Mine, Reference 1, in the NRC FES, Reference 6; and in the Environmental Report, Reference 2. These documents explain the soils and vegetation baselining program, and they present both the radiological and non-radiological data obtained from the program. The vegetation and soils baseline data have been accepted by the NRC and DEQ as part of the commercial licensing and permitting process. No additional baselining of soils and vegetation is planned at this time. The data from the post-reclamation sampling and evaluation program will be compared against existing baseline data in order to evaluate the site reclamation program.

After all the equipment from the wellfield and all buildings and equipment in the plant area have been buried or removed from the site, and after the ponds area has been backfilled; the disturbed areas should be contoured to blend with the natural topography. This action will take place prior to the re-application of topsoil on appropriate areas. Next, the locations

sampled during vegetation and soils baselining will again be sampled in the same manner as before and analyzed for the same radiological parameters. A gamma survey should also be conducted in the same areas as were monitored during baseline. Any contaminated soils discovered during this program may then be removed from the site and disposed of at an NRC licensed facility (tailings pond).

Once all radioactive contaminated soils have been disposed of the stored topsoil should be applied on appropriate areas (identified as category "A" in Reference 1) to its approximate original depth and then seeded. Affected areas that did not require topsoil removal (identified as category "B" in Reference 1) should be scarified and seeded.

Seeding should be performed in the fall after October 15 or in the spring before May 1 but should not be performed when the ground is frozen. Seed should be drilled 1/2 to 3/4 inches deep in the soil. If drilling is not practical, the seed should be broadcast with a rotary spreader and covered by harrowing, dragging, or hand raking. Based on site specific conditions, the following seed mixture should be planted at the rates shown:

Species	Pounds Pure Live Seed/Acre Drilled	Broadcast
Streambank Wheatgrass	5	10
Thickspike Wheatgrass	6	12
Indian Ricegrass	2	4
Big Sagebrush	1/4	1/2

Mulch should be applied to all of the larger disturbed areas (i.e., evaporation ponds, and processing plant) to retain soil moisture and to control erosion. A dry mulch consisting of

native hay or small-grain straw should be applied uniformly at a rate of two tons per acre. The mulch should be anchored with either a straight coulter machine or an agricultural disc on larger areas but may be anchored by hand on smaller sites. When anchoring with a straight coulter machine, seeding should preceed mulching. When anchoring with a disc, seeding should be performed following mulching and anchoring.

The area formerly occupied by the processing plant and the evaporation ponds will have already been fenced as described in Reference 1. These fences should remain in place until vegetation has been re-established. Snowdrift fences may be erected on the revegetated areas to retain snow and thereby increase the soil moisture.

PERSONNEL MANNING AND TRAINING

The decommissioning activities ideally should be under the overall direction and control of a Project Manager experienced in uranium solution mining and groundwater restoration. The day-to-day activities at the mine should be supervised by a Project Superintendent whose place of work should be the Bison Basin mine site. The Project Superintendent ideally should also have experience in uranium solution mining and groundwater restoration. The decommissioning activities will require the services of an experienced Radiation Safety Officer (R.S.O.) who may either be an employee or consultant. At the discretion of the firm performing the decommissioning, a qualified Safety/Radiation Protection Engineer (SRPE) may be engaged to assist the R.S.O. with the radiological aspects of the project. The types and

numbers of other employees should be up to the firm performing the decommissioning; however, all personnel either through experience or training should be qualified to perform assigned tasks.

All employees engaged in the activity of decommissioning should be trained in the hazards associated with working in potential radiological health problem areas. Training will be in accordance with the Source Material License SUA-1396 License Conditions and the "Radiological Safety Program" document (reference 5) specifically developed for the Bison Basin mine. Emphasis in training should be given in the following areas; use and maintenance of respirators, acid handling and spills, protective clothing, yellowcake handling, and self monitoring. Special Work Permits (SWP) should be issued for work performed in areas where additional monitoring surveys are warranted. The re-implementation of the full radiation protection program will not start until the wellfield is started-up.

The appropriate radiation monitoring instruments should be used and maintained in accordance with Source Material License SUA-1396 license conditions. The only exception is that the radiation monitoring instruments should be calibrated on a 12 month schedule instead of a 6 month schedule. An Eberline model, or equivalent, scintillation detector SAC-R5 and MS-3 miniscaler should be used to determine radon gas concentrations. Airborne particulate levels should be surveyed with a RAS-1 air sampler with patches counted on an Eberline model SAC-4, or equivalent, scintillation counter. Self monitoring for alpha activity should

be with an Eberline model PAC-6 and AC-24 probe, or a PRM5-3, or equivalent.

