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07-038

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

March 26, 2007

David B. McCoy
Executive Director
Citizen Action New Mexico
P. O. Box 4276
Albuquerque, NM 87196-4276

RE: ALLEGED NICKEL CONTAMINATION AT SANDIA NATIONAL LABORATORIES' MIXED WASTE LANDFILL, LETTER OF JANUARY 24, 2007

Dear Mr. McCoy:

New Mexico Environment Department (Department) Cabinet Secretary Ron Curry has asked me to respond to your electronic letter of January 24, 2007, in which you allege that groundwater at the Sandia National Laboratories' (SNL) Mixed Waste Landfill (MWL) is contaminated with nickel. Attached to your letter is a report prepared by Robert H. Gilkeson entitled *Nickel Contamination in the Regional Aquifer from Nickel Wastes Buried in the Sandia Mixed Waste Landfill, Version January 23, 2007.*

The Department has reviewed the report and your letter, and concludes that your assertion that groundwater at well location MW1 is contaminated with nickel as a result of a release from the MWL is not based on a technically sound analysis of extant data. The Department stands by its previous conclusion that the elevated concentrations of nickel are a result of corrosion (leaching) of the type 304 stainless-steel screen that was installed in this well. The Department therefore does not consider the owner/operators (the U.S. Department of Energy and Sandia Corporation) of the SNL Facility to be out of compliance with applicable law concerning this matter. Enclosed with this letter are comments that the Department has prepared in its review of the report by Gilkeson (2007).

Furthermore, the Department stands by its previous position as articulated in the Secretary's Final Order in matter of the MWL remedy and in the Department's Answer Brief in *Citizen Action v. Sandia Corporation, et al.*, No. 25,896 that the MWL is a solid waste management unit subject to corrective action, and not subject to the majority of provisions of 20.4.1 NMAC incorporating 40 C.F.R. 264 Subpart F.

Finally, the Department continues to disagree with your assertion that the Department is in violation of RCRA and the Sandia Consent Order.

Sincerely,

James P. Bearzi
Chief
Hazardous Waste Bureau

JPB:wpm

Enclosure

cc: J. Kieling, NMED HWB
W. Moats, NMED HWB
T. Skibitski, NMED DOE OB
T. Fox, NMED OGC
L. King, EPA VI

File: SNL, 2007

New Mexico Environment Department Comments on

Nickel Contamination in the Regional Aquifer from Nickel Wastes Buried in the Sandia Mixed Waste Landfill, Version January 23, 2007 (by Robert H. Gilkeson)

March 26, 2007

On January 24, 2007, the New Mexico Environment Department (NMED) received an electronic letter from David B. McCoy, Executive Director, Citizen Action, alleging that groundwater at the Sandia National Laboratories' (SNL) Mixed Waste Landfill (MWL) is contaminated with nickel. Attached to his letter was a report prepared by Robert H. Gilkeson entitled *Nickel Contamination in the Regional Aquifer from Nickel Wastes Buried in the Sandia Mixed Waste Landfill, Version January 23, 2007* (Gilkeson Report). The NMED has reviewed this report and has developed the following comments.

NMED comments are in regular font, following statements in the Gilkeson report, shown in bold font.

1. **Page 1, paragraph 1, first sentence of the Gilkeson Report states, "Moats report – *Evaluation of the Representativeness and Reliability of Groundwater Monitoring Well Data, Mixed Waste Landfill, Sandia National Laboratories* (NMED, November 2006), relies on the findings in Goering, et al. (SAND 2002-4098) that the elevated nickel levels measured in well MW1 are due to corrosion of the stainless steel well screen. However, this finding in Goering, et al. is technically incorrect and without basis to the water quality data collected over time from the well".**

Although the "Moats report" (Moats and others, 2006) cites the work by Goering and others (2002), NMED does not solely rely on the information presented by Goering, et al. As testified by NMED witnesses at the hearing held on corrective action for the MWL, and as provided in NMED's response to citizen comments on the MWL Corrective Measures Implementation Plan (NMED response R43, web page address http://www.nmenv.state.nm.us/hwb/snlperm.html), the lack of nickel contamination in the vadose zone is very strong evidence that a release of nickel from the MWL has not occurred. Other evidence includes: 1) there are no known mobile sources of nickel that were disposed of in the MWL; 2) the 460-ft thick vadose zone underlying the landfill and dominated by fine grained sediments would be expected to readily adsorb nickel, greatly restricting its migration to deep levels in the vadose zone; and 3) high or unusual levels of nickel do not occur in any of the wells constructed with polyvinyl chloride (PVC) screens. The technical evidence indicates that elevated concentrations of nickel detected in groundwater samples from well MW1 are caused by corrosion (leaching) of the well's stainless steel screen. NMED finds that Gilkeson's contention that a release from the MWL has caused nickel contamination does not have a sound technical basis.

