PDR RETURN TO 396-SS

40-4492

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Hydrogeology
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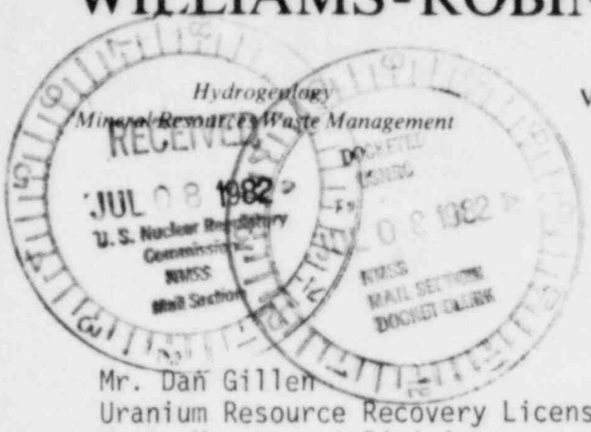
Geological Engineering
Surface and Borehole Geophysics



June 25, 1982

Mr. Dan Gillen
Uranium Resource Recovery Licensing Branch
Waste Management Division
U. S. Nuclear Regulatory Commission
7915 Eastern Avenue
Silver Spring, Maryland 20910

Dear Dan:

I am enclosing the Dames and Moore proposed monitoring well scheme for the FAP site. My comments are written in the margin of the report. I think all the comments are self-explanatory but if you have any problems with them, please call.

After looking at the well completion data (or the lack of it) in Table 5, I am somewhat concerned about the validity of our interpretations of the water quality in the unconfined aquifer north of the tailings pond no. 1. I am concerned also about what the proposed monitor well system will really monitor. Unless Dames and Moore wishes to take a stronger stand about the portions of the hydrostratigraphic section in which the proposed monitoring wells are open, it appears to me that too much uncertainty is associated with these wells. In addition they do not extend far enough north of the tailings pond to monitor the plume we have delineated on the basis of F. M. Fox wells 1 through 6. As a consequence of these observations it seems to me that it may be necessary to install a line of new monitoring wells down the length of the plume we have defined. These wells should be designed so that they can be pumped in order to lower the 5,000+ mg/l concentrations of sulfate that ultimately will discharge at the surface from the perched aquifer. In addition it seems to me that at least three new monitoring wells should be installed in the first aquifer below the first clay layer below the perched aquifer. Similarly, I suggest that a line of pump back wells be installed across the plume we have defined so that they withdraw water from the perched aquifer.

I am somewhat concerned about the data presented in Table 5. It seems to me that other documents that have been presented to us contain less uncertainty with respect to the completion data for the wells listed in Table 5. Our previous conclusions may not be valid if the uncertainty listed in the two right-hand columns of Table 5 is as severe as indicated. Some of these wells may be completed in the unconfined aquifer. It may be advisable for us to meet with the FAP personnel at the site and try to acquire more insight into the well completion situation and into the potential zones of discharge of contaminated water in the perched aquifer. It may be possible to measure the

20551
Info only

depths of some of the wells in question by use of a tape. According to Table 5 even the depths are not known for most of the wells, much less the perforated intervals.

Sincerely,

Roy

Roy E. Williams
Ph.D. Hydrogeology
Registered in Idaho

REW:sl

Enclosure

cc: Joyce Fields

Dames & Moore

250 East Broadway, Suite 200
Salt Lake City, Utah 84111
(801) 521-9255
TWX: 910-925-5692 Cable address: DAMEMORE

40-4492
w/ltr 6/25/82

June 3, 1981

Federal American Partners
Gas Hills Star Route
Riverton, Wyoming 82501

Attention: Mr. Rich Blubaugh,
Environmental Manager

Gentlemen:

RECOMMENDED STRATEGIES AND PROCEDURES
FOR GROUND WATER MONITORING AT
MILL WASTE DISPOSAL FACILITIES

The purpose of this letter is to provide recommendations for future ground water monitoring for the subgrade disposal area, the existing evaporation pond and the proposed evaporation ponds. The recommendations provided herein are designed to follow the intent, but not the letter, of guidelines provided in U. S. NRC Guideline 4.14 "Radiological Effluent and Environmental Monitoring at Uranium Mills" and Wyoming Department of Environmental Quality (DEQ) Guideline No. 8, Hydrology (January 1980, Revision 2). The monitoring program for each facility has a unique purpose and, therefore, each is discussed separately.

