MEMORANDUM

[redacted]

FROM: JOEL I. CEHN

SUBJECT: TESTING OF NEW WELLS AT BBC

DATE: DECEMBER 30, 2013

[redacted]

BACKGROUND

During 2013, Boeing drilled three additional well clusters on the property. Boeing's contractor (University of Guelph, Canada) has been studying the underground aquifer and needed test data from several untested areas. Each cluster has three separate wells, drilled to different depths, down to about 30 feet. The clusters are shown on the attached aerial map, labeled "SP-29, SP-424, and SP-900." The three wells in each cluster are labeled A, B, and C, in order of depth. I've requested the details of well construction, and will forward those separately.

Water from those wells can only be collected with special equipment, so I accompanied Boeing's contractors for sampling the well clusters on November 4th and 5th. We each took groundwater samples from the wells and had them analyzed for chemicals, principally TCE, a known contaminant at Boeing. We also had them analyzed for tritium, also a known contaminant. While on site, I collected an additional water sample from a flowing spring (OS-3, see map) in the area. This was also analyzed for tritium.

SUMMARY OF TESTING RESULTS

Tritium in Groundwater

Tritium is the most mobile of the radioactive elements found at Boeing. It has been found in groundwater and vegetation near the property line. Testing is done to gauge its movement in groundwater, which is toward BBC. Results show possible elevated tritium in one of the new wells in the south-central region of the property (New Well SP-424A). The level measured is 12 picocuries per liter of water (pCi/L). This compares to 19 pCi/L measured from a well in the southwest region two years ago. However, the value is rather close to the laboratory's limit of detection (9.7 pCi/L), and may be a statistical artifact (false positive). It may also be due to natural tritium in the atmosphere that has infiltrated this

shallow (8 ft.) well.[1] I plan to compare my results on this well with Boeing's, when they become available.

In any event, the measured levels are safe; they are well below the drinking water limit (20,000 pCi/L). Results are shown in Table 1. The tap water result may or may not indicate the presence of tritium. If present, it is due to natural, atmospheric tritium. The lab report is attached as an appendix.

TCE in Groundwater

All the collected samples were analyzed for a suite of chemicals (volatile organics), which includes trichloroethene (TCE). This is a known contaminant at Boeing. The list of tested chemicals is given in Table 2. All results were "non-detect" for TCE, with a sensitivity of almost one-quarter part per billion (0.29 ppb); ultra sensitive. Acetone and toluene was barely detected in several samples. These are not known Boeing contaminants. It was also barely detected in a "blank" sample (distilled water) that the lab tested for quality control. It appears to be contamination by the laboratory during analysis, since the "blank" sample did not come from a well. These chemicals are commonly used in the labs for cleaning glassware and equipment.

CONCLUSIONS AND RECOMMENDATIONS

All wells were free of TCE contamination. One of the new wells may have showed slightly elevated tritium contamination. This requires further research to confirm. Copies of the lab reports are enclosed.

I plan to review Boeing's results on these same wells, when they become available, and compare them to my results. I also plan to review Boeing's results on all BBC wells, which will be tested by Boeing early in 2014. My review will be forwarded to you at that time.

Our testing plan for next year is to re-test food crops grown on the property. This is planned for next summer. If new information emerges suggesting additional testing, we can do it at that time. Please contact me if you have any questions.

[1] Rainwater contains natural tritium, which is created in the upper atmosphere. Some of this water will eventually reach the groundwater aquifer. But the very long residence time in the aquifer results in the complete depletion of natural tritium via radioactive decay.

Table 1. Tritium Results

SOURCE	DATE	pCi/L
Background*	131104	9.7 ± 9.7
SP-29A	131004	< 9.7
SP-29B	131104	< 9.7
SP-29C	131104	< 9.7
SP-424A	131104	12.9 ± 9.7
SP-424B	131104	< 9.7
SP-424C	131104	< 9.7
SP-900A	131105	< 9.7
SP-900B	131105	< 9.7
OS-3	131105	< 9.7

Notes:

* tap water, BBC (labeled, SP-99)

< 9.7 = less than 9.7, which is the lab's detection limit

A, B, & C refer to separate wells in the cluster—A is the shallowest, C the deepest.

