

## **RENNIE FARM FREQUENTLY ASKED QUESTIONS**

### **1. What is the history of Dartmouth's use of the Rennie Farm property?**

Since 1965, Dartmouth has owned the approximately 223-acre Rennie Farm in Etna, NH. Dartmouth uses low levels of radioactive materials in life sciences research under the authority of a State of New Hampshire radioactive materials license. From the mid-1960s until 1978, a less than ½-acre area on the property was used by Dartmouth as a burial site for animal carcasses from medical and other research. In 1966, human remains used in teaching by Dartmouth Medical School were buried in a separate approximately 10-foot by 10-foot area adjacent to the animal carcass burial area.

### **2. How has the College addressed the contamination?**

The College has removed the animal carcasses and conducted extensive site investigation under the process established by state and federal law. The removal of the animal carcasses was approved by the New Hampshire Department of Health and Human Services, Radiological Health Section (RHS) in 2011 and began in late October. In November 2011, unexpected chemical waste was encountered and contaminated materials removed. Through the course of the project approximately 40 tons of potentially contaminated materials including laboratory waste and soil immediately surrounding the waste was excavated and shipped offsite to licensed disposal sites. The excavation continued through December 2011. Before, during, and after the excavation, soil and groundwater samples were collected and analyzed, consistent with state regulations, for purposes of site closure. After analyzing samples taken from the site, RHS deemed the site free of radiological contamination and safe for unrestricted use.

In an effort to better understand groundwater flows and to determine the extent of 1,4-dioxane contamination on the site, more than 64 groundwater-monitoring wells have been installed in the area. The investigation has also included geologic mapping, geophysical surveys, more than 70 soil borings, excavation of test pits, soil sampling, surface water sampling, hydraulic testing, and data evaluation. Groundwater flow off the site occurs through a combination of porous overburden rock/soil and fractured bedrock. The direction of flow is estimated to be in a north/northeast direction from the site.

Additional monitoring wells are being installed to monitor water quality beyond the boundaries of the Rennie Farm property and the site will be managed and monitored under a Groundwater Management Permit until it meets state standards.

### **3. How did the well at 9 Rennie Road become contaminated?**

The 1,4-dioxane, a volatile organic compound (VOC) detected in groundwater samples collected at the Rennie Farm property and in the water supply well at 9 Rennie Road, is anticipated to be related to laboratory testing materials buried along with test animals. Prior to the excavation of animal carcasses during late 2011, four groundwater-monitoring wells were installed and were regularly sampled for radiological and chemical contaminants. 1,4-dioxane was not detected prior to the excavation, and it was not known that 1,4-dioxane was contained within the excavation area.

In April 2012, for the first time, groundwater analysis at Rennie Farm detected 1,4-dioxane at concentrations exceeding the New Hampshire groundwater standard. No other contaminants have been discovered in groundwater in excess of state groundwater standards. The 1,4-dioxane concentration data collectively suggest that 1,4-dioxane concentrations in groundwater may have increased during the excavation of animal carcasses.

The 1,4-dioxane was likely transported along with naturally flowing groundwater to the water supply well through a series of interconnected fractures within bedrock. The 1,4-dioxane contaminated groundwater may also have been captured by the well, in part, by the pumping of water from the water supply well. The detected concentrations of 1,4-dioxane in samples collected from the water supply well range from approximately 4 micrograms per liter ( $\mu\text{g/L}$ ) to 7  $\mu\text{g/L}$ , and exceed the New Hampshire Ambient Groundwater Quality Standard (NH AGQS) of 3  $\mu\text{g/L}$ .

### **4. Is the area water supply at risk?**

1,4-dioxane has been detected in one private water supply well downgradient and to the east of the animal carcass burial area. The presence of 1,4-dioxane was also detected at levels below state water quality standards in a private water supply well along Hanover Center Road to the north. Dartmouth is investigating the source of this contamination to determine whether it is originating from the Rennie Farm site or if it is related to other potential sources of 1,4-dioxane (i.e. consumer products). Based upon our investigation, there are no data indicating that the water supply in the greater area surrounding Rennie Farm is at risk. As of November 10, 2016, more than 100 private water supply wells near the Rennie Farm site have been sampled by Dartmouth and/or by property owners with no additional detectable levels of 1,4-dioxane found.

Additional monitoring wells are being installed to monitor water quality beyond the boundaries of the Rennie Farm property.

