NOVEMBER 16, 2009
MALCOLM PIRNIE RESPONSE TO STATE DTSC

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ATTACHMENT 9

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CITY OF ORLAND
PLANNING DEPARTMENT

Ms. Nancy Sailsbery, Director
Community Services Department
City of Orland
815 Fourth Street
Orland, California 95963

Subject: Response to DTSC's Letter of November 5, 2009

Dear Ms. Sailsbery:

Malcolm Pirnie prepared this letter in response to the letter prepared by the Department of Toxic Substances Control (DTSC) and dated November 5, 2009 to the City of Orland and forwarded via email to Crystal Geyser Water Company (CGWC), Triad Holmes and Malcolm Pirnie on November 6, 2009.

In its letter, DTSC indicated that it had reviewed the Aquifer Test Report prepared by Malcolm Pirnie and submitted to the City of Orland as part of the Application for Site Plan Review, dated October 5, 2009. DTSC provided two recommendations in its letter. First, DTSC recommended that CGWC "conduct additional assessment including exploring other deeper aquifers as an option for source of groundwater." Secondly, DTSC indicated "The assessment should include performing modeling to determine if any impacts may exist that could affect the PCE plume during long term extraction of groundwater." DTSC also indicated that it is CGWC's "responsibility to ensure their activities do not significantly spread the contamination or exacerbate the problem."

In response to DTSC's first recommendation that CGWC should explore other deeper aquifers, Malcolm Pirnie has performed this work. In February 2009, Malcolm Pirnie directed the drilling of an exploratory boring on the subject property (Site) located at 1507 County Road 200. The boring was drilled to a total depth of 620 feet. Based on our interpretation of the borehole geophysical logs in conjunction with our examination of the drill cuttings, three nested monitoring wells were installed in the boring to enable the collection of depth-discrete groundwater samples. The "shallow" well was screened from 130 to 170 feet below ground surface (bgs); the "middle" well was screened from 290 to 310 feet bgs and 320 to 340 feet bgs; and the "deep" well was screened from 520 to 540 feet bgs and 550 to 570 feet bgs. Malcolm Pirnie directed the development and sampling of the wells shortly after completion. The key parameter for a mineral water source is the regulatory minimum threshold of 250 milligrams per liter (mg/L) of total dissolved solids (TDS). Groundwater samples from the water-bearing zone screened in the shallow well exceeded this threshold whereas samples from the two deeper wells did not and so would not be suitable for CGWC's use. Therefore, Malcolm Pirnie and CGWC selected the water-bearing zone from approximately 130 to 170 feet bgs for the completion of the test well installed later in 2009.

In response to DTSC's second recommendation that CGWC should perform numerical modeling to assess any impacts of the planned groundwater pumping on the existing PCE plume, Malcolm Pirnie has performed this assessment as well. We have completed an assessment of the interactions of pumping at the test well (i.e., proposed water supply well) at the Site and the plume of dissolved perchloroethylene (PCE) that has been documented in overlying aquifers northwest of the Site. Under contract to DTSC, URS Corporation (URS) developed a MODFLOW/MT3D groundwater model for the plume. For this assessment we modified URS's model to include (1) recent pumping records for the City's municipal wells near the Site and plume, (2) revised aquifer hydraulic properties for the D-zone based on the aquifer test performed on the test well, and (3) the most recent groundwater monitoring results (August 2009). The modeling effort revealed that pumping the test well at the Site would not cause the plume to arrive at the well within the timeframe simulated in the model, and that the effect of pumping on the plume in the D-zone would be minimal over the same time period. Modifications made to URS's model, the simulations that were conducted, and the results of those simulations are presented below.

MODEL MODIFICATIONS

Municipal Well Withdrawal Rates

The withdrawal records from the City of Orland provided to Malcolm Pirnie on October 26, 2009 were compared to the pumping rates and well locations that were used in the URS model. The URS model uses a different numbering sequence for the municipal wells than the City, so the pumping rates needed to be reconciled to the correct wells. Fortunately, the City also uses place names based on the location of the wells for their pumping records. From this evaluation we found that many of the wells that were simulated by URS to be pumping in their model runs were not, and that wells they did not include were being pumped by the City. We used the average pumping rate as reported from 2005 to 2009 to simulate the City's water withdrawal. Table 1 lists the wells and rates used.

