

Los Alamos

NATIONAL LABORATORY

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Los Alamos, New Mexico 87545

Date: February 7, 2000
In Reply Refer To: ESH-18/WQ&H:00-0037
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Mr. John Young
Hazardous and Radioactive Waste Bureau
New Mexico Environment Department
2044 Galisteo Street, Building A
P.O. Box 26110
Santa Fe, New Mexico 87505

SUBJECT: CONTAMINANT RESPONSE PROCESS-PILOT TEST 2

Dear Mr. Young:

The joint LANL/DOE/NMED Response to Contamination Committee met on January 24, 2000 to conduct a second phase of pilot testing on the Response to Contamination process. The purpose of the test was to determine the appropriateness of the 12 criteria, the amount and type of data necessary to evaluate the criteria, and to establish how the joint committee will develop the final rating. Regional aquifer well R-15 was the subject of the second pilot test. Please note that R-15 was requested by NMED personnel to be the second pilot test subject. Since no contaminant was detected in water samples from R-15 at or above a standard or health advisory limit, typically the R-15 water quality data would not have been a subject for this response process. The complete results of the pilot test are included as Attachment 1. An overall summary of the test is provided in this letter.

The priority of response to the presence of tritium in the 646-ft perched zone in R-15 was rated as "moderate" by committee consensus. The primary reasons cited for the rating were: the concentration of the contaminant at below the standard, the location of the well within one-half mile of the Lab boundary, the TA-50 groundwater discharge plan relies on understanding contaminant distribution in Mortandad Canyon, and the inability to monitor the 646-ft zone in well R-15.

Regarding improvements to the response criteria, there was consensus that criteria 10 (facilitate completing an RFI) and 11 (programmatic consistency) should be combined. The completion of an RFI is considered to be part of programmatic consistency and the committee members preferred to address all programmatic elements within the same criteria. The resulting list of criteria is presented in Attachment 2.

This letter and attachments serve as the report summarizing the results of the committee deliberations. Accordingly, I would appreciate a NMED written response confirming the committee's R-15 rating and concurring with the documentation of the meeting, in keeping with response to contamination process steps.



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With the successful completion of the pilot testing of the Response to Contamination process on wells R-9 and R-15, the committee considers this process ready to be implemented, as necessary, during future Hydrogeologic Workplan activities. Please note that recently I have become aware of chemical data regarding the presence of perchlorate in groundwater beneath Mortandad Canyon which may necessitate re-performing the Response to Contamination process on R-15, should future analyses indicate the presence of perchlorate in R-15 at levels at or above a standard or health advisory limit.

Thank you for your participation in the joint committee meeting. Please feel free to contact me at 665-4681 should you have any questions regarding this letter.

Sincerely,



Charles L. Nylander
Water Quality and Hydrology Group

CN/rm

Enclosures: a/s

Cy: Victoria Maranville, NMED/HRMB, Santa Fe, NM, w/enc.
Chris Hanlon-Meyer, NMED/OB, Santa Fe, NM, w/enc.
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David Rogers, LANL, ESH-18, MS K497, w/enc.
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Gene Turner, DOE/LAAO, MS A316, w/enc.
WQ&H File, MS K497, w/enc.
CIC-10, MS A150, w/enc.

**Response to Contamination Pilot Test
R-15**

**Attachment 1:
Results of Response to Contamination Process Pilot Test
January 24, 2000**

Response to Contamination Pilot Test R-15

#	Criteria	Comments
1	Existing quality of the groundwater, including other sources of contamination and their cumulative impact on the groundwater quality	Tritium is elevated in perched zone. The presence of drilling mud confounds conclusions regarding other constituents that are elevated. All are below standards or health advisory limits.
2	Physical and chemical characteristics of constituents	Tritium moves with water and is affected only by radioactive decay.
3	Hydrogeologic characteristics of immediate area	Perched zone in basalt at 646 feet.
4	Proximity and withdrawal rates of water supply wells	R-15 is located within the Pajarito Mesa well field
5	Current and future uses of the water	The perched zone is not currently used for water supply. The Pajarito Mesa supplies approximately 80% of Los Alamos County water
6	Potential for health risks caused by exposure of humans, wildlife, vegetation or physical structures to the constituents of concern (toxicity and pathways)	No constituent is above the standard or health advisory limit.
7	Location with respect to the Lab boundary	R-15 is about 0.4 mile north of the Laboratory boundary with San Ildefonso
8	Well construction issues	R-15 is a single completion well in the regional aquifer. No monitoring capability for the perched zone.
9	Schedule for drilling nearby wells	Nearby wells will be drilled between FY02 and FY04
10	Programmatic consistency	TA-50 Discharge Plan approval is contingent on a monitoring capability in Mortandad Canyon
11	Budget/Priorities	
	Overall Rating	Moderate

