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THE STATE OF WYOMING

ED HERSCHLER
GOVERNOR

Department of Environmental Quality

LAND QUALITY DIVISION

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CHEYENNE, WYOMING 82002

DOCKETED USNRC MAY 21 1985 MAIL SECTION DOCKET CLERK

RECEIVED MAY 21 1985 U.S. Nuclear Regulatory Commission Mail Section

MEMORANDUM

TO: Dale Smith, Director, NRC - Field Office

FROM: Kathy Muller Ogle, Mine Operations Environmental Representative
Wyoming DEQ/LQD

DATE: May 16, 1985

SUBJECT: Uranerz U.S.A., Inc., Ruth ISL Site (R & D #9); Groundwater Baseline, Classification of Quality of Use, and Restoration Results.

Attached please find three memos resulting from recent evaluations completed by Wyoming DEQ regarding the Uranerz - Ruth ISL site. The evaluations are as follows:

Lennox memo 5/1/85:	A determination of groundwater quality of use classification.
Finley memo 4/1/85:	An evaluation of groundwater restoration adequacy with regard to confirmation sampling.
Finley memo 4/26/85:	A determination of groundwater baseline.

It is my understanding there have been discussions on these matters between our reviewers and Randy Birch of your staff. Please advise me if there remain any unresolved issues regarding these determinations. It will be advantageous if the NRC and WDEQ can agree on baseline and quality of use classification for the groundwater at this site.

KMO:clw
cc: Roger Shaffer

FEE EXEMPT

DESIGNATED ORIGINAL

Certified By Mary C. Hood

Add'l Info
00619

THE STATE OF WYOMING

ED HERSCHLER
GOVERNOR

Department of Environmental Quality

Water Quality Division

HERSCHLER BUILDING CHEYENNE, WYOMING 82002 TELEPHONE 307 777-7781

MEMORANDUM

TO: Kathy Muller Ogle, Mine Operations Environmental Representative LQD

FROM: Richard J. Lennox, Engineering Evaluator *phil for RJL*

DATE: May 1, 1985

SUBJECT: Determination of Groundwater Baseline and Classification of Quality of use on Uranerz U.S.A. Inc., Ruth Site ISL project (R&D #9)

1. Information presented by Uranerz, U.S.A. Inc., letter dated January 4, 1985 indicates the following concerning the classification of quality of use based on Water Quality Rules and Regulations, Chapter VIII for individual areas or wells reported:

   a. Table D-Baseline Water Quality Data For 20-Sand Aquifer (Pre-operational Data)

      All parameter mean values meet the requirements of Class I - Domestic, Class II - Agriculture or Class III - Livestock Quality of use. When considering maximum observed values the parameters pH, and sulfate stand out as being above minimum standards for Class III - Livestock. Iron with a high of .62 mg/l is well within the treatable range and is therefore not considered critical to the classification scheme. Radium at a high of 20 pCi/l is also well within the treatable range. Therefore the quality of use assigned for the water is Class I - Domestic.

   b. Table D-6.9, p.1. Baseline Water Quality Data for 20 Sand Aquifer (1-m-20) (Pre-operational Data)

      Data indicates quality of use Classes I, II or III minimum requirements are met.

   c. Table D-6.9, p.3. Baseline Water Quality Data for 20 - Sand Aquifer (5-m-20) (Pre-operational Data)

      Data indicates quality of use for Classes I, II or III minimum requirements are met.

   d. Table D-6.9, p.4. Baseline Water Quality Data for 20 - Sand Aquifer (7-m-20) (Pre-operational Data)

      Data indicates quality of use for Classes I, II or III minimum requirements are met.

e. Table D-6.9, p.7. Baseline Water Quality Data for 20 - Sand Aquifer (4L & 8L) (Pre-operational Data)

Data indicates quality of use for Classes I, II and III minimum requirements are met except for radium 226 which had a maximum observed value of 225 pCi/l and a minimum observed value of 60 pCi/l. Since the treatable limit for radium is considered 100 pCi/l, the data would indicate that this water be classified as Class V (mineral commercial) based on the radium content. All other parameters remain as Class I, II or III.

f. Baseline Water Tables ISL Wellfield (Pre-operational Sampling)

Data indicates quality of use for Class I, II and III minimum requirement are met except for radium 226 which had a maximum observed value of 163 pCi/l and a minimum observed value of .6 pCi/l. When considering the mean of 55 pCi/l this is within the treatable range; therefore this water is classified as Class I - Domestic.

2. When the entire 20 - Sand Aquifer is considered the quality of use assigned is Class I - Domestic with an exception of radium which has a range of reported values of 225 - .2 pCi/l. Any evaluation concerning restoration of radium would have to consider each well on an individual basis.