SUBGRADE DISPOSAL AREA

This letter is intended to supersede and update the letter regarding monitoring in the subgrade area sent on August 25, 1980 to Mr. Ken Watts. Monitoring locations recommended in that letter need to be updated because of changes in operational plans and difficulties experienced in attempting to sample some of the existing wells.

Not a stand-alone Document. 20551
Must be included in Pkg. - Has mark-up indicated

The strategy recommended for monitoring the subgrade area is based on a phased approach to monitoring. This approach minimizes the amount of monitoring initially, increasing monitoring activities gradually if initial monitoring indicates seepage above anticipated rates. Implementation of a contingency plan for aquifer management is required if seepage is occurring in undesirable quantities. Attempts to define these statements semi-quantitatively is presented in the following paragraphs.

The objectives of the monitoring program for the subgrade disposal area are to:

1. Compare actual field conditions after disposal operations begin with those predicted by the mathematical modeling results presented in the Dames & Moore report.

2. Collect baseline information to provide a basis for comparison with operational monitoring results and provide Federal American Partners with a solid base of complete information for ground water quality prior to start-up of disposal operations. This information base is critical to refute any unjustified claims made by outside parties dur- or following operation of the disposal area.

3. Provide an early warning system for the prevention of large-scale excursions of liquid from the subgrade disposal area.

4. Provide information which will expedite release from bonding after facility closure.

To meet these objectives, a combination of existing wells and five new wells is proposed. We recommend that two wells be drilled south of the disposal area (labeled U-1 and C-1 on Plate 1) in the unconfined and confined aquifers. Additional unconfined and confined wells are recommended north of the disposal pit as shown on Plate 1. In addition, existing wells P-4, STF-1, BUL-F7, MW-3, MW-6 and Well No. 16 should be utilized for monitoring.

We recommend baseline monitoring consist of the collection of four samples from each well on a quarterly basis for a period of one year prior to start-up of disposal operations. We recommend that each sample be analyzed for the full parameter list shown on Table 1. Collection of this data is an "insurance package" for Federal American Partners in that all available parameters and some estimate of an individual parameter's natural concentration fluctuation will have been measured prior to any disturbance by disposal operations. We recommend that the analyses be performed on all wells listed above.

The next phase of monitoring would consist of operational monitoring. We recommend that operational monitoring be restricted to measurement of changes in the degree of saturation of materials surrounding the pit in the unconfined and perched aquifers and chemistry measured by lead indicators in the confined aquifer in monitoring wells installed close to the disposal area. Moisture content increases and radiation can be measured with geophysical logging techniques - specifically, natural gamma, temperature and/or neutron logs. These techniques are currently acceptable with the New Mexico Environmental Improvement Division (EID). In addition, we recommend lead indicators (water level, pH, specific conductance and temperature) be measured in water samples obtained from wells C-1, C-2 and C-3 in the confined aquifer. This monitoring should be performed on a quarterly basis and will constitute the monitoring program during operations.

We recommend that all other "perimeter" wells be monitored for lead indicators on an annual basis. We also recommend that all monitoring results be reviewed by a qualified ground water hydrologist on an annual basis and a letter report be submitted for your files.

We recommend the following criteria for instituting a contingency plan:

1. If ground water pH is less than ~~4.0~~ 5.0 for two successive quarterly measurements in the confined or unconfined aquifer, or specific conductance or sulfate is two times or more above confined aquifer baseline concentrations for two successive quarterly measurements, the contingency plan should be initiated.

2. If saturation is indicated on the basis of geophysical logging in the unconfined aquifer at the monitoring locations or water levels ~~rise more than five feet~~ develop in the unconfined aquifer within the first two years of operation, the contingency plan should be initiated. After two years, if monitoring indicates saturated ~~velocity fronts in excess of 100 feet per year,~~ the contingency plan should be initiated.

The contingency plan consists of three stages:

1. A meeting with representatives of Wyoming DEQ, FAP and its consultant(s) would be held. A mutually agreed to approach for defining the extent of contamination and possible remedial actions is the purpose of that meeting. ~~A likely first step in this process is the sampling and detailed analysis of ground water samples.~~ After defining the extent of the problem, it would be determined either that a serious problem does not exist

or

2. Locating the source of high seepage and installing ~~or constructing a lining locally or other measures~~ a well recovery field to control seepage would be implemented. If the source cannot be located and it is agreed that seepage quality is unacceptable, then

This would require a new work. A pump back system is the only possibility.

