



STATE OF NEW MEXICO

ENVIRONMENTAL IMPROVEMENT DIVISION
P.O. Box 968, Santa Fe, New Mexico 87504-0968
(505) 984-0020
STEVEN ASHER, Director

TONEY ANAYA
GOVERNOR
Joseph Goldberg
SECRETARY
Ted Guambana
DEPUTY SECRETARY
JOSEPH F. JOHNSON
DEPUTY SECRETARY

April 6, 1984

Richard A. Jordan, Manager
Regulatory Licensing and Compliance
Public Service Company of New Mexico
Alvarado Square
Albuquerque, NM 87158

Dear Mr. Jordan:

Enclosed are my staff's technical comments regarding your recent submittals for Persons Station.

Please note that our comments are only a technical evaluation of the material PNM has provided us to date. These comments should not be construed as an approval by EID of any actions PNM proposes.

We appreciate your cooperation in this matter. If you have any questions, please contact me.

Sincerely,

Anthony Drypolcher
Acting Bureau Chief
Ground Water/Hazardous Waste Bureau

AD/cm

Enclosure:



STATE OF NEW MEXICO

ENVIRONMENTAL IMPROVEMENT DIVISION
P.O. Box 968, Santa Fe, New Mexico 87504-0968
(505) 984-0020
STEVEN ASHER, Director

TONEY ANAYA
GOVERNOR

Joseph Goldberg

SECRETARY
Ted Guambana

DEPUTY SECRETARY

JOSEPH F. JOHNSON
DEPUTY SECRETARY

MEMORANDUM

TO: Anthony Drypolcher, Acting Bureau Chief, Ground Water and Hazardous Waste Bureau

FROM: David G. Boyer, Water Resource Specialist, Ground Water Section *AGB*
Dennis McQuillan, Water Resource Specialist, Liquid Waste-*D. McQ.* Surveillance Section

SUBJ: Public Service Company of New Mexico (PNM) Person Station

DATE: April 6, 1984

Pursuant to your request, we have reviewed the document "Final Soil Contamination Assessment and Preliminary Ground Water Assessment PNM Person Generating Station" dated February 29, 1984 (prepared by Geoscience Consultants of Albuquerque) and accompanying cover letter (with attachments) from PNM dated March 2, 1984. We have prepared some general comments on the technical adequacy of the report, followed by specific comments on the report text. Assistance in interpretation of vadose zone and unsaturated flow hydrology sections was given by Kevin Lambert of the Ground Water Section.

General Comments

PNM has performed a soil contamination assessment and preliminary groundwater contamination assessment at the Person Generating Station. The report presents the methodology used by PNM to define and characterize the contamination caused by use of a bottomless vertical pipe to receive spent solvents between 1976 and October, 1983. In our review of the report, we concur with PNM that a combination of three possible contaminant migration mechanisms (saturated fluid flow, unsaturated fluid flow and molecular diffusion/vapor phase transport) during vertical pipe use resulted in documented soil contamination. We further agree that given current soil moisture contents continued transport of any but insignificant amounts of contamination is not possible.

We strongly disagree with the conclusion of paragraph 3 of both the Executive Summary (P.1-1), and PNM's cover letter of March 2, 1984. PNM states that the results of the assessment do not support the open-bottom vertical pipe as the

source of the high levels of ground water contamination present in the newly drilled monitor wells immediately surrounding the site. Based on this conclusion PNM requests to be relieved of responsibility under the UIC provisions of the WQCC Regulations. Having evaluated the report, we oppose this request because the available data indicate the leaky vertical pipe is the source of contamination; further, omissions or possible inaccuracies in the report do not eliminate the pipe as the source. Specifically, we have the following comments:

1. The ratio of TCA/PCE in the vertical pipe fluids prior to removal was the same as that found in the ground water and consistent with the ratio in the solvent used by PNM.
2. Highest soil concentrations of PCE in boreholes were found to the north and west of the vertical pipe. The two higher concentrations of PCE and TCA in ground water were also found in the monitoring wells to the north and west. The highest PCE and TCA concentrations were found in the north well which was also the closest to the vertical pipe. PCE concentrations in this well averaged 2.3 mg/l (vs. WQCC standard of 0.02 mg/l).
3. Coreholes were not bored within 10 feet to the west and 15 feet to the east of the site. A preferential downward route to ground water may exist in these locations. Even where boreholes were only 5 feet apart, four-orders of magnitude differences in soil concentrations of PCE were sometimes found. The reported clay lens were thin and discontinuous and could have only temporarily impeded downward movement since the vadose zone is composed mainly of sand and gravels with little silt and clay.
4. Only one set of water level measurements in the three monitor wells within 62 and 98 feet of each other were reported in determining the hydrologic gradient. Variations in pumping schedules of nearby wells can locally reverse the relatively low gradient. To provide accurate water levels, additional information on the magnitude and frequency of fluctuations is necessary and should be obtained as part of PNM's Phase IV investigation.
5. 1,1-dichloroethene concentrations in the ground water were up to 1.3 mg/l in well #3, the closest monitor well (vs. WQCC standard of 0.005 mg/l). However, it was not detected in vertical pipe fluids and may not have been present during the October, 1983 sampling. Alternatively, analysis interference problems reported by PNM's contract laboratory in Appendix A may have prevented quantification if that contaminant was present.
6. Calculation and use of PCE pore fluid values to determine pore fluid concentration gradients at low PCE concentrations are tenuous at best. These low concentrations approach the levels of detection, and precision and accuracy of results at these low levels is questionable.

MEMO: Anthony Drypolcher

April 6, 1984

Page 3

7. There is no positive evidence that the ppm quantities of organic halogens in ground water below Person Station originate from the San Jose area sources one mile to the north. The most likely explanation of the contaminants in water from wells PSMW1, PSMW2 and PSMW3 is that one or more on-site sources, past or present, exist in close proximity to the contaminated wells.

PNM's Phase IV studies should give high priority to better definition of ground-water contamination in the subject area. PNM also should search for and evaluate other potential sources of organic contaminants including the on-site laboratory septic system. Information on the nature and disposition of chemical wastes from 1952 to the mid-1970's is needed. Possible changes in hydraulic gradient and water level fluctuations with time also need better definition.

Specific Comments

1. Section 1.0. The conclusions provided in the Executive Summary at the bottom of page 1-1 and top of page 1-2 are not completely supported since (1) a preferential flow path from the open-bottom vertical pipe through the vadose zone to the water table may exist and not have been detected by drilling (comments 2, 5, 13); (2) a vertical concentration gradient upwards may, in fact, not exist due to reported values being close to the detection level, and variability in the precision and accuracy of the measurement may be greater than the value reported (comment 10); and (3) the organic constituents found in the ground water but not in the vertical pipe may not have been in the pipe at the time of sampling or may not have been sampled for in the pipe (comment 12).

The occurrence of part-per-million (ppm) levels of organic contaminants including TCA and PCE is not a "regional ground-water quality problem common in the south valley of Albuquerque" as alleged in the report. In fact, such ppm levels have been found only in localized areas in close proximity to the source(s) of contamination. If the contaminated ground water below the PNM plant was part of the San Jose Area problem (approximately one mile to the north of PNM) then one would expect wells in the intermediate area to show similar contamination. However, shallow wells such as at Southwest Insulbead Inc. show no evidence of such contamination.

2. Section 2-1. The map on p. 2-3 (figure 2-1) and accompanying text should indicate the original location of the open-bottom vertical pipe (a.k.a. leaky underground storage tank) as being at corehole 5. The map shows that no corehole was drilled closer than 15 feet to the east (#2) and that #2 was only drilled to 50 feet. Coreholes in other directions immediately surrounding the vertical pipe were no less than 10 feet away and 5 feet away to the north and south. This is important since coreholes as close as 5 feet apart showed as much as four-orders of magnitude difference in PCE concentrations at the same depths (eg. #3 and #6). The lack of

coreholes and soil analyses within 5 feet of the vertical pipe location to the east and west precludes a definitive conclusion by PNM that contamination did not migrate downward to the water table from the vertical pipe since the coring program may not have detected a preferential path to the ground water. A discontinuous clay lens present in the vicinity of PS-5 (the pipe site) could divert fluids laterally for some distance during time of saturated flow (see also comments 5, 13).

If there is additional soil coring in the vicinity of the vertical pipe, it should especially be performed between holes #2 and 5, #3 and 5, and #4 and 7 in an attempt to locate the suspected preferential flow path of downward migration. However, as emphasized above, higher priority should be given to defining the extent of contamination in ground water.