REPORTING AND TIME TABLE

During the decommissioning phase of the Bison Basin project the firm performing the decommissioning should prepare and submit a monthly report to the DEQ and NRC. This report should be mailed by the 10th day of each month. The monthly report should contain a summary of decommissioning activities that have taken place during the past calendar month. All data pertinent to the decommissioning activity collected during the month should be included in the report. Progress and problem areas should be included in the monthly report. The firm performing the decommissioning should also prepare an annual report which should be similar in format to the monthly report, and also contain a comprehensive summary of the groundwater restoration and site reclamation efforts supported by the appropriate data.

A precise time schedule for decommissioning activities is difficult to construct because of the uncertainty surrounding the length of time required to restore the groundwater in the mining unit No. 1 production zone aquifer. Based on the results of the R & D restoration program (see reference 3) and assuming a 300 GPM R.O. unit is utilized in the groundwater restoration effort, an estimated time table for decommissioning is presented in Table 2. The time table assumes that 1) planned objectives are achieved at the end of each phase, and 2) average winter weather conditions prevail while decommissioning is taking place.

TABLE 2

DECOMMISSIONING TIME TABLE

Cumulative Time (Months)	Description of Activity
1 through 3	Site preparation: prepare wellfield and plant for groundwater restoration activities; install down hole pumps, order and install water treatment unit, etc.
4 through 15	Restore mining unit No. 1 production zone aquifer by circulating up to 8 pore volumes of treated water through the aquifer.
16 through 21	Stability period; monitor groundwater quality, use R.O. unit to empty ponds - surface discharge permeate, route brine back to ponds.
22 through 28	Dismantle and remove wellfield equipment, plant equipment, and buildings. Remove pond residue and liners to disposal site. Reclaim ponds and all disturbed areas. Seed reclaimed areas at the appropriate time. Properly abandon all wells. Report conclusions of on-site decommissioning activities.

REFERENCES

1. Ogle Petroleum Inc., "Bison Basin Project In-Situ Uranium Mine, Supportive Information for Permit to Mine Application, DEQ", November 1979.

2. Ogle Petroleum Inc., "Environmental Report for U.S. Nuclear Regulatory Commission, Source Material License Application, Production Scale In-Situ Mine, Wyoming", August, 1979.

3. Ogle Petroleum Inc., "Final Restoration Report", April, 1980.

4. Ogle Petroleum Inc., "Letter to Mr. Ed Francis, Land Quality Division (copy to NRC), Containing Baseline Data for Mining Unit No. 1", May, 12, 1981.

5. Ogle Petroleum Inc., "Radiological Safety Program," May, 1980.

6. U.S. Nuclear Regulatory Commission, "Final Environmental Statement Related to the Operation of Bison Basin Project", Docket No. 40-8745, April, 1981.

7. U.S. Nuclear Regulatory Commission, "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct or Source Materials," September, 1984.

8. U.S. Nuclear Regulatory Commission, "Letter to Mr. Shaffer, DEQ from Mr. Pettengill, NRC", November 20, 1985.

9. U.S. Nuclear Regulatory Commission, "Source Material License No. SUA-1396, Docket No. 40-8745 (Including Amendments)", May, 1981.

10. Wyoming Department of Environmental Quality, "Land Quality Division Rules and Regulations, Chapter XXI", May, 1983.

11. Wyoming Department of Environmental Quality, "Permit to Mine No. 504", August, 1980.

APPENDIX A

RESTORATION SAMPLING WELLS

BASELINE DATA

MONITOR WELL M-4

BASELINE WATER QUALITY DATA

(Restoration Sampling Well)

PARAMETER	EPA DRINKING WATER STANDARD	TARGET RESTOR-ATION VALUE	SAMPLE ROUND 1 COLLECTED 08-29-78	SAMPLE ROUND 2 COLLECTED 09-22-78	SAMPLE ROUND 3 COLLECTED 10-11-78	SAMPLE ROUND 4 COLLECTED 10-28-78
Total Dissolved Solids		Baseline	1390	1270	1284	1278
*Specific Conductance (mhos/cm)			1700	1725	1750	1675
*Sodium		Baseline	433	426	421	421
Potassium		Baseline	11	11	10	10
Calcium		500	10	16	22	19
Magnesium		250	3	5	3	3
*Sulfate	250	Baseline	840	740	770	760
*Chloride	250	250	40	36	36	38
Carbonate			36	30	24	24
Bicarbonate			73	92	85	73
*Carbonate+ Bicarbonate		500	109	122	109	97
pH (pH units)	5-9	6.5 to Baseline	9.3	9.3	9.5	9.4
Aluminum		Baseline	-0.05	-0.05		
Ammonia (as N)		Baseline	-0.01	0.11	0.24	10.1
Arsenic	0.05	Baseline	-0.01	-0.01		
Barium	1.0	1.0	-0.05	-0.05		
Boron	0.75	Baseline	-1.0	-1.0		
Cadmium	0.01	Baseline	-0.002	-0.002		
Chromium	0.05	Baseline	-0.01	-0.01		
Copper	1.0	Baseline	-0.01	-0.01		
Fluoride	1.4 - 2.4	Baseline	1.18	0.88		
Iron	0.3	Baseline	-0.01	-0.01	-0.01	-0.01
Lead	0.05	Baseline	-0.05	-0.05	-0.05	-0.05
Manganese	0.05	Baseline	-0.01	-0.01		
Mercury	0.002	Baseline	-0.001	-0.001		
Molybdenum		Baseline	-0.05	-0.05		
Nickel	0.013	Baseline	-0.04	-0.04		
Nitrate (as N)	10	10.0	-0.01	-0.01	-0.01	0.36
Nitrite (as N)	1	1.0	-0.01	-0.01	-0.01	-0.01
Selenium	0.01	Baseline	-0.01	-0.01	-0.01	-0.01
*Uranium (as U_3O_8)	5	5.0	-0.001	0.006	-0.001	-0.001
Vanadium		Baseline	-0.05	-0.05		
Zinc	5	5	-0.01	-0.01	-0.01	-0.01
Radium 226 (pCi/l)	5	Baseline plus Statistical error	38.0±0.3	112.7±0.3	165.4±0.4	1.6±0.3
Thorium 230 (pCi1)			2.71±1.55	3.7±1.0	23.9±4.4	0±0.5