Table 1
Annual Pumping in Gallons from City of Orland Municipal Wells

Well ID	CENTRAL ST. #1	R/R AVE. #2	WOODWARD #3	SUISUN ST. #5	SHOP WELL #6	ROOSEVELT #7	Total
2005	48,043,000	172,253,000	154,909,097	118,380,199	156,186,000	19,636,000	669,407,296
2006	59,674,000	189,229,000	143,101,097	139,740,598	147,138,000	27,545,999	706,428,694
2007	85,399,000	183,567,000	173,254,300	120,574,000	144,944,000	53,796,000	761,534,300
2009*	112,301,333	169,494,667	258,195,733	146,551,067	109,020,000	29,689,333	825,252,133
Average	76,354,333	178,635,917	182,365,057	131,311,466	139,322,000	32,666,833	740,655,606
Ave gpm	91	327	294	225	297	37	1271
Ave ft/day	17,597	63,092	56,739	43,360	57,207	7,192	

* 2009 was prorated to 12 months from 9 months of records

One observation that can be made from these data is that the City's well withdrawal rates are increasing at approximately 60 to 100 gallons per minute (gpm) per year (2005 – 2006 increase was 68 gpm, 2006 – 2007 increase was 102 gpm, 2007 to 2009 increase 121 gpm). The model simulated and used the average rate for each well. However, if the withdrawal rates continue to increase, the City's wells will have an increasingly larger influence on the future plume configuration and even further lessen any changes associated with the test well operating at a maximum annual average of 100 gpm, which is already de minimis compared with the rate of the City's pumping.

New Information from Hydrogeologic Investigations at the Site

The hydrogeologic investigations performed at the Site revealed some differences in stratigraphy and hydrogeologic properties from the properties that were simulated in the URS model. The first difference is that the stratigraphy at the Site is comprised of only three hydrostratigraphic units: a 60-foot thick upper aquifer, a 70-foot thick confining unit and a 40-foot thick lower aquifer (total thickness of 170 feet). The URS model simulates seven layers, with four aquifers separated by three confining units for a total thickness of 160 feet. A comparison of well logs from the Site, cone penetrometer test (CPT) logs from URS investigations (e.g., closest to furthest CPT 40, CPT 39, and CPT 38) and the URS model 7-layer stratigraphy indicated that the stratigraphy found at the Site continues for some distance away from the Site as reflected at CPT 40 and CPT 39, while further away at CPT 38, the stratigraphy corresponds to the URS model.

When comparing the stratigraphy it is clear that the upper two aquifers simulated by URS (A- and B-Zones) merge to become one aquifer (60-foot thick upper aquifer beneath the Site) and the lower two confining units merge to become one confining unit (70-foot thick confining unit and pinching out or disappearance of the C-Zone). The model was modified within about 2,000 feet of the Site to reflect the Site stratigraphy by changing layer 2 from confining to aquifer(i.e., increasing hydraulic conductivity) and layer 5 from aquifer to confining (i.e., decreasing hydraulic conductivity). Because the URS model is a generalized model, these changes used the hydraulic conductivities in the URS model to simulate aquifers (i.e., 120 ft/day) and confining units (i.e., 2.83×10^{-3} ft/day).

The aquifer testing conducted by Malcolm Pirnie at the Site estimated an average transmissivity of 30,000 gallons per day per foot. The simulated D-Zone thickness near the Site is 30 feet, therefore, this transmissivity yields a hydraulic conductivity of 133 ft/day. This is not significantly different than the value modeled by URS. The hydraulic conductivity of the D-Zone, simulated as layer 7 in the model, was increased to 133 ft/day within 2,000 feet of the Site.