3. Section 2.5 (page 2-17). The report does not make clear whether the soil samples removed from PS-4 at 25 feet, 40 feet and 70 feet and tested to determine K_u values were obtained in situ, or whether they were removed and recompacted in the stainless steel test rings.
4. Sections 2.5 (p. 2-18) and 4.3 (p. 4-14). The methodology described provides an accurate representation of K_u using Θ vs Ψ and K_{sat} . Either laboratory or field values of these variables will work for generating K_u . At this time the only information available is laboratory results. Therefore, laboratory determined K_u should be the estimator because the actual field conditions to determine K_u are not known. Even though laboratory techniques may yield maximum values, without additional field results the laboratory K_u 's must be taken as an accurate representation of the field situation. No field values exist to support the statement that laboratory values are greater than actual field conditions (paragraph p.4-6 and 4-14). Hence, the laboratory determined K_u 's, from laboratory Θ vs Ψ and K_{sat} , are taken to represent the actual field conditions (see also comment 7).
5. Section 4.1 (p. 4-1). Some discontinuous clay zones up to 20cm (7.9 inches) thick were present in some coreholes and other material consisted mainly of homogeneous sands with some gravels. Therefore, a horizontal clay lens in the vicinity of the vertical pipe could intercept downward saturated fluid movement, cause perching and lateral flow with downward movement resuming when the lens becomes discontinuous. Clay lens were also present at depths of about 70 feet (figure 4-1) and high corehole contamination was detected only above that level.
6. Section 4.3 (p. 4-6). The text in the second paragraph should be corrected to refer to figures 4-5A through 4-7B (p. 4-8 to 4-13) instead of figures 4-8 to 4-10.
7. Section 4.3 and Section 4.4 (p. 4-14). It is unclear whether the laboratory determined K_{sat} for the saturated zone (0.008 cm/sec) was obtained from the same laboratory samples used for determining K_{sat} in the

MEMO: Anthony Drypolcher

April 6, 1984

Page 5

vadose zone (0.008 cm/sec). The lithologies of the vadose zone and the saturated zone show little difference (p. 4-3). Therefore, the Ksat (0.008 cm/sec) of the saturated zone (laboratory determined and field supported) is representative of the vadose zone under saturated conditions. Consequently, field data now exists to support the laboratory determined Ksat of the vadose zone. This in turn places credence in the laboratory Ku's representation of the actual field conditions. Hence, the statement that the laboratory Ku's are higher than the field Ku's (paragraph p. 4-6 and 4-14) is not supported by the findings on page 4-14 of Section 4.4.

8. Section 4.4 (p. 4-18). Since the three monitoring wells were within 62 to 98 feet of each other, gradient direction may be difficult to determine if values of measured water levels are close or nearly equal. The installation by PNM of additional shallow wells on the property but further apart should assist in further defining the gradient.
9. Section 5.5 (p. 5-32). The conclusions regarding additional contaminant migration through the vadose zone appear realistic under current conditions. Little additional contaminant movement in the vadose zone can be expected via saturated fluid flow, unsaturated fluid flow and molecular diffusion/vapor phase transport.
10. Sections 6.1.2, 6.1.3, and 6.1.7. PNM presents the argument that (1) low concentrations of PCE in the pore fluids below 60 feet, and (2) upward pore fluid concentration gradients from the water table (approximately 110 feet) to 70 feet are not consistent with the open bottom pipe as the source since the gradient should be downwards. However, closer examination of pore fluid concentrations and gradients does not support that assertion. Pore fluid concentrations are calculated from soil PCE concentrations and weight-percent moisture (Table 6-1, p. 6-2). PCE concentrations at 70 feet and below are all reported to be close to or less than 0.01 ppm and reported to three significant figures. Soil PCE concentrations in holes PS-4 and PS-5 above 70 feet are greater than 150 ppm and range upwards to greater than 2,000 ppm. The lower level of detection for tetrachlorethylene (PCE) is listed as 0.01 mg/l in all PNM's analyses except for 0.001 mg/l in the analysis of November 8, 1983. PNM's reported variability in analytical measurements close to the level of detection may range from 30% to greater than 100% of the reported value (eg. 0.019 ± 0.016 , 0.004 ± 0.006). Therefore, since detection limitations and reporting variability at these low levels of PCE can markedly affect the values reported, the presentation, discussion and conclusions drawn from use of PCE concentration gradients at low PCE levels are very tenuous at best. Even if a small upward PCE concentration gradient could be shown to exist in the interval from 70 to 110 feet for the boreholes under discussion, it could be argued that the source could be the vertical pipe with the mechanism being a preferential downward path to ground water not detected by coring followed by vapor phase transport upward from the contaminated ground water.