Blank spaces indicate parameters not analysed.

NOTES: All values in mg/l except as otherwise noted.
-Means not detected at levels indicated.
*Excursion Parameters.

All samples analyzed by Chemical and Geological Laboratories, Casper, Wyoming

MONITOR WELL P22

BASELINE WATER QUALITY DATA

(Restoration Sampling Well)

PARAMETER	EPA DRINKING WATER STANDARD	TARGET RESTOR-ATION VALUE	SAMPLE ROUND 1 COLLECTED 09-12-78	SAMPLE ROUND 2 COLLECTED 10-06-78	SAMPLE ROUND 3 COLLECTED 10-19-78	SAMPLE ROUND 4 COLLECTED 10-28-78
Total Dissolved Solids		Baseline	1486	1499	1612	1812
*Specific Conductance (mhos/cm)			1850	1900	2100	2125
*Sodium		Baseline	437	468	490	493
Potassium		Baseline	10	9	10	11
Calcium		500	29	29	39	41
Magnesium		250	4	6	4	3
Sulfate	250	Baseline	880	965	1040	1100
*Chloride	250	250	36	30	28	30
Carbonate			18	36	24	36
Bicarbonate			61	61	0	0
*Carbonate+ Bicarbonate		500	79	97	24	36
pH (pH units)	5-9	6.5 to Baseline	9.5	9.5	10.6	10.7
Aluminum		Baseline	-0.05	-0.05		
Ammonia (as N)		Baseline	0.10	0.20	0.19	2.9
Arsenic	0.05	Baseline	-0.01	-0.01		
Barium	1.0	1.0	-0.05	-0.05		
Boron	0.75	Baseline	-1.0	-1.0		
Cadmium	0.01	Baseline	-0.002	-0.002		
Chromium	0.05	Baseline	-0.01	-0.01		
Copper	1.0	Baseline	-0.01	-0.01		
Fluoride	1.4 - 2.4	Baseline	0.70	0.98		
Iron	0.3	Baseline	0.02	-0.01	0.10	-0.01
Lead	0.05	Baseline	-0.05	-0.05	-0.05	-0.05
Manganese	0.05	Baseline	-0.01	-0.01		
Mercury	0.002	Baseline	-0.001	-0.001		
Molybdenum		Baseline	-0.05	-0.05		
Nickel	0.013	Baseline	-0.04	-0.04		
Nitrate (as N)	10	10.0	-0.01	-0.01	-0.01	0.07
Nitrite (as N)	1	1.0	-0.01	-0.01	-0.01	-0.01
Selenium	0.01	Baseline	-0.01	-0.01	-0.01	-0.01
*Uranium (as U_3O_8)	5	5.0	-0.001	-0.001	-0.001	-0.001
Vanadium		Baseline	-0.05	-0.05		
Zinc	5	5	-0.01	-0.01	-0.01	-0.01
Radium 226 (pCi/L)	5	Baseline plus Statistical error	23.7 0.4	8.3 0.3	21.0 0.4	29.6 0.3
Thorium 230 (pCi)			0 0.5	1.4 1.1	5.8 2.2	0 0.5

Blank spaces indicate parameters not analysed.

NOTES: All values in mg/l except as otherwise noted.
-Means not detected at levels indicated.
*Excursion Parameters.