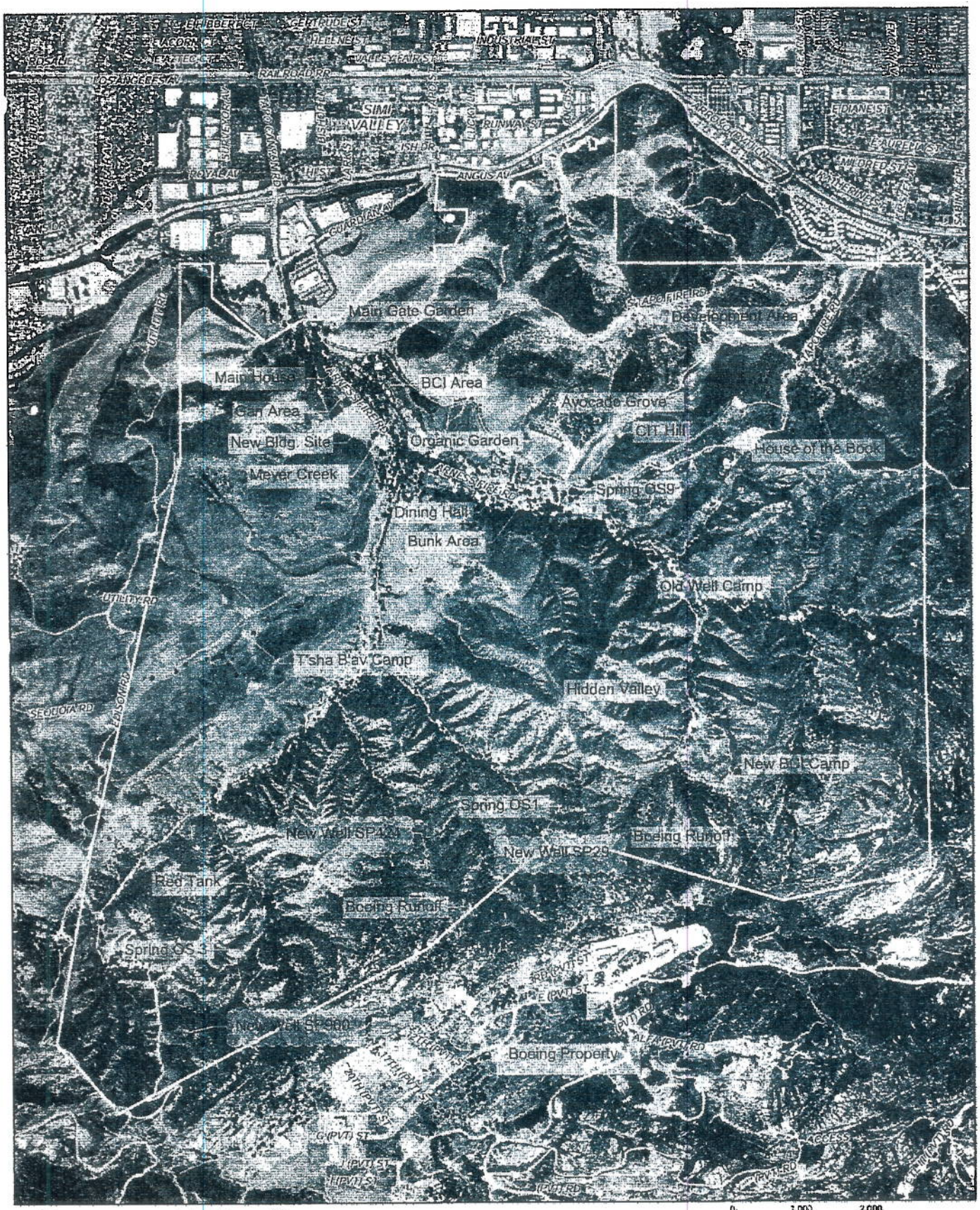
SP-900C was only sampled by Boeing. Results pending.

Table 2. Chemical Analytes

Method: 8260C - Volatile Organic Compounds Detectable by GC/MS

1,1,1-Trichloroethane
1,1,2,2-Tetrachloroethane
1,1,2-Trichloroethane
1,1-Dichloroethane
1,1-Dichloroethene
1,2,4-Trichlorobenzene
1,2-Dibromo-3-Chloropropane
1,2-Dichlorobenzene
1,2-Dichloroethane
1,2-Dichloropropane
1,3-Dichlorobenzene
1,4-Dichlorobenzene
2-Butanone (MEK)
2-Hexanone

4-Methyl-2-pentanone (MIBK)
Acetone
Benzene
Bromoform
Bromomethane
Carbon disulfide
Carbon tetrachloride
Chlorobenzene
Dibromochloromethane
Chloroethane
Chloroform
Chloromethane
cis-1,2-Dichloroethene
cis-1,3-Dichloropropene
Cyclohexane
Bromodichloromethane
Dichlorodifluoromethane
Ethylbenzene
1,2-Dibromoethane (EDB)
Isopropylbenzene
Methyl acetate
Methyl tert-butyl ether
Methylcyclohexane
Methylene Chloride
m-Xylene & p-Xylene
o-Xylene
Styrene
Tetrachloroethene
Toluene
trans-1,2-Dichloroethene
trans-1,3-Dichloropropene
Trichloroethene (TCE)
Trichlorofluoromethane
Vinyl chloride
Xylenes, Total



Key: Garden

Testing Locations for soil, water, and/or vegetation.

THE BRANDEIS-BARDIN INSTITUTE PROPERTIES

ENVIRONMENTAL TESTING

0 1,000 2,000 Feet

N

Disclaimer: The County does not warrant the accuracy of this map and no decision involving a risk of economic loss or physical injury should be made in reliance thereon.