3. Install a pump-back system to control seepage.

Near the end of operations, quarterly samples for a one year period should be collected from all wells with the complete parameter list shown on Table 1 as measured in the base line program. The purpose of this monitoring will be to document conditions at the time of closure. A summary of the monitoring program for the subgrade disposal area is presented on Table 2 and a tabulation of monitoring well construction data presented on Table 3. Monitoring should continue on an annual basis for 5 years after closure.

If the subgrade disposal system operates as anticipated, the total monitoring program would consist of collection of eight sets of samples with a complete parameter list from all the monitoring wells, quarterly geophysical logging of three monitor wells in the unconfined and perched aquifers, quarterly monitoring of lead indicators in three wells in the confined aquifer and annual measurements of lead indicators in all wells. We believe this monitoring program will achieve all monitoring objectives without generating a large amount of unneeded data.

I don't agree. This program will work only if the underdrain system works. If it doesn't work too much time will elapse before this system reveals it.

EXISTING EVAPORATION POND AREA

We recommend that the monitoring program in the existing evaporation pond area consist of continued sampling of the same wells currently being sampled (shown on Plate 2). However, we believe the amount of water quality data collected so far is sufficient to characterize existing conditions and recommend that quarterly sampling of wells be reduced to lead indicators. We also recommend that water quality analyses be conducted on an annual basis for several key constituents including arsenic, uranium and radium, as shown on Table 4. This level of monitoring will provide more than adequate information for decisions regarding the existing evaporation pond area. The primary goal of the monitoring program, as we view it, is to assess the effectiveness of the recovery wells. A listing of monitoring wells with well construction characteristics is presented on Table 5.

I don't agree Sulfate at least should be continued,

The need for a contingency plan in the existing evaporation pond area is limited since, in effect, the existing monitoring program constitutes implementation of a contingency plan. The monitoring program has successfully documented existing conditions after 20 years of disposal and the probability of any significant changes to existing conditions is low. If large changes in water quality were to occur, a sequence of events similar to those outlined for the subgrade area contingency plan would be appropriate. Near the end of operations we recommend quarterly sampling for a one year period of all monitoring wells with a complete parameter list as shown on Table 4. This is, again, to provide documentation of closure conditions.

Garbage. If his philosophy is accepted DEQ will be correct about their "open ended seepage plume"

Already have occurred, and an effective pump back system should have already been installed. The existing plume is very contaminated relative to anyone's standards.

This plan will not monitor the plume as we have interpreted it. The monitoring plan should extend at past FM Fox well 6. In addition after looking at the absence of well completion data as noted in table 5 I am becoming less comfortable about the unconfined zone not being contaminated. I suggest that you consider a line of new wells properly designed and constructed along the channel we have defined, open to the top of the first clay layer below the phreatic aquifer. I suggest that these be paired with at least 3 new wells in the aquifer below the 1st clay layer and open 20 to 30 feet below the potentiometric surface in that aquifer. A pump back system should be installed across our plume at a distance of about 500' north of the existing pond. The new line of wells should be designed so that they can be pumped.

PROPOSED EVAPORATION PONDS A AND B

Monitoring of the proposed evaporation ponds will consist of unsaturated zone monitoring in the form of a leak detection system. We propose this be accomplished by a series of ten monitor wells placed around the perimeter of the evaporation ponds as shown on Plate 1. Eight of these wells are placed on the exterior of the evaporation pond system drilled as close as possible to the liquid; preferably through the embankment. These wells should be extended to a depth of approximately 50 feet. Monitoring of two ~~deep~~ wells placed near Ponds A and B in a similar manner to the shallow wells will serve the dual purposes of monitoring the unsaturated zone and monitoring of water quality directly below the impoundments in the unconfined aquifer. In addition, we recommend that visual monitoring of the eastern subgrade disposal area pit wall be performed on a weekly basis to assure that seepage is not exiting the western portion of evaporation Pond A. Monitoring of the wells placed around the perimeter of the evaporation ponds will consist of neutron, gamma and/or temperature logging.

Baseline monitoring will consist of four quarterly measurements for a one-year period prior to disposal operations. This is necessary to calibrate baseline conditions and to familiarize monitoring personnel with equipment operation. In addition, water quality for the two deep wells in the unconfined aquifer should be analyzed quarterly for one year for the full parameter list.

Monitoring during operations will consist of quarterly geophysical logging of all wells and quarterly measurement of lead indicators in the deep wells. A contingency plan should be implemented if ~~saturation or near saturation is noted~~ on the basis of the geophysical logs, water quality in the unconfined aquifer shows pH less than ~~4.0~~ or specific conductance increases by a factor of two or more for two successive quarterly measurements.

this will work only if the ponds are lined.

