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Date: May 17, 2004

To: Nancy Peters, Hopkinton Board of Health

From: Jesse Schwalbaum, Earth Tech

CC: Dick Jubinville, Earth Tech

Subject: Harvey Landfill Analytical Results from April 2004 Sampling

As you requested, I have reviewed the results of the most recent round of water quality sampling and analyses conducted on the monitoring wells in the vicinity of the former Harvey Landfill in Hopkinton. The water samples were obtained on April 8 and 9, 2004 by staff from Brown & Caldwell.

In general, the water quality results are similar to the results of previous sampling rounds, although there are some notable trends and anomalies. These will be discussed below. First, I think is important to clarify a set of related issues revolving around cadmium, pH, the low flow sampling method and the viability of some of the monitoring wells.

pH Issues

The results of the first round of sampling conducted in August of 2003 showed high levels of pH in some of the monitoring wells, notably MW-1B, MW-2B, MW-4B and MW-7B. All of these are wells that are screened in shallow bedrock. The source of the high pH levels was determined to be the grout used in the well construction. The grout is a non-permeable material used to fill in the space that was formed during the drilling process between the natural soils and the well. It's purpose is to prevent the short circuiting of water between the ground surface and the well screen. The grout is formed of basic (high pH) materials. When the wells were sampled for the first time, the pH of the sampled water appears to have been highly impacted by the grout. The potential impact of the grout on water samples was further exacerbated by the inappropriate design of some of the wells. In particular, the screens of wells MW-1B and MW-7B are in direct contact with the grout.

The level of the pH by itself is not a major water quality issue. However, pH effects the concentration of other contaminants, notably metals. High pH lowers the solubility of metals. This means that although there may be significant levels of dissolved metals in the groundwater, when that water comes into contact with the grout, these metals can come out of solution and would not be detected in the water sample. This is why we have consistently considered the

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results from the first round of sampling at these wells to be invalid.

The potential impact of the grout on the pH and on the levels of metals in the affected wells has continued to be an issue. The pH levels continue to be significantly higher in these wells than in the other wells. This raises the question of whether the elevated pH is due to actual groundwater conditions or as a result of contamination from the grout.

A perfect example of the uncertainty posed by the grout/pH issue can be found in the most recent round of sampling. After purging well MW-4B using the low flow sampling method, the pH level at the time of sampling was found to be relatively high at 8.39. The sample was taken but Brown & Caldwell wisely chose to continue to purge the well to see if the pH would continue to drop. The pH did indeed drop to 7.10 and another sample was taken. The sample with the high pH showed no cadmium. The later sample with the lower pH detected cadmium at 0.016 mg/l. Only the initial sampling results with no cadmium were reported in the table prepared by Brown & Caldwell.

In my opinion, all of the water quality results for metals (including iron, lead and cadmium) for wells MW-1B, MW-2B, MW-4B and MW-7B are of questionable validity. The pH of the water samples may be impacted by the grout in the wells and may be under-representing the levels of metals in the groundwater.

Low Flow Sampling Procedures

In the process of reviewing this issue, Earth Tech also noted that the low flow sampling procedure, as specified by the EPA, does not appear to have been consistently adhered to by Brown & Caldwell field staff. The EPA procedure specifies that samples should not be obtained until stabilization of specific chemical field parameters are met. Our review of the field notes from the latest sampling round indicates that these stabilization parameters were not always strictly met before a sample was taken.

Trends and Anomalies

Now that there have been four rounds of sampling and analysis for most of the wells it is possible to review trends and anomalies in the data. Earth Tech makes note of the following:

- The levels of iron at MW-1B are extremely erratic, ranging from 11 to 130 mg/l (we have discounted the first round of sampling)
- Levels of sodium and chloride at MW-2B appear to be increasing over time.
- Levels of sodium, chloride and sulfate appear to be increasing steadily at MW-2S.
- Dissolved oxygen levels at MW-3 are high and have continued to rise over the year. The most recent analysis indicates that iron levels have increased by an order of magnitude.
- Alkalinity levels at MW-4B have steadily decreased while sulfate levels have steadily increased.

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- The levels of sodium, TDS, chloride and COD have increased steadily at well MW-4S.
- Chloride, sodium, specific conductance and TDS levels have consistently decreased at well MW-7S.

These trends and anomalies can provide clues as to what might be happening within this hydro-geochemical system and should be taken into account when designing the final groundwater monitoring program.

Recommendations

Earth Tech has raised the potential that the analytical results for metals for the bedrock wells may be invalid and recommends that Brown & Caldwell address the pH and grout issues for these wells. A strict adherence to the low flow method for these wells may have to be abandoned. We recommend that each of the wells be purged for prolonged periods in order to determine how low the pH will go. Unless it can be established with certainty that these wells provide representative samples of the groundwater, the wells should be replaced.

For the remainder of the wells, Brown & Caldwell should review the recommended the EPA's criteria for stabilization of field parameters and assure that these procedures are strictly adhered to by field personnel.

Brown & Caldwell should closely review water quality trends and anomalies from the four rounds of water quality analyses and consider their potential causes before finalizing the long-term groundwater monitoring plan.

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