New Groundwater Quality Data Collected by URS

URS's August 2009 groundwater monitoring results indicate that the plume has reduced in size and concentration from that observed in 2004. The 2004 results were used as the starting concentrations in the URS model. For our assessment, the plume was simulated using the URS 2004 and 2009 sampling results. We updated the plume configuration to reflect the 2009 concentration distribution for the 32 monitoring wells sampled.

We also noted that URS did not simulate PCE fate and transport in Layers 6 and 7 (i.e., the confining unit above the D-Zone and the D-Zone) of the model. The planned withdrawal from the test well is from the D-Zone so simulating the plume movement in this layer is important. For this reason we changed the MT3D (fate and transport) model to simulate transport in these layers.

MODEL SIMULATIONS

After the groundwater model had been updated with the new information noted above, the fate of the plume was simulated under four scenarios:

1. Using the 2004 plume configuration, URS's simulation of in-situ remediation, no pumping at the Site
2. Using the 2004 plume configuration, URS's simulation of in-situ remediation, pumping 100 gpm at the Site
3. Using the 2009 plume configuration, URS's simulation of in-situ remediation, no pumping at the Site
4. Using the 2009 plume configuration, URS's simulation of in-situ remediation, pumping 100 gpm at the Site

First, the plume configuration in the D-Zone in both scenarios 2 and 4 (no pumping at the Site) was assessed with respect to potential concentrations arriving at the Site over a 30-year timeframe of pumping. Then, to assess the effects of pumping the test well on the plume geographic position and configuration in the D-Zone, the resulting 10-, 20- and 30-year plume configurations from scenarios 1 and 2 were compared as well as the results from simulations 3 and 4. Any differences in the plume configuration/location in these comparisons would be attributable to the pumping of the test well.

RESULTS

2004 Plume Configuration - The non-pumping scenario (Scenario 1) showed PCE arriving in the D-Zone (due to City well pumping) within 11 years of the start of the simulation and continuing to expand over the next 30 years. In Scenario 2, PCE arrival in the D-Zone is slightly sooner at 10 years but the expansion of the plume is about the same rate as Scenario 1 (non-pumping). However, the plume is off-set by about 200 feet toward the Site well at the end of the 30-year simulation. The plume does not arrive at the test well and at 30 years the closest detectable concentration of PCE is more than 1,600 feet from the Site.

2009 Plume Configuration – The non-pumping scenario (Scenario 3) showed PCE arriving in the D-Zone (again, due to City well pumping) after 29 years. In the pumping scenario (Scenario 4), it arrives in the D-Zone after 28 years. The detectable plume area at 30 years in the D-Zone in both scenarios 3 and 4 is only a few acres in size although it is slightly smaller in Scenario 4 (the pumping scenario). This small area is offset towards the Site by about 100 feet and remains more than 2,500 feet from the Site in both scenarios. Therefore, there is no predicted arrival of PCE at the Site.

In summary, Malcolm Pirnie modified the URS model by (1) correcting and updating the actual pumping from City wells, (2) used a measured value for hydraulic conductivity for the D-Zone from our aquifer test rather than an estimated value, and (3) updated the PCE concentrations at the State's monitoring wells to reflect the more recent August 2009 sampling results. Running the model with these changes, Scenario 4 indicates that pumping the test well will have no impact on the plume size or concentration and it will remain more than 2,500 feet from the Site.

Lastly, and as a point of clarification, DTSC indicated in its letter that "The result of the pump test indicated there may be a draw down of water level to and from nearby wells." The results of our aquifer test clearly showed that of the 11 private homeowner's wells that we monitored during the 4-week study, 10 showed no change in water levels based on our test. The one well that is unusually deep (175 feet) and screened in the same zone as our test well had a measureable drawdown. Based on CGWC's maximum annual average pumping rate of 100 gallons per minute (gpm) as compared to the rate of 410 gpm used for the aquifer test, we estimate an average drawdown in this one well to be one to two feet. This very small change will not affect the homeowner's use of their well.

Please contact me at 510-735-3020 with any questions or comments on the work performed and reported in this letter.

Very truly yours,

MALCOLM PIRNIE, INC.

James F. Strandberg, CHg
Project Manager

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