The contingency plan for the proposed evaporation ponds which are proposed with synthetic liners, will consist of identifying the leak area, draining a suspected leak area in the pond, repairing the leak, testing the repaired area for any additional leaks and returning the area to normal service.

If the ponds operate as designed, no detailed closure monitoring is required. The operational monitoring will constitute a sufficient record to document closure.

oOo

We recommend that any existing ~~monitoring wells which are abandoned~~ all abandoned wells, including abandoned exploration holes be grouted or otherwise properly plugged.

Attached is a list of references documenting the geophysical techniques we have recommended for monitoring the unsaturated zone. In addition, we have listed suitable references for ground water monitoring, sampling and sample preservation techniques. If you have any questions regarding the monitoring program outlined or desire further services, please do not hesitate to contact us.

Yours very truly,

DAMES & MOORE

Larry T. Murdock

L. T. Murdock

Wm R Highland

W. R. Highland

LTM/WRH:si
Tables 1 to 6
3 copies Plate 1
3 copies Plate 2
References

TABLE 1

PARAMETERS TO BE ANALYZED FOR GROUND WATER MONITORING PROGRAM 4)

Lead Indicators

- Water Level (prior to sampling)
- pH
- Specific Conductance
- Temperature

Laboratory Measurements

Common Ions[1)]

Ammonia (NH_3^+)	Magnesium (mg^{+2})
Bicarbonate (HCO_3^-)	Nitrate (NO_3^-)
Carbonate (CO_3^{-2})	Nitrite (NO_2^{-2})
Calcium (Ca^{+2})	Potassium (K^+)
Chloride (Cl^-)	Sodium (Na^+)
Boron (B)	Sulfate (SO_4^{-2})
Fluoride (F^-)	Total Dissolved Solids (TDS)

Trace Metals[1)]

Aluminum (Al)	Lead (Pb)
Arsenic (As)	Manganese (Mn)
Barium (Ba)	Mercury (Hg)
Cadmium (Cd)	Molybdenum (Mo)
Chromium (Cr)	Nickel (Ni)
Copper (Cu)	Selenium (Se)
Iron (Fe)	Zinc (Zn)

Radionuclides[3)]

Uranium (U-Natural)[1),2)]	Polonium (Po_{210})[2)]
Radium (Ra_{226})[1),2)]	Lead (Pb_{210})[2)]
Vanadium (V)[1)]	Thorium (Th_{230})[2)]

1) Parameters listed in Wyoming DEQ guidelines.
2) Parameters listed in USNRC Regulatory Guide 4.14.
3) USNRC Guidelines call for measurement of suspended (total) concentrations as well as dissolved concentrations for wells used or potentially used as a drinking water source, irrigation or stock watering.
4) The full parameter list presented is recommended for pre-operational monitoring.

TABLE 2

RECOMMENDED GROUND WATER MONITORING PROGRAM

SUBGRADE DISPOSAL AREA

Type of Monitoring	Frequency	Parameters *	Wells To Be Monitored
Baseline	Quarterly for one year or four times prior to disposal start-up	All (Shown on Table 1)	All (Listed Below)
Early Warning-operational	Quarterly	Moisture Content and Radiation with Geophysical Logs	P-4 U-1, U-2.
Early Warning-operational	Quarterly		C-1, C-2, C-3
Operational	Annual	Lead Indicators	STF-1, BUL F-7 MW-3, MW-6 Well No. 16
Closure	Quarterly for one year near end of operations	All	All

* Lead indicators and full parameter list are shown on Table 1

TABLE 3

GROUND WATER MONITOR WELL DATA

SUBGRADE AREA

Well	LOCATION FAP Coordinates E	N	Approximate Distance From Subgrade Disposal Pit	Date Drilled & Aquifer	ELEVATION Casing	Ground	DIAMETER Casing	Hole	DRILLING DATA TOTAL DEPTH Casing	Hole	Screened And/Or Gravel-Packed Interval	Static Water Level
MW-5	795,649	774,419	1,400'	January 3, 1980 Unconfined	6,657.33	6,655.21			300'	300'		258'
MW-3	794,395	776,738	500	January 7, 1980 Unconfined-Perched	6,570.75	6,568.74				250		163
P-4	796,368	776,810	150	July 9, 1980 Unconfined	6,607.63	6,605.83	5"	10"	214	220	184-214'	205
BUL F-7	795,878	778,288	1,500	October 27 to November 4, 1978 Unconfined	6,499.47	6,495.68	2"	3¾"	236	263.5	0-236.5	175
STF-1	795,198	778,678	1,700	October 19-25, 1978 Unconfined	6,580.31	6,578.76	2"	3¾"	298	299.5	0-299.5	260
Federal #16A	798,467	777,818	2,100	Sept. 26-29, 1972 Confined	6,492	6,490	8"	12¼"	390	390	290-390	153
U-1				Unconfined-Perched								
U-2				Unconfined-Perched								
C-1	To Be Installed			Confined								
C-2				Confined								
C-3				confined								