All samples analyzed by Chemical and Geological Laboratories, Casper, Wyoming

BASELINE WATER QUALITY DATA

(Restoration Sampling Well)

PARAMETER	EPA DRINKING WATER STANDARD	TARGET RESTORATION VALUE	SAMPLE ROUND 1 COLLECTED 09-03-80	SAMPLE ROUND 2 COLLECTED 09-10-80	SAMPLE ROUND 3 COLLECTED 09-17-80	SAMPLE ROUND 4 COLLECTED 10-29-80
Total Dissolved Solids		Baseline	1446	1304	1319	1313
Specific Conductance (mhos/cm)			2180	2080	2200	2000
Sodium		Baseline	456	410	432	407
Potassium		Baseline	11	12	10	9
Calcium		500	8	8	16	20
Magnesium		250	6	5	7	6
Sulfate	250	Baseline	856	770	750	764
Chloride	250	250	31	33	33	31
Carbonate			10	0	0	0
Bicarbonate			83	98	107	122
Carbonate+ Bicarbonate		500	93	98	107	122
pH (pH units)	5-9	6.5 to Baseline	8.93	7.72	7.87	7.56
Aluminum		Baseline	-0.05	-0.05	-0.05	-0.05
Ammonia (as N)		Baseline	0.15	0.10	0.28	0.13
Arsenic	0.05	Baseline	0.006	0.005	0.006	0.004
Barium	1.0	1.0	-0.02	-0.02	-0.02	-0.02
Boron	0.75	Baseline	-1.0	-1.0	-1.0	-1.0
Cadmium	0.01	Baseline	-0.005	-0.005	-0.005	-0.005
Chromium	0.05	Baseline	-0.01	-0.01	-0.01	-0.01
Copper	1.0	Baseline	-0.01	-0.01	-0.01	-0.01
Fluoride	1.4 - 2.4	Baseline	1.38	0.92	0.97	1.04
Iron	0.3	Baseline	-0.05	-0.05	-0.05	0.09
Lead	0.05	Baseline	-0.05	-0.05	-0.05	-0.05
Manganese	0.05	Baseline	-0.01	-0.01	-0.01	-0.01
Mercury	0.002	Baseline	-0.001	-0.001	-0.001	-0.001
Molybdenum		Baseline	-0.05	-0.05	-0.05	-0.05
Nickel	0.013	Baseline	-0.01	-0.01	-0.01	-0.01
Nitrate (as N)	10	10.0	0.17	0.28	0.21	0.52
Nitrite (as N)	1	1.0	-0.01	-0.01	-0.01	-0.01
Selenium	0.01	Baseline	-0.002	-0.002	-0.002	-0.002
Uranium (as U_3O_8)	5	5.0	0.014	-0.005	0.029	0.011
Vanadium		Baseline	-0.05	-0.05	-0.05	-0.05
Zinc	5	5	-0.005	0.015	-0.005	-0.005
Radium 226 (pCi/l)	5	Baseline plus Statistical error	63.5± 2.0	70.2 ±2.1	63.2 ±1.9	30.7± 1.4
Thorium 230 (pCi/l)			-0.6 ±1.0	1.6 ±0.8	0.2 ±1.2	0.7 ±0.4

NOTES: All values in mg/l except as otherwise noted.
-Means not detected at levels indicated.
*Excursion Parameters.

All sample analyzed by Energy Analytical Laboratory; Casper, Wy.

BASELINE WATER QUALITY DATA

(Restoration Sampling Well)

PARAMETER	EPA DRINKING WATER STANDARD	TARGET RESTOR-ATION VALUE	SAMPLE ROUND 1 COLLECTED 09-03-80	SAMPLE ROUND 2 COLLECTED 09-10-80	SAMPLE ROUND 3 COLLECTED 09-17-80	SAMPLE ROUND 4 COLLECTED 10-29-80
Total Dissolved Solids		Baseline	1369	1308	1349	1308
*Specific Conductance (mhos/cm)			2100	2020	2040	1980
*Sodium		Baseline	434	406	427	400
Potassium		Baseline	12	11	10	10
Calcium		500	17	21	24	22
Magnesium		250	4	6	6	6
*Sulfate	250	Baseline	794	755	770	764
*Chloride	250	250	30	32	33	31
Carbonate			2	0	0	0
Bicarbonate			95	117	122	122
*Carbonate+ Bicarbonate		500	97	117	122	122
pH (pH units)	5-9	6.5 to Baseline	8.53	7.89	7.69	7.43
Aluminum		Baseline	-0.05	-0.05	-0.05	-0.05
Ammonia (as N)		Baseline	0.17	0.13	0.21	0.09
Arsenic	0.05	Baseline	0.005	0.004	0.003	0.003
Barium	1.0	1.0	-0.02	-0.02	-0.02	-0.02
Boron	0.75	Baseline	-1.0	-1.0	-1.0	-1.0
Cadmium	0.01	Baseline	-0.005	-0.005	-0.005	-0.005
Chromium	0.05	Baseline	-0.01	-0.01	-0.01	-0.01
Copper	1.0	Baseline	-0.01	-0.01	-0.01	-0.01
Fluoride	1.4 - 2.4	Baseline	0.89	1.02	1.02	1.13
Iron	0.3	Baseline	-0.05	-0.05	-0.05	-0.05
Lead	0.05	Baseline	-0.05	-0.05	-0.05	-0.05
Manganese	0.05	Baseline	-0.01	-0.01	-0.01	-0.01
Mercury	0.002	Baseline	-0.001	-0.001	-0.001	-0.001
Molybdenum		Baseline	-0.05	-0.05	-0.05	-0.05
Nickel	0.013	Baseline	-0.01	-0.01	-0.01	-0.01
Nitrite (as N)	10	10.0	0.15	0.31	0.29	0.77
Nitrate (as N)	1	1.0	-0.01	-0.01	-0.01	-0.01
Selenium	0.01	Baseline	-0.002	-0.002	-0.002	-0.002
Uranium (as U_3O_8)	5	5.0	-0.005	-0.005	0.007	-0.005
Vanadium		Baseline	-0.05	-0.05	-0.05	-0.05
Zinc	5	5	-0.005	-0.005	-0.005	-0.005
Radium 226 (pCi/1)	5	Baseline plus Statistical error	28.88±1.36	43.03±1.88	29.7± 1.3	16.5±1.0
Thorium 230 (pCi1)			0.7 ±1.7	0.5± 0.8	3.0±1.6	1.0±0.6

