

HOFFER & ASSOCIATES CONSULTING HYDROGEOLOGISTS

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August 4, 1998

Robert Haslam, Site Project Manager
Sites Management Section
VTDEC - Waste Management Division
103 South Main Street/West Office
Waterbury, VT 05671-0404

Re: Status Report, Moran Residence, Stowe, Vermont
SMS Site #98-2402

Dear Bob:

This letter documents recent activities at the Moran residence since our meeting at the site on July 20, 1998. Since the meeting, additional activities have included leak testing of the lines from the well pump to the pitless adapter and from the pitless to the house, sampling and photoionization detector (PID) screening of soils from beneath the foundation through the garage wall, soil gas screening around the perimeter of the building, and installation of a packer in the bedrock supply well. In addition, periodic monitoring of the product recovery system has continued on a regular basis. Provided with this letter is a site basemap showing the approximate footprint of the Moran residence and soil-gas and soil sample locations.

Line Pressure Testing

On July 21, the black polyethylene lines between the pump and the pitless adapter and those connecting the pitless adapter to the house were vacuum tested to assess if there were any holes in the plumbing. The tests consisted simply of disconnecting both ends of the lines, sealing both ends and applying a vacuum. If the line held a vacuum of at least seven inches of mercury vacuum for a minimum of 30 minutes, it was considered sound.

The first test was conducted on the one-inch diameter line connecting the pump to the pitless. This line held 15 inches mercury vacuum for 30 minutes with no observable decrease in vacuum. The second test conducted was on the one-inch line between the pitless and the main house water system. In order to conduct this test, the line had to be disconnected from a "T" fitting at the pitless prior to sealing the ends. The pipe was tested at nine inches of mercury for 30 minutes, without an observable decrease in vacuum for the duration of the test. The final test was conducted on the ¾-inch pipe from the "1" fitting to the solenoid valve controlling the waterfall. This line was sealed only at the pitless, and not at the valve. It also held vacuum (seven inches mercury) for 30 minutes without decreasing.

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During the testing of the lines from the pitless, there were no petroleum odors or staining observed in the soils above the pitless adapter and around the casing. The total depth of the excavation was between 3.75 and 4.0 feet below grade, through topsoil and compacted sand fill.

Soil PID Screening

On July 31, a soil-gas and soil sampling effort was conducted. Bill Bronner of MTB Builders assisted with drilling through the garage wall and the sampling of the material beneath the foundation. Sampling of the soils beneath the building was conducted by first drilling an approximately one-inch diameter hole in the northern garage wall and then inserting a steel (and later copper) pipe into the sand fill. The pipe was driven in ½ to one foot intervals, removed and the sand core driven out of the pipe into a clean zip-lock bag. The bag was sealed, and the sample allowed to equilibrate for a several seconds prior to inserting the PID¹ tip to obtain a headspace measurement. The location of the soil samples and the respective headspace measurements are indicated on Figure 1. Headspace readings showed relatively little contamination from 0.0 to four feet from the wall, with PID headspace readings from 1.1 to 3.8 parts per million (ppm). Elevated headspace readings were encountered beyond a distance of four feet from the wall, with concentrations in the 500 to 800 ppm range. The highest PID reading was from the 6.0 to 6.5 foot interval, with a reading of 808 ppm. The last sample was obtained from approximately nine feet from the wall, which is estimated to be within four to five feet of the fuel line. No water or free product was observed in any of the soil samples.

A soil-gas survey was conducted around the perimeter of the house. Soil-gas samples were collected by driving a solid, one-inch diameter slam bar to refusal or to five feet, whichever came first. Depths reached were typically between 3.5 and 4.5 feet below grade. The slam bar was then removed, and a copper pipe with the end crimped and slots cut into the sides from the base to about six inches from the base inserted to the bottom of the hole. The PID was connected to the top of the pipe using a section of PVC tubing. The PID remained connected until the concentration indicated stabilized, and the maximum measurement recorded. The locations and recorded measurements from the soil gas survey are shown on Figure 1. The highest PID readings were from soils adjacent to the garage along the western wall, and just south of the tanks (points 1 through 6). In addition, points 8 and 9 returned slightly elevated PID measurements (12 - 13 ppm), although these readings may be suspect due to suspected contamination of the sampling tube. Readings from the north and northeastern sides of the house (points 10 through 16) did not indicate the presence of contamination in this area. Slightly elevated readings were obtained from those points east of the fuel line and the garage (points 17 through 20). The driveway was not sampled due to the relatively shallow depth to bedrock in the area.

¹ PID measurements taken using a Photovac 2020 PID equipped with 10.6 eV lamp, calibrated with isobutylene, set to respond to isobutylene.