2. **Page 1, paragraph 2, third sentence states "The Moats Report does not acknowledge**

that nickel wastes were disposed of in the MWL".

The report by Moats and others (2006) states that, "The MWL was operated for land disposal from 1955 to 1988, and included at various times throughout its operational history, disposal of hazardous, radioactive, and mixed wastes". That the report did not specifically mention that nickel waste or any other specific waste types were disposed of in the landfill was not vital to the subject matter of the report.

A wide variety of metals and radionuclides (many of which behave chemically as metals) were disposed of in the MWL. Metals in general (including nickel) have a tendency to be adsorbed by clays, including those used in the manufacture of drilling mud. Moats and others (2006) evaluated a variety of metals as concentrations in groundwater as part of their analysis of the potential effects of drilling mud and drilling additives on the quality of water samples. They concluded that groundwater samples retrieved from wells at the MWL and analyzed for metals are reliable and representative of formation water.

3. **Page 1, paragraph 4, first and second sentences state, "In fact, the Moats report does not acknowledge the nickel contamination that was measured in boreholes drilled below the dump as shown by the concerns in the NMED 1998 Notice of Disapproval (NOD) for the *Report of the Mixed Waste Landfill Phase 2 RCRA Facility Investigation*. The NMED NOD described the presence of elevated nickel concentrations to a depth of 100 feet below ground surface (bgs) and a *hot spot* of nickel contamination at a measured level of 97.5 mg/kg at a depth of 50 ft bgs in borehole BH-3".**

The SNL responses to the 1998 NOD and the relevant data led the NMED to conclude many years ago that nickel contamination does not actually exist in the vadose zone at the MWL. Thus, Moats and others (2006) did not mention nickel in the context of the NOD because it was not relevant to the topic of the report, and it would have conveyed outdated and incorrect information to the public.

The one sample containing 97.5 mg/kg nickel reported in the Phase 2 RCRA Facility Investigation Report occurred in angle-borehole BH-3 at a true vertical depth of about 43 ft bgs. Nickel concentrations were detected at background levels at all other intervals sampled in this borehole. Background levels of nickel were also detected at all sampling intervals in all adjacent boreholes to a true vertical depth of (typically) about 104 ft. It was therefore determined that the one sample result of 97.5 mg/kg is anomalous and isolated, and not indicative of a release from the landfill.

4. **Page 1, paragraph 6, third sentence states, "However, the very high levels of dissolved nickel and low levels of dissolved chromium are evidence that the nickel contamination is not from corrosion of the screen". Also page 2, paragraph 2, last**

sentence reads, "Corrosion would create finely divided particles of nickel and result in a markedly higher value of nickel in the unfiltered water sample".

Gilkeson argues that the presence of dissolved nickel and the absence of appreciable dissolved chromium is incontrovertible evidence that the nickel is representative of contamination from the landfill. Gilkeson does not consider that chromium and nickel have different physical and chemical properties, and thus may behave differently in response to corrosive or other chemical conditions.

The well screen installed in well MW1 is made of type 304 stainless steel. The corrosion of stainless steel well screens is not well understood. However, a bench study commissioned by the U. S. Environmental Protection Agency (EPA) involving, among other alloys, the corrosion of type 304 stainless steel found that samples of leachate in contact with the steel contained detectable levels of dissolved nickel, but not chromium (*Report on the Corrosion of Certain Alloys*, EPA, July 2001). It was therefore shown that nickel can be easily leached from stainless steel, remaining in dissolved form, while chromium may not (or at least may leach at a much slower rate compared to nickel).

5. **Page 2, paragraph 4, first sentence states, "The NMED has allowed Sandia to collect water samples from well MW1 with the inappropriate high-flow purging methods that pump the well dry with water samples collected a week later of the aerated water that refilled the well".**

Data show that well MW1 was sampled within one day of purging through at least April 2002, a period of 14 years after its installation.

The NMED disagrees with Gilkeson's comment; the data show that groundwater data obtained from the monitoring wells at the Mixed Waste Landfill (MWL) are generally representative of formation water. The pumping and sampling procedures employed by Sandia are appropriate, and in fact are a necessity given the natural conditions that exist at the MWL. The majority of the wells at the MWL are "low yield wells" because the saturated sediments that they intercept have low saturated hydraulic conductivities (Ksat). The NMED and EPA both recognize that low yield wells exist in the real world and sometimes that the desired ideal sampling conditions can not be obtained. Because low yield wells are a reality, and contamination is not always in high Ksat zones, the sampling of low yield wells is not prohibited by regulation and procedures for sampling them are found in EPA guidance.