MEMO: Anthony Drypolcher

April 6, 1984

Page 6

11. Sections 6.1.4 and 6.1.9. The highest concentration of PCE in the ground water (approximately 2.3 mg/l) was found in the monitoring well (PSMW-3) closest to the vertical pipe (30 feet). The other two monitor wells were located 50 feet from the possible source. PNM points out that PSMW-3 is up gradient from the vertical pipe and that the high level detected is inconsistent with the pipe as the source if the gradient direction continues unchanged throughout the year. However, only one gradient measurement over a short distance is presented. Water wells in the area on various pumping schedules can produce differences and reversals of the local gradient that will only show up with frequent measurements of water levels. Even if the overall-gradient is in the southeast direction as shown on figure 4-11 (p. 4-18), local variations in near-surface lithology (such as generally westward deposition of Santa Fe Group sediments at the site) could have facilitated saturated transport of fluids westerly in the vadose zone when the tank was in use. Coreholes to the north and west of the possible source showed generally greater concentrations of PCE for depths between 10 through 60 feet (p. 5-29 and figures 5-3A to 5-8A). Higher concentrations in the closest well (to the north) and the west well would then be consistent with a hypothesis that fluid movement in the vadose zone was through unsaturated flow approaching or equal to saturated flow when the pipe was in use, mainly to the north and west, and then downward to ground water through an as yet undetected preferential flow path in the vicinity of the vertical pipe.
12. Sections 6.1.5 and 6.1.8. Since tetrachloroethylene (PCE, b.p. = 121°C) is less volatile than trichloroethane (TCA, b.p. = 74°C), PCE was selected by PNM as the most conservative organic tracer since it would have a longer residence time in soils (PNM letter to A. Drypolcher, December 16, 1983). A commercial solvent used by PNM and placed in the vertical pipe (Dowelene) had a ratio of TCA/PCE of 3/1. A sample taken by PNM on October 13, 1983 showed the pipe to have a ratio of TCA to PCE of 4.8/1. The average of TCA to PCE in the three ground water monitor well samples was also 4.8/1. (Table 3-4). By contrast and as would be expected, TCA/PCE ratios in soil core samples were less than one (eg. PS-4 at 60 feet: 1/26, PS-5 at 15 feet: 1/4). The fact that both pipe and ground water to TCA/PCE ratios are the same and that ground water in the monitoring well closest to the tank has the highest concentrations of contaminants strongly indicates the vertical pipe as the contaminant source.

1, 1-dichloroethene (or 1,1-dichloroethylene) was also found in the three ground water monitoring wells with the highest level averaging 1.3 mg/l in the closest well (#3) to the vertical tank. According to PNM's laboratory analysis, 1,1-dichloroethene was not detected in the vertical pipe for the October sampling. PNM uses this result to assert that the presence of that contaminant in ground water may be a reflection of the more regional Albuquerque South Valley contamination problems (p. 1-2). However, its lack of detection in October, 1983, does not mean that the contaminant may

MEMO: Anthony Drypolcher

April 6, 1984

Page 7

not have been present at earlier times in the vertical pipe. Also, Radian Corporation's report of analysis (February 23, 1984, Appendix A) indicated difficulties in quantifying 1,1-dichloroethene, and previously (February 15, 1984, Radian letter) it was not thought to be a predominant compound in the contaminated ground water. Also, methylene chloride, not reported by PNM as being analyzed in the vertical pipe, and dichloroethane had concentration levels in ground water of 0.0068 and 0.0045 mg/l respectively.

New Mexico Water Quality Control Commission Regulations provide maximum allowable concentrations in ground water of 0.02 mg/l for PCE and 0.005 mg/l for 1,1-dichloroethene. Ground water samples in all three PNM monitor wells greatly exceed those maximum values.

13. Section 6.1.6 (p. 6-5). The most likely viable flow mechanism to cause contamination is a preferential flow path, as yet undetected, which would now be characterized by residual PCE concentrations. When the vertical pipe was in use, unsaturated flow was approaching or equal to saturated flow along this preferential path, and flow to the ground water from the pipe likely occurred under these conditions.
14. Appendix A: Analytical data for organic contaminants

We have many questions regarding these data. It is not clear as to which organic compounds were specifically tested for and not detected. It would be useful to know whether or not constituents of kerosene, stoddard solvent and paint, for example were tested for. Precision and accuracy levels are also not always clear.

DGB:DMc:egr

cc: EID Legal Section
EID Hazardous Waste Bureau
Surveillance Section