TABLE 4

RECOMMENDED GROUND WATER MONITORING PROGRAM

EXISTING EVAPORATION POND AREA

Type of Monitoring	Frequency	Parameters	Wells To Be Monitored
Operational	Quarterly	Lead Indicators	All (Listed on Table 5)
Operational	Annual	TDS, SO_4, Cl, As Mn, U-nat, Ra_{226} and Lead Indicators	All
Closure	Quarterly for one year near end of operaticns	Cl, Mn, NO_3, SO_4, pH, TDS, As, Total Fe, pb, Mo, Ra_{226}, Th_{230}, U-nat, Pb_{210}, Po_{210}	All

TABLE 5

GROUND WATER MONITOR WELL DATA

EXISTING EVAPORATION POND AREA

Well	LOCATION FAP Coordinates E	N	Approximate Distance From Existing Evaporation Pond	Date Drilled & Aquifer	ELEVATION Casing	Ground	DIAMETER Casing	Hole	DRILLING DATA TOTAL DEPTH Casing	Hole	Screened And/Or Gravel-Packed Interval	Static Water Level
R-1			100'	Nov. 1978 - Perched					No Records		No Records	
R-2			100	Nov. 1978 - Perched					No Records		No Records	
R-3			150	Nov. 1978 - Perched					70'			
R-4			200	Nov. 1978 - Perched					67'			
R-5			200	Nov. 1978 - Perched					40'			
R-6			250	Nov. 1978 - Perched					40'			
M-1			500	Nov. 1978 - Perched								
M-2	Data Supplied		550	Nov. 1978 - Perched			Data Supplied					
M-3	by FAP		700	Nov. 1978 - Perched			by FAP					
M-4			600	Nov. 1978 - Perched								
TPI-1			1,600	Nov. 1978 - Perched								
TPI-10			400	Nov. 1978 - Perched								
TPI-20			600	Nov. 1978 - Perched								
TPI-24			800	Nov. 1978 - Perched								
TPI-D2			850	Nov. 1978 - Unconfined					360'			
Fox 1			1,950	Nov. 1978 - Perched								
Fox 2			2,400	Nov. 1978 - Perched								

Note: Well locations shown on Plate 2.

How do we know these wells sample the perched zone if these construction data are missing? We can't.

I don't if a well this deep is in an unconfined aquifer.

TABLE 6

RECOMMENDED GROUND WATER MONITORING PROGRAM

PROPOSED EVAPORATION PONDS A AND B

Type of Monitoring	Frequency	Parameters	Wells To Be Monitored
Baseline	Quarterly for one year or four times prior to disposal startup	Moisture content and radiation with geophysical logs	All
Operational	Quarterly	Moisture content and radiation with geophysical logs	All
Closure	Continue operational monitoring until liquid is removed from pond and reclamation complete	Moisture content and radiation with geophysical logs	All

I think this is MacCary?

REFERENCES

Keys, W.S. and L. M. MacCary, "Application of Borehole Geophysics to Water Resources Investigations," Techniques of Water Resources Investigations of the U.S.G.S. Chapter F-1, 1971.

U.S. Environmental Protection Agency, 1977, Procedures Manual for Ground Water Monitoring at Solid Waste Disposal Facilities, EPA-530/SW-611.

_____, 1979, Methods for Chemical Analyses of Water and Wastes, Environmental Monitoring and Support Lab, Cincinnati, Ohio, EPA-600-06.

_____, 1980, Regulatory Guide 4.14, Revision 1, Radiological Effluent and Environmental Monitoring at Uranium Mills, Office of Standards Development, Washington, D.C.

Wilson, L.G., "Monitoring in the Valdose Zone: A Review of Technical Elements and Methods," Environmental Monitoring Systems Laboratory, U.S. EPA, Las Vegas, Nevada.

Wyoming Department of Environmental Quality Guideline No. 8, Hydrology, Revision 2, January, 1980.

Sue - please order this for me thru usiw.