



The State of New Hampshire
DEPARTMENT OF ENVIRONMENTAL SERVICES

Thomas S. Burack, Commissioner



EMAIL ONLY

June 2, 2016

Michael D. Cimis, Assistant Director of Environmental Health & Safety
Dartmouth College
37 Dewey Field Road, Suite 6216
Hanover, NH 03755

**Subject: Hanover – Dartmouth College Rennie Farm Site, Hanover Center Road
DES Site #201111109, Project #27737**

Supplemental Hydrogeologic Investigation – Phase I Report, prepared by
GZA GeoEnvironmental (GZA), dated May 6, 2016

Dear Mr. Cimis:

The Department of Environmental Services (Department) has completed its review of the above-referenced Report for the Dartmouth College Rennie Farm site in Hanover. The Report was recently submitted to the Department pursuant to our December 11, 2015 letter approving the GZA Work Plan¹, which provided the proposed scope for the Phase I hydrogeologic investigation. The Phase I study focused on additional investigations and testing to further assess the extent of 1,4-dioxane, the primary residual contaminant associated with the site, in groundwater; and the nature of the residual 1,4-dioxane source area at the site. Our review comments are presented as follows.

Major Findings of the Phase I Hydrogeologic Investigation

Consistent with the approved Work Plan, the Phase I Investigation included: additional field mapping of bedrock lithology and structure, geophysical surveys to assess bedrock fracture locations/orientations, assessment of water resources and consumptive groundwater usage in the site area, installation of additional monitoring wells and a replacement water supply well for the #9 Rennie Road property, and on-going groundwater monitoring. Based on results of this additional work as recently completed by GZA, the Department notes the following significant findings, which form a framework for the current understanding of site conditions:

- The distribution of 1,4-dioxane in groundwater downgradient from the on-site source area has been defined via installation and sampling of a network of overburden and bedrock monitoring wells. To date, GZA has overseen the installation of 24 monitoring wells (and the replacement bedrock water supply well noted above). Groundwater samples were also collected from approximately 17 private water supply wells in the site vicinity, most of which are constructed as bedrock wells.
- Results of the above investigations demonstrate that the extent of 1,4-dioxane in overburden groundwater at concentrations exceeding the Department's Ambient Groundwater Quality Standard (AGQS) of 3 micrograms per liter (ug/l) appears to be limited to the Site itself.

¹ "Work Plan – Supplemental Hydrogeologic Investigation – Phase I, Groundwater Management Zone Delineation and Water Supply Investigation" (dated December 2, 2015), prepared by GZA on behalf of the Dartmouth College Office of Environmental Health and Safety.

Based on our review, the Department approves the additional investigations and testing as proposed by GZA, subject to the following conditions:

- As we have previously discussed, please include installation of one additional direct-push soil probe and groundwater sampling point in the area directly downgradient (northeast of) the human burial area proximate to the eastern side of the 1,4-dioxane source area. Please include collection of a groundwater sample from this location, and existing monitoring well GZ-14U, and submit for laboratory analysis² for formaldehyde; and,
- Include confirmatory groundwater testing (for radiological parameters) at monitoring wells GZ-9L and GZ-14U, at which 1,4-dioxane has been detected at the highest concentrations. At a minimum, the radiological testing shall include analysis for carbon-14, tritium, nickel-63, cesium-137, and lead-210. The Department suggests inclusion of upgradient monitoring well GZ-1, to allow collection of radiological concentration data representative of background groundwater conditions in the site area.

The Department acknowledges Dartmouth's timely submittal of the GZA Report. Should you have any questions with regard to any of our comments, please contact me directly at the Department's Waste Management Division.

Sincerely,



Paul L. Rydel, P.G.
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David Gordon, MPH, Environmental Health Program
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James Wieck, PG, GZA GeoEnvironmental, Inc.
Attention Health Officer, Town of Hanover

² Noting that the AGQS for formaldehyde is 100 ug/l, laboratory analysis shall be performed using an appropriate USEPA-approved analytical method capable of reporting formaldehyde to a concentration of no greater than 20 ug/l. For reference, the Department typically sees formaldehyde analysis using USEPA Method 8315A.

In accordance with ACCA Manual J

Report Prepared By:

Ultra Geothermal Inc.

For: Lenke Residence
5 Storrs Road
Hanover, New Hampshire

Design Conditions: Hanover

Indoor:		Outdoor:	
Summer temperature:	72	Summer temperature:	92
Winter temperature:	70	Winter temperature:	-12
Relative humidity:	50	Summer grains of moisture:	85
		Daily temperature range:	Medium