Several of the wells at the MWL are constructed such that their screens straddle the water table. This is a common practice that is effective for monitoring the uppermost part of the saturated zone and to account for potential seasonal variations in water levels and contaminant concentrations. The surface of the water contained in any given well is in contact with air (and thus oxygen). The formation water at the water table surrounding the wells is also in contact with air. No matter what sampling procedures are employed, some of the water that flows into the wells will have been exposed to oxygen in air.

See NMED's response to citizen comments for the CMI Plan at the above referenced internet link, responses R29, R38, and R40.

6. **Page 2, paragraph 4, last sentence states, "At the time of construction, well MW1 was adequately productive to support a low-flow water sampling methodology as shown by the fact that the permeability of the screened interval was measured using a pumping test."**

Gilkeson argues that a single pumping test result alone is enough evidence to support a conclusion that the well can be sampled using a lower pumping rate and in a manner that would not result in purging the well dry. This is unlikely to be true.

The four pumping tests conducted on MW1 from May 2-4, 1994, utilized average pumping rates of 0.52, 0.90, 0.90, and 0.32 gpm. After purging to the depth of the pressure transducer (about 7 feet), the well required about 6 hours to recover. A graph of drawdown versus time indicates that the well was unable to sustain the pumping rates of 0.52 gpm or higher without going dry. Furthermore, the drawdown rates at pumping rates of 0.32 and 0.52 gpm are similar, strongly suggesting that even the lowest pumping rate (0.32 gpm) was unsustainable for the well. If the test had been allowed to continue at the lowest pumping rate utilized in the test, well MW1 would have almost certainly been purged dry.

7. **Page 2, paragraph 6 states, "The borehole log describes the aquifer strata across the well screen as follows:**
   467 – 472 ft bgs GM – silty sandy gravel; predominantly fine gravel with a trace of clay.
   472 – 479 ft bgs. SM – silty fine sand, trace clay.

   The next paragraph starts, "The borehole log predicts the saturated strata across the screened interval have a capability to produce a continuous flow of water for low-flow purging and sampling".

Gilkeson argues that well MW1 could be pumped without being purged dry based on the sediment types making up the saturated zone surrounding the well screen.

The geologic log actually states:

467-472 ft	GM	silty sandy gravel. some fine sand, trace silt, trace clay, predom. fine gravel.
472-479 ft	SM	silty sand. some silt, clay, clay, predom. fine sand

The abbreviation "predom." is taken to mean "predominantly"; the second listing of "clay" for the 472-479 ft interval duplicates the log accurately. The sampling methods (grab or split spoon) and percent core recovered were not specified in the log for these intervals. The Unified Soil Classification System symbols recorded by the geologist suggest that these intervals to be composed of silty sandy gravel (GM) and silty sand (SM). Because the sampling method and percent core recovered were not recorded in the log, it is not known specifically how representative the samples are in comparison to the actual strata. However, intervals above and below are classified as silty sand and low plasticity silt (ML), suggesting much of the strata contain or are mostly made up of fine-grained sediments.

Silty gravels and silty sands are not "clean" (containing little or no) sands and gravels, and a fine-grained matrix of the sediments encountered in these intervals is strongly implied by the use of terms such as "clay" and "silt". Both SM and GM sediments can have low hydraulic conductivities in comparison to well graded sands and gravels (SW and GW), and especially compared to gap graded or uniform sands and gravels (SP and GP). The NMED interprets the log to record a silty sandy fine-grained gravel at 467-472 feet, and a silty fine-grained sand from 472 to 479 feet. That these sediments actually exhibit low hydraulic conductivity and yield groundwater at a low rate is not surprising, considering the totality of the available information and data. Slug test results confirm the low hydraulic conductivity.

8. Page 2, last paragraph, second sentence states, "The 2006 field sampling log on file at NMED shows the well was purged at a rate of 2.3 liters per minute, a purging rate 10 times faster than the rate recommended by the EPA and NMED for low-flow sampling".

NMED guidance for low-flow sampling states that low-flow purging and sampling pumping rates generally range from 0.1 to 1.0 liter per minute (L/min). Purge rates are not necessarily the same as sampling pumping rates, and the former are often higher. A purge rate of 2.3 L/min is not extraordinary, nor is it an unacceptable purge rate in this circumstance.