NOTES: All values in mg/l except as otherwise noted.
-Means not detected at levels indicated.
*Excursion Parameters.

All sample analyzed by Energy Analytical Laboratory; Casper, Wy.

APPENDIX B

DEQ WATER QUALITY ANALYSIS

MINING UNIT NO. 1

Wyoming Department of Environmental Quality
Water Quality Division Laboratory

File: re525623.txt

Report Of Analysis

Sample Number.....5-256-23 through 27
Station.....OPI
Collected by.....Rick Engelmann
Date.....9/9/85
ID No.....See below

Sample No: 5-256-	23	24	25	26	27
Station:	A-13	A-38	B-60	A-101	A-98
Chloride	391	643	345	254	571
Sulfate	1440	1860	1360	1170	1680
TDS	4112	5548	3784	3144	5340
Ammonia	0.28	0.28	0.23	0.16	0.31
Nitrate/nitrite-N	0.08	0.04	0.04	0.04	0.04
pH, lab	7.343	7.109	7.147	7.283	7.189
Sp. Cond	6100	8200	5700	4700	7800
Aluminum	<0.2	<0.2	<0.2	<0.2	<0.2
Arsenic	0.040	0.026	0.009	0.015	0.020
Barium	<0.1	<0.1	<0.1	<0.1	<0.1
Cadmium	<0.005	<0.005	<0.005	<0.005	<0.005
Calcium	134	164	99	62	130
Chromium	<0.01	<0.01	<0.01	<0.01	<0.01
Copper	<0.01	<0.01	<0.01	<0.01	<0.01
Fluoride	0.58	0.34	0.56	1.02	0.42
Iron	0.05	0.06	0.18	0.34	0.08
Lead	<0.01	<0.01	<0.01	<0.01	<0.01
Magnesium	45	60	32	19	51
Manganese	0.16	0.21	0.09	0.07	0.09
Mercury	<0.001	<0.001	<0.001	<0.001	<0.001
Nickel	<0.02	0.153	0.070	<0.02	0.053
Potassium	13	16	12	9	16
Selenium	<0.01	<0.01	<0.01	0.177	0.028
Sodium	1161	1563	1112	899	1406
Vanadium	<0.2	<0.2	<0.2	<0.2	<0.2
Zinc	<0.005	<0.005	<0.005	<0.005	<0.005
T. Uranium	20.4	18.8	23.0	15.1	27.2
Radium 226	*	*	*	*	*
Alkalinity	1000	1420	887	655	1324
Carbonate	0	0	0	0	0
Bicarbonate	1000	1420	887	655	1324
Boron	0.54	0.32	0.40	0.35	0.42
Molybdenum	<0.1	<0.1	<0.1	<0.1	<0.1
Ion Balance	3.22	0.85	3.37	2.01	-0.37

* results will be submitted at a later date.

Approved By: _____
Kent M. Angelus
Chemical Analysis Supervisor
Date: October 28, 1985

Notes: All analysis results are reported in milligrams per liter except where noted.

APPENDIX C

JOB SAFETY ANALYSIS WORKSHEETS

ALTAIR RESOURCES INC.