Building Component		Sensible Gain (BTUH)	Latent Gain (BTUH)	Total Heat Gain (BTUH)	Total Heat Loss (BTUH)
Whole House	6,729.9 sq.ft.	30,959	8,853	39,812	89,317
Basement		1,509	693	2,202	16,590
All Rooms	2,800 sq.ft.	1,509	693	2,202	16,590
Infiltration		279	233	512	1,143
People	2	600	460	1,060	0
Miscellaneous		100	0	100	0
Floor	2,800 sq.ft.	0	0	0	5,510
S Wall BelowGr	625 sq.ft.	0	0	0	1,743
W Wall BelowGr	26.7 sq.ft.	0	0	0	74
E Wall BelowGr	26.7 sq.ft.	0	0	0	74
W Wall BelowGr (2)	447 sq.ft.	0	0	0	1,246
Window	3 sq.ft.	69	0	69	89
W Wall BelowGr (3)	155 sq.ft.	0	0	0	432
E Wall BelowGr (2)	120 sq.ft.	0	0	0	335
N Wall BelowGr	848.7 sq.ft.	0	0	0	2,366
Window	3 sq.ft.	24	0	24	89
E Wall BelowGr (3)	480.3 sq.ft.	0	0	0	1,339
Window	3 sq.ft.	69	0	69	89
S Wall BelowGr (2)	80 sq.ft.	0	0	0	223
N Wall BelowGr (2)	40 sq.ft.	0	0	0	112
S Wall BelowGr (3)	160 sq.ft.	0	0	0	446
E Wall	37 sq.ft.	48	0	48	167
Door	23 sq.ft.	320	0	320	1,113
FF Master Zone		2,847	725	3,572	7,228

Building Component		Sensible Gain (BTUH)	Latent Gain (BTUH)	Total Heat Gain (BTUH)	Total Heat Loss (BTUH)
Door	25 sq.ft.	348	0	348	1,209
S Wall	40 sq.ft.	35	0	35	121
Central Hall	280 sq.ft.	1,170	313	1,483	3,818
Infiltration		375	313	688	1,536
Floor	280 sq.ft.	0	0	0	0
N Wall	85 sq.ft.	74	0	74	258
Window	43 sq.ft.	344	0	344	1,273
W Wall	35 sq.ft.	31	0	31	106
Ceiling	342 sq.ft.	346	0	346	645
FF Bath	152 sq.ft.	488	73	561	1,371
Infiltration		87	73	160	357
Miscellaneous		75	0	75	0
Floor	152 sq.ft.	0	0	0	0
S Wall	115 sq.ft.	100	0	100	349
Window	10 sq.ft.	120	0	120	296
E Wall	121.7 sq.ft.	106	0	106	369
Four Season Room	140 sq.ft.	5,179	1,524	6,703	12,358
Infiltration		1,551	1,294	2,845	6,358
People	1	300	230	530	0
Floor	140 sq.ft.	0	0	0	0
N Wall	88 sq.ft.	77	0	77	267
Window	72 sq.ft.	576	0	576	2,131
E Wall	34.5 sq.ft.	30	0	30	105
Window	29 sq.ft.	667	0	667	858
Glassdoor	24 sq.ft.	552	0	552	673
W Wall					

Building Component		Sensible Gain (BTUH)	Latent Gain (BTUH)	Total Heat Gain (BTUH)	Total Heat Loss (BTUH)
Window	26 sq.ft.	312	0	312	770
E Wall	26.7 sq.ft.	23	0	23	81
Ceiling	221 sq.ft.	224	0	224	417
Second Floor		8,182	1,882	10,064	18,451
SF Master Bath	93 sq.ft.	360	36	396	699
Infiltration		44	36	80	179
Miscellaneous		50	0	50	0
Floor	93.3 sq.ft.	0	0	0	0
E Wall	65 sq.ft.	57	0	57	197
Window	5 sq.ft.	115	0	115	148
Ceiling	93 sq.ft.	94	0	94	175
SF Master Closet	89 sq.ft.	267	0	267	785
Infiltration		0	0	0	0
Floor	88.7 sq.ft.	0	0	0	0
N Wall	140 sq.ft.	122	0	122	425
E Wall	63.3 sq.ft.	55	0	55	192
Ceiling	89 sq.ft.	90	0	90	168
SF Master Bedroom	285 sq.ft.	1,627	448	2,075	3,431
Infiltration		261	218	479	1,072
People	1	300	230	530	0
Floor	284.6 sq.ft.	0	0	0	0
N Wall	160.5 sq.ft.	140	0	140	487
Window	12 sq.ft.	96	0	96	355
W Wall	147 sq.ft.	128	0	128	446
Window	18 sq.ft.	414	0	414	533
Ceiling	285 sq.ft.	288	0	288	538
SF Main Bath	125 sq.ft.	802	95	897	1,878
Infiltration		113	95	208	464
Miscellaneous		75	0	75	0
Floor	125.4 sq.ft.	0	0	0	0
E Wall	167 sq.ft.	146	0	146	507
Window	8 sq.ft.	184	0	184	237
S Wall	73.8 sq.ft.	64	0	64	224
Window	5 sq.ft.	60	0	60	148
Ceiling	158 sq.ft.	160	0	160	298
Bedroom 205	154 sq.ft.	1,851	564	2,415	3,913
Infiltration		401	334	735	1,643
People	1	300	230	530	0