Packer Installation

On August 3, a packer was installed in the well in an attempt to determine whether the fuel oil is entering the well above or below the surface of the water. The static water level prior to packer installation was 35.21 feet below the top of casing (TOC). A sorbent was lowered into the well to soak up as much free product as possible prior to installing the packer. The packer was placed initially at a depth of 40 feet below TOC and inflated. Water above the packer was then removed by bailing, and the water level monitored. Initial results indicated that the water level was rising above the packer, suggesting that the packer was leaking, or that water was moving around the packer through irregularities in the borehole. The packer was reset at 38 feet BTOC and the water bailed, with the same result. The packer was again reset, this time at 36 feet BTOC (at the static level), and the water removed. The static water level approximately 45 minutes after removal of the water was measured at 32.75 feet BTOC, 2.5 feet above the original static level. This higher water level indicates that water is entering the well at some level above the current static level and is draining downward to lower fractures. Whether the fuel oil is entering the well at the same point is unknown at this time. At my departure at 6:00 PM on August 3, no additional fuel oil had entered the well, and the water level was still rising.

Free Product Monitoring

Since the meeting on July 20, product thickness in the well has been monitored on a biweekly basis. Measurements are summarized below (see enclosed Figure 2).

Date	Depth to FP (feet)	Depth to H ₂ O (feet)	Product Thickness (ft)
July 20	31.12	31.20	0.08
July 23	32.36	33.16	0.80
July 31	34.45	34.60	0.15
August 3	35.01	35.21	0.20

In addition, the site was visited on July 21 and 29 to check the operation of the pump unit, but free product thickness data were not collected on these dates. As of August 3, approximately 75 gallons of fuel oil have been removed from the well by bailing and use of the bladder pump recovery system.

Summary, Conclusions, and Recommendations

Since July 20, 1998, activities at the Moran residence site in Stowe have included vacuum testing of the lines from the pump to the house, sampling of the soils beneath the house, soil gas screening around the perimeter of the building, installation of a packer in the well, and ongoing free product measurement and recovery efforts.

All of the polyethylene lines tested, (those connecting the pump to the pitless, and from the pitless to the house and to the waterfall) passed the tightness tests conducted on July 21. In addition, there was no indication of contamination in the excavation to the pitless. Soil samples from beneath the house taken through the garage wall indicated that contamination is present in the sand fill, and becomes more concentrated near the fuel line. Soil gas screening conducted around the perimeter of the building did not conclusively indicate contaminant migration pathways, but did suggest that the area of greatest contamination is immediately surrounding the tanks and those areas south of the tanks (toward the garage). There was little indication of contamination at the northern end of the house during the soil gas survey.

The packer installation in the well indicates that there is a source of water to the well above the current static water level. The elevation and location of this source is as yet undetermined. Whether the fuel oil entering the well is coming from above the current static level is also unclear. Fuel oil continues to enter the well, although in significantly smaller quantities than initially observed. To date, approximately 75 gallons of free product has been recovered from the well.

The fact that the piping from the pump to the house passed the leakage tests indicates that the route of fuel oil entry to the system was not through these lines. In addition, the absence of contamination in soils surrounding the pitless indicates that product is not entering the well through a leaky pitless adapter. At this time, because additional efforts to determine the route of entry to the pump are likely to be fairly costly and somewhat difficult to implement, they should be considered secondary to the primary objectives of determining the point of fuel oil entry to the well, and whether the well can be used again or must be replaced.

The results of the soil sampling effort through the garage wall indicates the presence of significant amounts of petroleum vapors beneath the building. Due to the permeable nature of the fill used during the construction of the house, a soil vapor extraction system may be effective in removing the lighter-phase components of the fuel oil. We recommend performing some type of pilot test to assess the usefulness of soil-vapor extraction. We may also want to see if some test borings could be extended through the garage wall at lower elevations, in an attempt to access liquid-phase fuel oil.

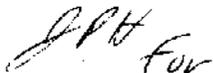
Continued monitoring of the static water level in the well, both above and beneath the packer is necessary to determine the nature of the flow gradient in the well, as well as whether free product is entering the well from above or below the packer. In addition, continued operation of the product pump is recommended, at least until the product

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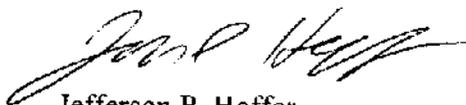
thickness in the well is too thin for the pump to work effectively. At that time, sorbents will be employed to facilitate product removal.

If you have any questions regarding these conclusions or recommendations, please do not hesitate to call.