ACCIDENT PREVENTION
JOB SAFETY ANALYSIS - WORK SHEET

SHEET NO. 1

TITLE OF JOB OPERATION: Decontamination of Injection Surge & Make Up Tanks #202 & #204

REQUIRED AND/OR RECOMMENDED PERSONAL PROTECTION EQUIPMENT: Respirator with acid mist & radionuclide cartridge, rubber suit, rubber boots, rubber gloves and face shield on hard hat.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURE
1. Acquire SWP from radiation staff		
2. Drain tank		
3. Remove intake & discharge lines		
4. Remove motor & agitator assembly	4. Heavy equipment	4. Forklift and other appropriate equipment will be used.
5. Open bottom hatch		
6. Ventilate for 1/2 hour		
7. Wash with acid solution	7. Acid & radionuclide hazard.	7. a. Required personal protective equipment will be used
8. Check for contamination in accordance with the guidelines		b. Air samples for radionuclides will be taken.
9. Repeat steps 7 & 8 until criteria from the guidelines is satisfied		
10. Prepare release to unrestricted area papers.		

ANALYSIS MADE BY: Kenley Brown RSO

ANALYSIS APPROVED BY:

ALTAIR RESOURCES INC.

ACCIDENT PREVENTION
JOB SAFETY ANALYSIS - WORK SHEET

SHEET NO. 2

TITLE OF JOB OPERATION: Decontamination of IX columns (110, 112 & 114)

REQUIRED AND/OR RECOMMENDED PERSONAL PROTECTION EQUIPMENT: Respirator with acid mist and radionuclide cartridge, rubber suit, rubber boots, rubber gloves & face shield on hard hat.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURE
1. Acquire SWP from Radiation staff 2. Open hatch 3. Drain Tank 4. Remove resin to approved container 5. Remove intake and discharge lines 6. Ventilate 7. Monitor for radon gas & O_L 8. Wash with acid solution 9. Check for contamination in accordance with the guidelines 10. Repeat steps 8 & 9 until criteria from the guidelines is satisfied 11. Prepare release to unrestricted area papers.	8. Acid and radionuclide hazards.	8. a. Required personal protective equipment will be used b. Air samples for radionuclides will be taken.

ANALYSIS MADE BY: Kurtz Brown RSO

ANALYSIS APPROVED BY: Richard Cathcart

ALTAIR RESOURCES INC.

ACCIDENT PREVENTION
JOB SAFETY ANALYSIS - WORK SHEET

SHEET NO. 3

TITLE OF JOB OPERATION: Decontamination of precipitation tanks (320, 322, 324, 326 & 328)

REQUIRED AND/OR RECOMMENDED PERSONAL PROTECTION EQUIPMENT: Respirator with acid mist & radionuclide cartridge, rubber suit, rubber boots, rubber gloves & face shield on hard hat.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURE
1. Acquire SWP from radiation staff		
2. Open discharge opening		
3. Wash with H_2O		
4. Remove motor and agitator assembly	4. Heavy equipment	4. Forklift and other appropriate equipment will be used
5. Remove intake and discharge lines		
6. Open discharge opening		
7. Wash with acid solution until all visible yellowcake is removed	7. Acid & radionuclide hazard.	7. a. Required personal protective equipment will be used b. Air samples for radionuclides will be taken.
8. Check for contamination in accordance with the guidelines		
9. Repeat steps 7 & 8 until criteria from the guidelines is satisfied		
10. Prepare release to unrestricted area papers		

ANALYSIS MADE BY: Kenley Brown RSO

ANALYSIS APPROVED BY:

ALTAIR RESOURCES INC.

ACCIDENT PREVENTION
JOB SAFETY ANALYSIS - WORK SHEET

SHEET NO. 4

TITLE OF JOB OPERATION: Decontamination of cone bottom product tanks (302, 304 & 306)

REQUIRED AND/OR RECOMMENDED PERSONAL PROTECTION EQUIPMENT: Respirator with acid mist & radionuclide cartridge, rubber suit, rubber boots, rubber gloves and face shield on hard hat.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURE
1. Acquire SWP from radiation staff 2. Drain tank 3. Wash tank with H_2O		
4. disconnect intake and discharge lines	4. Heavy equipment	4. Forklift and other appropriate equipment will be used
4.A Remove motor and agitator assembly		
5. Open top & bottom hatches 6. Ventilate for 2 hours		
7. Wash with acid solution	7. Acid hazard and radionuclide hazards.	7. a. Required personal protective equipment will be used b. Air samples for radionuclides will be taken.
8. Check for contamination in accordance with the guidelines 9. Repeat steps 7 & 8 until criteria is satisfied 10. Prepare release to unrestricted area papers.		

ANALYSIS MADE BY: Kurby Brown RSO

ANALYSIS APPROVED BY:

ALTAIR RESOURCES INC.