**5. What are the risks associated with 1,4-dioxane?**

1,4-dioxane is manmade and has been primarily used as an additive in solvents. It has also been used in varnishes and paint strippers, and can be present in certain personal care products. Fish and plants will not accumulate 1,4-dioxane in their tissues. Please see the links for the summary sheets developed by the United States [Department of Health and Human Services](#) and the NH [DES](#) that provide information regarding 1,4-dioxane.

**6. Why hasn't Dartmouth excavated the entire animal carcass burial area?**

- We will be installing a pump and treat system to keep 1,4-dioxane contaminated groundwater from flowing out of the animal carcass burial area and to remove 1,4-dioxane from both the soils and fractured bedrock;
- 1,4-dioxane is highly soluble in water, and based on the soil and groundwater data collected, the remaining 1,4-dioxane at the site may be dissolved in groundwater located within the soil and fractured rock, and removal of soil alone will likely not remove all of the residual 1,4-dioxane;
- Collectively the 1,4-dioxane concentration data suggest that 1,4-dioxane concentrations in groundwater may have increased during the excavation of animal carcasses. We are concerned that excavation without having hydraulic controls (pumping and removal of groundwater) in place first may cause a similar condition;
- Once the hydraulic control system is operating, monitoring of the water quality in the source area will be used to identify residual contamination in the soil, if present. Excavation of soil could be used at that time to remove any residual sources of contamination.

**7. Do the human remains buried on the property pose a risk to the water supply?**

Dartmouth Medical School records indicate that the interment of non-cremated human remains was limited to a one-time event in 1966. Anatomy students at the medical school used the human remains over the course of their studies. While initially embalmed, the majority of fluids drain out of the bodies or evaporate during the time in which they are being studied.

Groundwater samples were collected from two monitoring wells near the human remains for analysis for formaldehyde. Laboratory analysis of the samples did not detect formaldehyde within the groundwater samples.

**8. Are there any radiological materials left on the site and do they pose a risk to the water supply?**

During 2011, tons of contaminated and potentially contaminated materials and soil were removed from the site. During the excavation numerous soil and groundwater samples were collected and analyzed for purposes of site closure. After analyzing samples, RHS deemed the site free of radiological contamination and safe for unrestricted use. To supplement and confirm the historical results, samples of 1,4-dioxane contaminated groundwater were collected in June 2016 and analyzed for the long-lived radioisotopes of concern (tritium, carbon 14, cesium 137, lead 210 and nickel 63). Additional soil samples were also collected and analyzed for the same radioisotopes during a supplemental excavation in August 2016. None of the samples contained radiological materials above background levels.

**9. What are Dartmouth's plans to mitigate contamination on the Rennie Farm site?**

Dartmouth plans to capture contaminated groundwater onsite and treat it to prevent migration off the property. Once groundwater controls and treatment are in place, excavation can be considered if the data suggests residual site source contamination is not being effectively treated. A remedial action plan has been prepared and approved by the New Hampshire Department of Environmental Services (DES) that includes control of migration groundwater achieved using a system of groundwater pumps in wells surrounding the excavation area, and an associated groundwater treatment system to be constructed this fall and winter. The operation of the groundwater pumping and treatment systems, and groundwater quality monitoring will be performed under a Groundwater Management Permit issued by DES.

**10. How has Dartmouth communicated with residents in the Rennie Farm area?**

Dartmouth has been proactive in notifying potentially impacted parties and communicating with state and local officials regarding the project. We have expanded our communications to include a larger circle of neighbors and have established a website with resources and information. The College is working to gather feedback from neighborhood residents and respond to their requests and concerns with transparency. All project documents will continue to be available via the [NH DES One Stop Data Center](#). New Hampshire DES and RHS were invited to campus to present a community information session in September 2016. A public forum on the health risks associated with 1,4-dioxane was also held in October 2016 at Dartmouth. The College holds drop-in hours for neighbors and media at the Rennie Farm site and on campus. Additional information sessions are being planned. Regular email communications to neighbors provide updates and news about the project.

**11. What should a neighborhood property owner do if they have questions about matters related to real estate?**

We are willing to talk with any property owner who has questions or concerns about real estate matters because of the proximity of their property to the Rennie Farm site. Please contact [maura.c.clarke@dartmouth.edu](mailto:maura.c.clarke@dartmouth.edu) for more information.