Gilkeson does not consider that the depth to groundwater at the MWL (approximately 460 feet bgs) places practical limitations on the type and performance of pumps capable of raising water to the surface from such depths. NMED's experience with Bennett sampling pumps (such as used at the MWL) is that they are capable of a maximum pumping rate of only about 1-1.5 gpm at these depths. Experience also shows that lowering the pumping rate to 0.5 gpm (2 L/min) and at the same time maintaining the desired continuous output of water for sample collection can be difficult. As discussed in comment #7, well MW1 would purge dry at a pumping rate of 0.5 gpm. Thus, achieving a lower pumping rate would be even more difficult.

9. Page 3, paragraph 5 states, "The nature and extent of the nickel contamination in the groundwater below the mixed waste landfill is poorly understood at the present time because of the insufficient number of monitoring wells and the inappropriate

methods that are used for the collection of water samples."

Nickel contamination does not exist in the groundwater at the MWL (see comment #1). SNL uses appropriate methods for the collection of water samples (see comment #5).

The number of wells installed at the MWL is sufficient. MWL-BW1 has been acceptable as a background well (until recently going dry). NMED has required SNL to replace well MWL-BW1. The other six wells at the MWL are adequate for providing water level data and down-gradient water-quality information. Wells at the MWL provide representative water samples. See also NMED's response to citizen comments for the CMI Plan at the above referenced internet link, response R53.

10. Page 3, last two paragraphs in part state, "For water samples collected from the upper screen in monitoring well MW4, the NMED water quality data base lists anomalously high dissolved nickel values of 31.9 and 32.2 ug/L for splits of water samples collected on April 16, 2003. A much lower nickel value of 15.9 ug/L was measured in an unfiltered water sample collected on April 20, 2004, and an even lower value of 4.5 ug/L was measured in an unfiltered water sample collected from well MW4 on April 19, 2005.

An elevated nickel value of 69.4 ug/L was measured in an unfiltered water sample collected from well MW3 on April 22, 2003. The high turbidity of 11 NTUs measured in this water sample may be responsible for the high nickel value. For this sampling date, nickel was not analyzed for a filtered water sample. The overall poor quality of the groundwater monitoring data for the mixed waste landfill prevent knowledge of the danger of groundwater contamination now and in the future from the buried wastes."

In these two paragraphs, Gilkeson asserts that a contaminant plume of nickel is widespread at the MWL. The dissolved nickel concentrations that Gilkeson cites for MW4 (31.9 and 32.2 μg/L, duplicate samples) and for MW3 (69.4 μg/L) represent samples taken during the same sampling event conducted in April 2003.

Of the eight sample results recorded in the data set for MW3, the median concentration is 30 μg/L and the mean is 32 μg/L. Of the ten sample results for well MW4, the median concentration is 3 μg/L and the mean is 9 μg/L. For wells MW3 and MW4, dissolved nickel concentrations in groundwater samples range from 11.5 to 69.4 μg/L and 1.1 to 32.2 μg/L, respectively.

As apparent in the above ranges, the values cited by Gilkeson as evidence of contamination are the maximum values for the two data sets. However, the mean and median of any given data set are generally best representative of central tendency ("average" conditions) compared to other statistical descriptors. In each case mentioned by Gilkeson, the maximum concentration of each data set is more than two times higher than the mean and median concentrations. Therefore, the maximum concentrations are at least two times higher than the levels that would normally be considered best representative of typical groundwater conditions.

The median and mean nickel concentrations in water samples from MW4 are clearly representative of natural background conditions. The median and mean concentrations of dissolved nickel in water samples from MW3 are higher than expected relative to those observed in samples from the wells screened with PVC. For this reason, NMED suspects that well MW3 may also be suffering some corrosion of its well screen, but not to the degree of that by MW1.

11. Page 3, last paragraph, first sentence states, "An elevated nickel value of 69.4 µg/L was measured in an unfiltered water sample collected from well MW3 on April 22, 2003".

This sentence is incorrect. It should have referred to a *filtered* water sample.

12. Page 3, last paragraph, third sentence states, "For this sampling date, nickel was not analyzed for a filtered water sample".

This sentence is incorrect. It should have referred to an *unfiltered* water sample.

13. Page 3, last paragraph, last sentence states, "The overall poor quality of the groundwater monitoring data for the mixed waste landfill prevent knowledge of the danger of groundwater contamination now and in the future from the buried wastes".

NMED disagrees with this comment. NMED finds that wells at MWL meet the regulatory requirements of 20.4.1 NMAC, that the use of drilling mud and additives for the installation of some wells has not caused the quality of water samples to become compromised, that well development was adequate, that well locations are acceptable and useful, and that the design and for and construction materials used to install the wells at MWL are acceptable. See comments #1 and 6, and NMED's response to citizen comments for the CMI Plan at the above referenced internet link, responses R39, R45, R49, R50, R53, R54, and R55.