ACCIDENT PREVENTION
JOB SAFETY ANALYSIS - WORK SHEET

SHEET NO. 5

TITLE OF JOB OPERATION: Decontamination of Production Surge tank (102 & 104)

REQUIRED AND/OR RECOMMENDED PERSONAL PROTECTION EQUIPMENT: Respirator with acid mist & radionuclide cartridge, rubber suit, rubber boots, rubber gloves, face shield on hard hat.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURE
1. Acquire SWP for job		
2. Drain tank		
3. Open bottom & top hatch discharge		
3.A Disconnect intake lines		
4. Ventilate for X time		
5. Monitor for radon gas, oxygen		
6. Ventilate more if required		
7. Repeat step 5		
8. Remove bottom sludge	8. Possible radionuclides in sludge	8. a. Required personal protective equipment will be used b. Air sample for radionuclides will be taken during operation
9. Check for contamination in accordance with the guidelines		
10. Wash tank with acid solution	10. Acid hazard.	10. Respirating with acid mists & radionuclide filter will be used.
11. Check for contamination in accordance with the guidelines		
12. Repeat step 10 & 11 if still contaminated		
13. Prepare release to unrestricted area.		

ANALYSIS MADE BY: Kimberly Brown RSO

ANALYSIS APPROVED BY: Alan J. Latchford

ALTAIR RESOURCES INC.

ACCIDENT PREVENTION
JOB SAFETY ANALYSIS - WORK SHEET

SHEET NO. 6

TITLE OF JOB OPERATION: Decontamination of sand filters (210, 212 & 214)

REQUIRED AND/OR RECOMMENDED PERSONAL PROTECTION EQUIPMENT: Respirators with acid mist & radionuclide cartridge, rubber suit, rubber gloves, rubber boots & face shield on hard hat.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURE
1. Acquire SWP from radiation staff 2. Drain tank of H_2O 3. Disconnect intake and discharge lines 4. Drain tank of filter media 5. Open top hatches 6. Ventilate 7. Wash with acid solution 8. Check for contamination in accordance with the guidelines 9. Repeat steps 7 & 8 until criteria from the guidelines in satisfied 10. Prepare release to unrestricted area papers.	7. Acid and radionuclide hazard.	7. a. Required personal protective equipment will be used b. Air samples for radionuclide will be taken.

ANALYSIS MADE BY: Kirby J. Brown RSO

ANALYSIS APPROVED BY: [signature]

ALTAIR RESOURCES INC.

ACCIDENT PREVENTION
JOB SAFETY ANALYSIS - WORK SHEET

SHEET NO. 1

TITLE OF JOB OPERATION: Decontamination of elution tanks (220, 222, 224 & 226)

REQUIRED AND/OR RECOMMENDED PERSONAL PROTECTION EQUIPMENT: Respirator with acid mist & radionuclide cartridge, rubber suit, rubber boots, rubber gloves & face shield on hard hat.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURE
1. Acquire SWP from radiation staff		
2. Drain tank		
3. Wash with H_2O		
4. Disconnect intake and discharge lines	4. Heavy equipment	4. Forklift and other appropriate equipment will be used
4.A Remove motor & agitator assembly		
5. Open top and bottom hatches		
6. Ventilate for 2 hours		
7. Wash with acid solution	7. Possible acid and radionuclide hazard.	7. a. Required personal protective equipment will be used b. Air samples for radionuclides will be taken.
8. Check for contamination in accordance with the guidelines		
9. Repeat steps 7 & 8 until criteria for the guidelines is satisfied		
10. Prepare release to unrestricted area forms.		

ANALYSIS MADE BY: Kirby Brown RSO

ANALYSIS APPROVED BY: [illegible]

ALTAIR RESOURCES INC.

ACCIDENT PREVENTION
JOB SAFETY ANALYSIS - WORK SHEET

SHEET NO. 8

TITLE OF JOB OPERATION: Decontamination of pipe and fittings (plant & wellfield)

REQUIRED AND/OR RECOMMENDED PERSONAL PROTECTION EQUIPMENT: Respirator with acid mist & radionuclide cartridge, rubber gloves, face shield on hard hat.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURE
1. Disconnect pipe 2. Remove all fitting possible 3. Submerge pipe in acid bath 4. Swab bore 5. Rinse with H_2O 6. Check for contamination in accordance with the guidelines 7. Repeat steps 3 thru 6 until criteria for the guidelines is satisfied 8. Prepare release to unrestricted area papers.	3 & 4) Acid hazard.	3 & 4) Required personal protective equipment will be used.

ANALYSIS MADE BY: Kurby Brown RSO

ANALYSIS APPROVED BY:

ALTAIR RESOURCES INC.