3. The baseline determination as presented in memorandum from Jim Finley, dated March 26, 1985 is concurred with.

cc: A. J. Mancini, Groundwater Control Supervisor
File

MEMORANDUM

TO FILE: Uranerz, U.S.A., Inc. Ruth Site, R & D #9

FROM: Jim Finley, Hydrologist

DATE: April 1, 1985

SUBJECT: Evaluation of Restoration Results for Confirmation Sampling

CHECKED BY:

A. Introduction

In a letter dated February 14, 1985, Uranerz, U.S.A., Inc. submitted water quality data collected from the 11 sampling wells within their well field. Restoration of the 20-sand aquifer has been conducted since February, 1984. A request was made to determine whether or not the water quality data submitted indicates the restoration process has progressed sufficiently for DEQ/LQD to conduct confirmation sampling.

B. Discussion

The data supplied was analyzed following the procedures suggested in the Finley memo dated March 25, 1985. No parameters with complete data sets greatly exceeded baseline conditions and most registered well below the baseline average.

Of the parameters with non-detectable measures, only three failed the proportion test. Of the three parameters one, barium, has a maximum concentration less than the baseline maximum; the other two parameters have maximums greater than baseline levels. The reverse osmosis technique used to restore the groundwater quality to baseline conditions is representative of the best practical technology. Therefore, the restoration effort is judged against the quality of use criteria as determined by DEQ/WQD. None of the parameters exceed the suitability levels, and as such, did not adversely affect the conclusion drawn.

C. Conclusion

Based on the data submitted, the restoration process has sufficiently lowered water quality parameter concentrations to justify confirmation sampling by DEQ/LQD. All parameters are below baseline levels or within the quality of use standards.

D. Recommendation

Three wells are suggested for the confirmation sampling.

JF/kv

cc: Bill Kearney
District III
Dick Lennox - WQD
Kathy Ogle

MEMORANDUM

TO: Uranerz U.S.A., Inc. Ruth Site, R & D #9

FROM: Jim Finley, Hydrologist

DATE: March 26, 1985

SUBJECT: Baseline Determination

CHECKED BY:

A. Introduction

The objective of this determination evolved in response to a meeting between representatives of Uranerz, DEQ/LQD, DEQ/WQD, and the NRC held December 7, 1984, at the LQD office. Of the several topics discussed, one in particular is addressed in this memo. A determination describing which sets of pre-operation water quality data are valid to use in defining baseline conditions for the 20-sand aquifer.

As a result of this meeting, Uranerz submitted water quality data collected at five wells (I-M-20, 5-M-20, 7-M-20, 4L, and 8L) plus the results of one sampling from each of the 31 wells comprising the ISL well field. Also included was a table representing a compilation of all the available pre-operation water quality data.

B. Discussion

Baseline water quality for the mineralized 20-sand aquifer is presented as Table D-6.9(i) in the approved permit. Wells included in this compilation were 4L, 8L, 1-M-20, 4-M-20, and 5-M-20. Two of these, 4L and 8L, are located within the well field and the others lie outside the well field configuration. A total of 31 samples were used in the production of the table.

In deciding what data to use in a revised baseline evaluation, it is first necessary to check the data to see whether or not there are significant differences between the water quality as a function of well location. The fact that the well field was constructed in its present location suggests that this area is more mineralized than the surrounding zone. As such, there might exist a difference in the observed water quality between those wells within the well field and those outside the well field. The assumption is made that the water quality of the aquifer is homogeneous both outside and inside the well field within the natural variation of the total population. Based upon this assumption statistical comparisons were attempted on the data submitted.

The data were analyzed after splitting the information into two categories. Parameters which occurred in measurable (i.e., detection limit) amounts in all samples were considered as full data sets and those parameters having some non-detectable measures were considered

as incomplete data sets. Two different statistical schemes were used to evaluate each category of data.

Incomplete Data Sets

In their original baseline determination, Uranerz assigned parameters existing in non-detectable quantities the analytical detection limit when at least one sample in a series was measurable. This elevates the calculated mean statistic and does not accurately estimate the population parameter. Therefore, another statistical comparison was conducted wherein the proportion of non-detectables to detectables was tested in order to determine whether or not the data from outside the well field could be combined with that collected inside the well field.

The resultant statistical test has a binomial distribution since the proportions are determined from counts. Snedecor and Cochran (1974) describe the chi-square test and how it is completed. The previously mentioned assumption of homogeneity implies that the proportion of non-detectable to detectable measures remains constant over time. Acceptance of the null hypothesis, i.e., no difference in the two proportions, suggests that there is no basis upon which to claim any difference between the water within the well field and outside the well field. Results of the tests conducted on a parameter-by-parameter basis indicate that combining the data is valid. The plus signs in Table 1 indicate those parameters which were tested with this statistical procedure.