Sincerely,
HOFFER & ASSOCIATES



Timothy F. Schmalz
Project Geologist



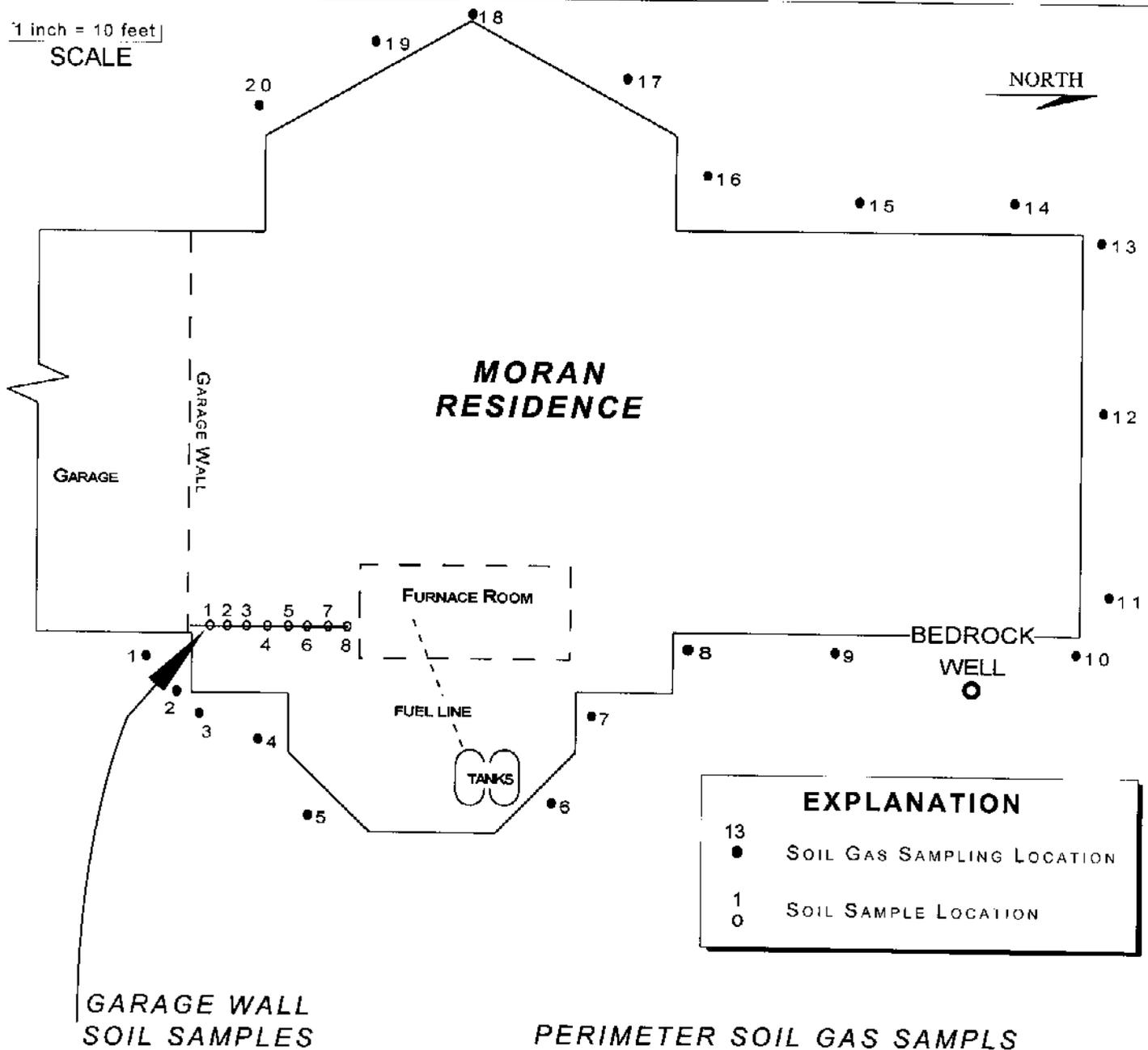
Jefferson P. Hoffer
Principal Hydrogeologist

enc.

cc: Robert Moran

1 inch = 10 feet
SCALE

NORTH



EXPLANATION	
13	SOIL GAS SAMPLING LOCATION
10	SOIL SAMPLE LOCATION

GARAGE WALL SOIL SAMPLES

SAMPLE #	FEET FROM WALL	PID HEAD SPACE
1	0.0 - 3.0	1.1
2	3.0 - 4.0	3.8
3	4.0 - 4.5	507
4	4.5 - 5.0	778
5	5.0 - 5.6	683
6	5.6 - 6.0	523
7	6.0 - 6.5	808
8	6.5 - 9.0	602

PERIMETER SOIL GAS SAMPLS

Site #	Depth (ft.)	PID	Site #	Depth (ft.)	PID
1	4.0	1.9	11	4.0	0.0
2 (d.spout)	3.0	1.2	12	2.5	0.0
3	4.5	12.0	13	2.5	0.0
4	3.5	25.9	14	3.5	0.0
5	3.5	7.2	15	4.5	0.0
6	3.5	2.0	16	3.5	0.0
7	4.0	1.4	17	3.5	0.6
8	4.5	12.3	18	4.0	1.2
9	4.0	13.2	19	2.5	2.6
10	4.0	0.5	20	3.25	1.4

FIGURE 1
SOIL AND SOIL GAS SAMPLING RESULTS, JULY 31, 1998,
MORAN RESIDENCE, STOWE, VERMONT, SMS SITE #98-2402.

FIGURE 2