ACCIDENT PREVENTION
JOB SAFETY ANALYSIS - WORK SHEET

SHEET NO. 9

TITLE OF JOB OPERATION: Decontamination of pumps (plant)

REQUIRED AND/OR RECOMMENDED PERSONAL PROTECTION EQUIPMENT: Respirators with acid mist & radionuclide cartridge, rubber suit, rubber gloves, rubber boots & face shield on hard hat.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURE
1. Acquire SWP from radiation staff 2. Pumps will be disconnected from the motors 3. Pumps will be dismantled 4. Wash with acid solution 5. Check pump parts and external motor parts for contamination in accordance with the guidelines 6. Repeat steps 4 & 5 until criteria in the guidelines is satisfied 7. Prepare release to unrestricted area papers.	2 & 3. Possible radionuclide dust hazard.	2,3 & 4. a. Required personal protective equipment will be used b. Air samples for radionuclides will be taken during operation

ANALYSIS MADE BY: Kirby Brown RSO

ANALYSIS APPROVED BY:

ALTAIR RESOURCES INC.

ACCIDENT PREVENTION
JOB SAFETY ANALYSIS - WORK SHEET

SHEET NO. 10

TITLE OF JOB OPERATION: Decontamination of Filter Press (310)

REQUIRED AND/OR RECOMMENDED PERSONAL PROTECTION EQUIPMENT: Respirator with acid mist & radionuclide cartridge, rubber suit, rubber gloves, rubber boots, face shield on hard hat.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURE
1. Acquire SWP from radiation staff 2. Remove intake and discharge lines 3. Remove pump at bottom of press 4. Remove filter plates & fiberglass cloth 5. Wash with acid solution 6. Check for contamination in accordance with the guidelines 7. Repeat steps 5 & 6 until criteria for the guidelines is satisfied 8. Prepare release to unrestricted area forms.	2,3,& 4. Dried yellowcake (radionuclide) may be suspended in air 5. Acid fumes and radionuclide hazard may exist.	2,3,4&5. a. Required personal protective equipment will be worn at all times b. Air samples will be taken during operation.

ANALYSIS MADE BY: Kenneth Brown RSO

ANALYSIS APPROVED BY:

ALTAIR RESOURCES INC.

ACCILENT PREVENTION
JOB SAFETY ANALYSIS - WORK SHEET

SHEET NO. 11

TITLE OF JOB OPERATION: Decontamination of luboraton hood.

REQUIRED AND/OR RECOMMENDED PERSONAL PROTECTION EQUIPMENT: Respirator with acid and radionuclide cartridge, rubber coat, rubber gloves, face shield on hard hat.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURE
1. Acquire SWP from radiation staff 2. Disconnect air discharge line 3. Wash with acid solution 4. Check for contamination in accordance with the guidelines 5. Repeat step 3 & 4 until criteria for the guidelines is satisfied 6. Prepare release to unrestricted area papers.	2. Possible radionuclide hazard 3. Possible acid mist & radionuclide hazard.	2 & 3. a. Required personal protective equipment will be used b. Air samples will be taken during operation.

ANALYSIS MADE BY: Kenneth Brown RSO

ANALYSIS APPROVED BY:

ALTAIR RESOURCES INC.

ACCIDENT PREVENTION
JOB SAFETY ANALYSIS - WORK SHEET

SHEET NO. 12

TITLE OF JOB OPERATION: Decontamination of equipment not used for processing uranium. Includes trucks, forklifts,*

REQUIRED AND/OR RECOMMENDED PERSONAL PROTECTION EQUIPMENT: Wash tank and any other piece of equipment under this classification.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURE
1. Check for contamination in accordance with the guidelines 2. If any surface contamination is found, wash with weak acid solution 3. Repeat steps 1 & 2 until criteria in the guidelines is satisfied 4. Prepare release to unrestricted area papers.	2. Acid hazard.	2. Rubber gloves. * acid for caustic tanks, pumps and motors, heaters, soda ash storage tank, patrol, snowblower, filter-back, concrete floor, tank pad, and structural steel.

ANALYSIS MADE BY: Kurt J Brown RSO

ANALYSIS APPROVED BY: Robert Cathcart

ALTAIR RESOURCES INC.

ACCIDENT PREVENTION
JOB SAFETY ANALYSIS - WORK SHEET

SHEET NO. 13

TITLE OF JOB OPERATION: Decontamination of submersible pumps

REQUIRED AND/OR RECOMMENDED PERSONAL PROTECTION EQUIPMENT: Respirator with acid mist and radionuclide cartridge, rubber gloves.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURE
1. Remove pump from motor 2. Dissassemble pump 3. Wash pump parts & motor surface in acid solution 4. Check for contamination in accordance with the guidelines 5. Repeat steps 3 & 4 until criteria for the guidelines is satisfied 6. Prepare release to unrestricted area papers	2. Radionuclide dust hazard 3. Possible acid mist & radionuclide hazard.	2. Respirator with radionuclide cartridge will be worn 3. Required personal protective equipment will be used.

ANALYSIS MADE BY: Kenley Brown RSO

ANALYSIS APPROVED BY: Robert Lockyer