Response to Contamination Pilot Test

R-15

Criteria 1: Existing quality of the groundwater, including other sources and their cumulative impact on groundwater quality

Existing Data:

- The groundwater from the perched zone (646 ft) at R-15 is predominantly a sodium-calcium-bicarbonate type solution. It contains 3770 ± 850 pCi/L tritium and 1.2 ppb dissolved uranium. The nonsorbing solute (sulfate, nitrate, chloride, fluoride and tritium) concentrations are similar to TA-50 discharge and alluvial groundwater in Mortandad Canyon.
- The groundwater from near the top of the regional aquifer (1007 ft) is a sodium-bicarbonate type solution. Activities of tritium are less than detection using two different analytical counting methods and dissolved uranium is 2.4 ppb.
- Other water quality parameters for R-15 and surrounding wells are in Table 1.

Discussion Summary:

- The background data shown on Table 1 are the maximum and minimum concentrations that have been measured at the 15 background sampling stations in four quarters of sampling. An exception to this is uranium, for which the average of 54 samples is presented.
- The bentonite used for drilling is being analyzed after a nitric acid digestion to get the total of each analyte. The analytical results are expected in 3 weeks.
- In TA-50 effluent and alluvial water, the ^{90}Sr is about 40 $\mu\text{g/L}$ and the tritium is 20,000-30,000 pCi/L.
- The uranium in the perched zone is about double what is in the regional aquifer. However, the isotopes are about 40 times higher. This may be the result of the drilling mud, as the samples were very turbid.

Criteria 2: Physical and chemical characteristics of the constituents

Existing Data:

- Six constituents (chloride, fluoride, TKN, sulfate, dissolved uranium, and tritium) above background were present in the perched zone (Table 1). All of these are also associated with the TA-50 effluent and the Mortandad Canyon alluvial groundwater. The presence of uranium above background is likely due to the addition of bentonite during drilling.
- Six constituents (TKN, sulfate, dissolved uranium, uranium-234, uranium-235, and uranium-238) are above background in the regional aquifer. The presence of dissolved uranium, U-234, U-235, and U-238 are likely due to addition of bentonite during drilling. Other constituents may also be elevated due to the addition of bentonite. Sulfate and TKN are also associated with the TA-50 effluent and the Mortandad Canyon alluvial groundwater.
- The constituents that are present above background (with the exception of uranium) are non-sorbing and therefore are conservative.
- All of the constituents present above background are significantly below standards (Table 1).

Response to Contamination Pilot Test

R-15

Discussion Summary:

- Tritium is only affected by radioactive decay.
- Uranium can be mobile, under oxidizing conditions. At R-9, geochemical modeling suggests that 56% of the uranium is sorbed within the perched zone.
- TKN are organic nitrogen compounds that can be positively charged and will sorb. They partially sorb and partially dissolve. TKN is present in the TA-50 outfall, but Sandia Canyon could also be a TKN source.

Criteria 3: Hydrogeologic characteristics of the immediate area

Existing Data:

- The geologic units encountered in R-15 are (from top to bottom): alluvium (16 ft thick); Tshirege Member of the Bandelier Tuff (49 ft thick); Tswankawi Pumice (1 ft thick); Cerro Toledo interval (54 ft thick); Otowi Member of the Bandelier Tuff (300 ft thick); Guaje Pumice Bed (52 ft thick); Puye Formation (thickness of 20 ft); late Pliocene soil (5 ft thick); Cerros del Rio basalts (248 ft thick); Puye Formation (355 ft thick); and Totavi Lentil of the Puye Formation (encountered from 1100 to TD at 1107 ft).
- Saturated or near-saturated conditions may exist in the Cerro Toledo interval (depths of 74 and 87 ft), based on moisture content and estimated rock porosity. However, no free groundwater was produced in these zones.
- The first free groundwater encountered in R-15 was in a perched zone of saturation in the Cerros del Rio basalts. The static water level is at 646 ft. The perching layer is a 5-ft thick interval of clay-rich rock at the base of the Cerros del Rio basalts.
- A possible zone of saturation may be present in the upper part of the Puye Formation. The driller observed the fluidity of the mud increased; however, saturated conditions were not found when the use of drilling mud was halted. The drilling mud from at depth of 482 ft contained a higher tritium activity than would be expected from mud mixed with regional aquifer water.
- The regional aquifer is within the lower part of the Puye Formation. The static water level is at 964 ft (elevation of 5854 ft). The elevation of the static water level is consistent with regional aquifer elevation in nearby wells PM-1, PM-3, TW-3, and TW-8.
- The occurrence of perched water in the basalt suggests that the vertical gradient in that portion of the borehole is downward.
- Vertical gradient in the regional aquifer may be downward or there may be no vertical gradient, suggesting horizontal flow. The measurements were too close together and the upper measurement was a composite, so there is no way to distinguish with the data obtained during drilling.
- A slug test was conducted in the perching layer that confirmed it is a low conductivity material.