Complete Data Sets

Calculation of a mean, standard deviation, etc., is possible for any given set of data and these statistics are also useful in comparing two sets of data. The statistical comparison is again whether or not data from outside the well field is sampled from the same population as the data collected inside the well field. Two tests, an analysis of variance and a t-test of means, are potential procedures to make this comparison.

Several assumptions, none of which may be relaxed, control whether or not either of these tests are valid. In a general sense, the populations from which the samples are drawn are normally distributed, the samples are randomly collected, and the variances are equal. The first is checked by plotting frequency diagrams, the second by investigating sampling procedures, and the third by conducting a simple F-test. Normality is generally approached as sample size increases unless some transformation of the data is required.

The majority of parameters with complete data sets did not meet all three assumptions and an alternative comparison was required. Bivariate plots, or plots of one parameter against another, containing data from all wells will graphically indicate whether or not

any discrimination between groups exists. Based on these plots and statistical tests of those parameters meeting the assumptions, no significant difference exists between samples collected from within the well field and outside the well field.

One parameter, radium 226, was measured in significantly different amounts outside and inside the well field. These two groups of samples represent different populations and can not be combined as they were in the original baseline determination. The variation about the resultant mean is quite large as is seen in Table 1.

Table 1 is a revision of Table D, submitted January 4, 1985. Changes include sample sizes, minimum and maximum levels, and the treatment of parameters with non-detectable measures.

C. Conclusion

Expansion of the original baseline data set is justified and using data collected from outside the well field is valid for this determination. Elevating the mean by assigning non-detectable samples the analytic detection limit is not valid, and the procedures used herein better address the problem of statistically handling non-detectables.

Small sample sizes require the application of alternative statistical techniques unless the ruling assumptions are satisfied. Baseline determinations require close scrutiny of the data before any lumping of data is made. Applying statistical procedures to a set of data without first looking at distributions is not valid and could result in gross misinterpretations of the data collected.

D. Recommendation

As a result of the investigation conducted as well as conversations with both Randy Brich and Kent Peterson of the NRC, and Dick Lennox of DEQ/WQD, the following is recommended:

Table 1 is suggested as a revision of Table D in defining baseline water quality conditions of the 20-sand aquifer. Comparisons of data collected subsequent to the restoration process should follow the same procedures used in this determination.

JF:lg

cc: District III
Dick Lennox, WQD
Randy Brich, NRC
Kathy Ogle
Bill Kearney
Attachments
/jfrd/9/

Reference

Snedecor, G. W. and W. G. Cochran, 1974, "Statistical Methods," The Iowa State University Press, Ames, Iowa, 593 p.

TABLE 1
Baseline Water Quality Data for 20-Sand Aquifer
Pre-operational Data: Wells 7-M-20,
4L&8L, 5-M-20, 1-M-20, and Wellfield Wells

Parameter	N	Max	Min	Mean	Std. Dev.
Temperature, C, Field	47	15	11	13.5	1.05
pH-Field(s.u.)	47	9.4	7.7	8.5	0.32
pH-Lab(s.u.)	49	9.4	6.2	8.1	0.42
Conductivity-Field umhos	41	605	390	440	42.5
Conductivity-Lab umhos	49	636	450	516	35.6
TDS, Evaporation @ 180 C	80	394	288	335	23.7
Sodium	80	129	98	112	5.8
Potassium	56	10	2	4	1.4
Calcium	56	11	1	7	2
Magnesium	56	7	0	2	1.4
Sulfate	80	203	68	101	15.7
Chloride	80	14	2	6	2.2
Carbonate	75	65	0	+	
Bicarbonate	80	207	54	161	33.4
Hydroxide		NR			
Ammonia as N	56	0.30	ND	+	
Nitrate as N	56	0.22	ND	+	
Floride	48	0.85	0.14	0.49	0.03
Total Alkalinity as $CaCO_3$	80	190	64	157	13.7
Total Hardness as $CaCO_3$	56	49	12	26	6.4
Boron	56	0.19	ND	+	
Aluminum	56	0.40	ND	+	
Arsenic	56	0.09	ND	+	
Barium	56	0.08	ND	+	
Cadmium	56	0.008	ND	+	
Chromium	56	0.02	ND	+	
Copper	56	0.02	ND	+	
Iron	56	0.94	ND	+	
Lead	56	0.15	ND	+	
Manganese	46	0.07	ND	+	
Mercury	56	ND	ND	+	
Nickel	56	ND	ND	+	
Selenium	55	0.04	ND	+	
Zinc	46	0.89	ND	+	
Molybdenum	56	ND	ND	+	
Uranium, U_3O_8	80	0.335	ND	+	
Vanadium, V_2O_5	56	0.07	ND	+	
Radium 226, pCi/L	25	225	0.6	111	61.6

+ indicates no mean or standard deviation calculated because of the occurrence of non-detectable levels of the particular parameter
ND - non-detectable
NR - not reported