Discussion Summary:

- Saturation was expected in the Cerro Toledo interval, however there was no free water.
- Perched water was present in the basalt at 646 ft. The confining layer has low conductivity based on a slug test conducted in that interval.

Response to Contamination Pilot Test R-15

- The gradient may be either horizontal or downward. The test conditions were such that it is not possible to distinguish.
- In the unsaturated zone core was analyzed for tritium. The highest value from the unsaturated zone core was 3021 pCi/L at 68 ft. The core had 1,132 pCi/L tritium at 85 ft. The tritium was measured by liquid scintillation of vapor extracted from the rock.

Criteria 4: Proximity and withdrawal rates of water supply wells

Existing Data:

Water Supply Well	Distance from R-15	Average Annual Withdrawal Rate	Total Withdrawal	Average Drawdown
PM-3	1.4 mile ENE	214 x 10 ⁶ gallons (1968-1996)	6.4 x 10 ⁹ gallons (1968-1996)	24 ft (1968-1996)
PM-5	0.6 mile WSW	156 x 10 ⁶ gallons (1986-1996)	1.7 x 10 ⁹ gallons (1986-1996)	92 ft (1986-1996)
PM-4	0.7 S mile south	301 x 10 ⁶ gallons (1982-1996)	4.5 x 10 ⁹ gallons (1982-1996)	39 ft (1982-1996)

- Contaminants have not been detected in these water supply wells.

Discussion Summary:

- The presence of the contaminants detected in R-15 within the Pajarito Mesa well field strongly indicates there is the potential to affect water supply wells.

Criteria 5: Current and Future Uses of Water

Existing Data:

- No known wells for water supply are completed in the 646-ft perched zone in the basalt.
- R-15 is in the center of the Pajarito Mesa well field and the regional aquifer which supplies about 80% of the water supply for the county of Los Alamos.

Discussion Summary:

- No comments

Criteria 6: Potential for health risks caused by exposure of humans, wildlife, vegetation, or physical structures to the constituent(s) of concern (toxicity and pathways)

Existing Data:

- None of the constituents that are present in above background concentrations in the perched zone or the regional aquifer are at or near the MCL.

Discussion Summary:

Response to Contamination Pilot Test R-15

- The Existing Data section should address the potential pathways to ecological or vegetation receptors and to the regional aquifer.
- The data (not detectable tritium in the regional aquifer) does to indicate a direct pathway to the regional aquifer.
- The location of R-15 is on the side of Mortandad Canyon and it may have missed the connection to the regional aquifer which more likely would be in the center of the canyon where most of the water infiltrates.
- R-15 was sited on the side of the canyon because a southeast component of flow in the Cerro Toledo was suspected. However, this was not observed.

Criteria 7: Location of the well with respect to the Lab boundary

Existing Data:

- R-15 is located in Mortandad Canyon, approximately 0.4 mile north of the boundary with San Ildefonso Pueblo

Discussion Summary:

- San Ildefonso has requested money from DOE to install a regional aquifer well. The location of the well has not been selected, but one candidate site is in Mortandad Canyon.

Criteria 8: Well Construction Issues

Existing Data:

- R-15 is a single completion well in the regional aquifer

Discussion Summary:

- There is no way to monitor the 646-ft perched zone in R-15.

Criteria 9: Schedule for drilling near-by wells

Existing Data:

- The Hydrogeologic Workplan schedule as amended by the FY99 Annual Status Report is:

Planned Well	Schedule for Drilling	Funding Source
R-12	Completed (1/00)	ER
R-10	FY02	ER
R-13	FY04	ER
R-14	FY03	NWT

Discussion Summary:

- The schedule for the surrounding wells will not meet the expectations of the Groundwater Quality Bureau and is likely to impact approval of the TA-50 Discharge Plan.

Response to Contamination Pilot Test R-15

Criteria 10: Programmatic Consistency

Existing Data:

- There has been significant public concern about Mortandad Canyon, leading to an investigation by the Inspector General
- The TA-50 Discharge Plan is predicated on information from R-15 and other Mortandad Canyon R-wells.

Discussion Summary:

- As noted above, the TA-50 Discharge Plan approval is likely to be impacted by the lack of wells in Mortandad Canyon.
- There is no direct relationship between the deep well drilling and the completion of an RFI report because the deep wells are not included in surface aggregate reports.

Criteria 11: Budget/Priorities

Existing Data:

Discussion Summary:

- The budget does not have a direct bearing on this pilot test.
- Priorities will be discussed at the Quarterly Meeting in January, and the priority sequence is likely to evolve.

Response to Contamination Pilot Test Results for R-15

Table 1: Water Quality in R-15 and surrounding wells (Note: R-15 water samples contained bentonite)								
Parameter (mg/L or pCi/L)	R-15 Perched 646 ft	R-12 Perched 443, 464 ft	R-15 Regional 1,100 ft	TW-8 Regional ESH-18, 1998	TW-3 Regional ESH-18	R-12 Regional 805 ft	PM-3 Regional ESH-18	PM-1 Regional ESH-18
pH	7.71	7.65, 7.65	8.13	7.5	6.1	7.64	7.9	8.3
Cl (F) ²	11.5	31.5, 197	3.20	3.6 (NF)	3.9 (NF)	10.1	7.0 (NF)	6.0 (NF)
F (F)	1.15	0.52, 0.85	0.29	0.15 (NF)	0.36 (NF)	0.43	0.25 (NF)	0.21 (NF)
NO ₃ (F)	<0.01	4.93, 0.24	<0.01	0.26 (NF)	0.65 (NF)	0.46	0.47 (NF)	0.49 (NF)
NH ₄ (F)	0.06	<0.02, 14.2	0.03			0.02		
TKN (NF) ²	7.1		2.0					
SO ₄ (F)	35.4	24.7, 191	15.1	3 (NF)	4 (NF)	10.1	6 (NF)	6 (NF)
U (F)	0.00129 ± 0.00017	0.00251 ± 0.00034, 0.00204 ± 0.00028	0.00244 ± 0.00033	0.00041 ± 0.00010 (NF)	0.00044 ± 0.00010 (NF)	0.00408 ± 0.00056	0.00041 ± 0.00010 (NF)	0.0017 ± 0.0003
Sr-90 ³ (NF)	0.12 ± 0.49	0.47 ± 0.75, -0.20 ± 0.32	-0.04 ± 0.40	0.6 ± 0.8	0.5 ± 0.8	0.16 ± 0.66	0.1 ± 1.6	0.3 ± 1.6
U-234 (NF)	0.495 ± 0.112	1.74 ± 0.26, 2.13 ± 0.32	18.7 ± 2.2	not known	not known	2.39 ± 0.36	not known	not known
U-235 (NF)	0.045 ± 0.032	0.061 ± 0.034, 0.146 ± 0.052	0.698 ± 0.140	not known	not known	0.070 ± 0.042	not known	not known
U-238 (NF)	0.301 ± 0.082	0.926 ± 0.176, 2.46 ± 0.34	13.25 ± 1.62	not known	not known	1.32 ± 0.22	not known	not known
Pu-238 (NF)	0.0121 ± 0.0162	-0.0145 ± 0.0170, 0.0111 ± 0.0156	0.0111 ± 0.0150	-0.002 ± 0.032	-0.014 ± 0.030	-0.0024 ± 0.0174	-0.018 ± 0.010	0.006 ± 0.020
Pu-239, 240 (NF)	0.0123 ± 0.0166	0.023 ± 0.026, 0.048 ± 0.028	-0.0072 ± 0.0144	-0.006 ± 0.022	-0.018 ± 0.020	0.0015 ± 0.0174	-0.013 ± 0.022	0.012 ± 0.020
Am-241 (NF)	0.025 ± 0.022	0.0168 ± 0.0192, 0.014 ± 0.022	0.0168 ± 0.0192	0.022 ± 0.048	-0.014 ± 0.034	0.0172 ± 0.0170	-0.015 ± 0.026	-0.018 ± 0.030
Tritium (NF)	4,151	254.7 ± 16.6, 208.1 ± 7.0	1.21 ± 1.40	311 ± 1,520	441 ± 1,540	46.9 ± 1.6	81 ± 1,280	291 ± 1,280

1. EPA standard. 2. F means filtered and NF means non-filtered. 3. Analytical error is reported as 2 standard deviations. 4. DOE-DCG for drinking water systems.

Response to Contamination Pilot Test Results for R-15

#	Criteria
1	Existing quality of the groundwater, including other sources of contamination and their cumulative impact on the groundwater quality
2	Physical and chemical characteristics of constituents
3	Hydrogeologic characteristics of immediate area
4	Proximity and withdrawal rates of water supply wells
5	Current and future uses of the water
6	Potential for health risks caused by exposure of humans, wildlife, vegetation or physical structures to the constituents of concern (toxicity and pathways)
7	Location with respect to the Lab boundary
8	Well construction issues
9	Schedule for drilling nearby wells
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