

Far from the End in Endicott, New York

By Lenny Siegel
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Endicott, New York is the birthplace of IBM. For decades “Big Blue” employed tens of thousands of people there. But over the same period IBM released large quantities of volatile organic compounds (VOCs) such as trichloroethylene (TCE) into the subsurface there. Since 1979, when it first reported the release, IBM has spent tens of millions of dollars addressing the contamination. Off-site groundwater remediation and vapor mitigation have been remarkably successful, but contamination in the source areas remains high. Employees of IBM’s successors at the site are still being exposed to low levels of TCE. The IBM site consists of 139 acres formerly owned by IBM plus reportedly about 220 acres downgradient.

Off-site Groundwater

In March, 2015 the New York State Department of Environmental Conservation (DEC) issued a Record of Decision for the cleanup of Operable Unit #3 (Southern Area) and Off-Site Capture Zone A, the bulk of the shallow groundwater contamination that had spread south of the Huron Campus, as the IBM plant is now known, to the Susquehanna River. At first glance, the selected remedy is confusing. It calls for “no further action.” But what DEC has really approved is the indefinite continuation of the highly successful pump, treat, and flush remedy already in place as an Interim Remedial Measure.



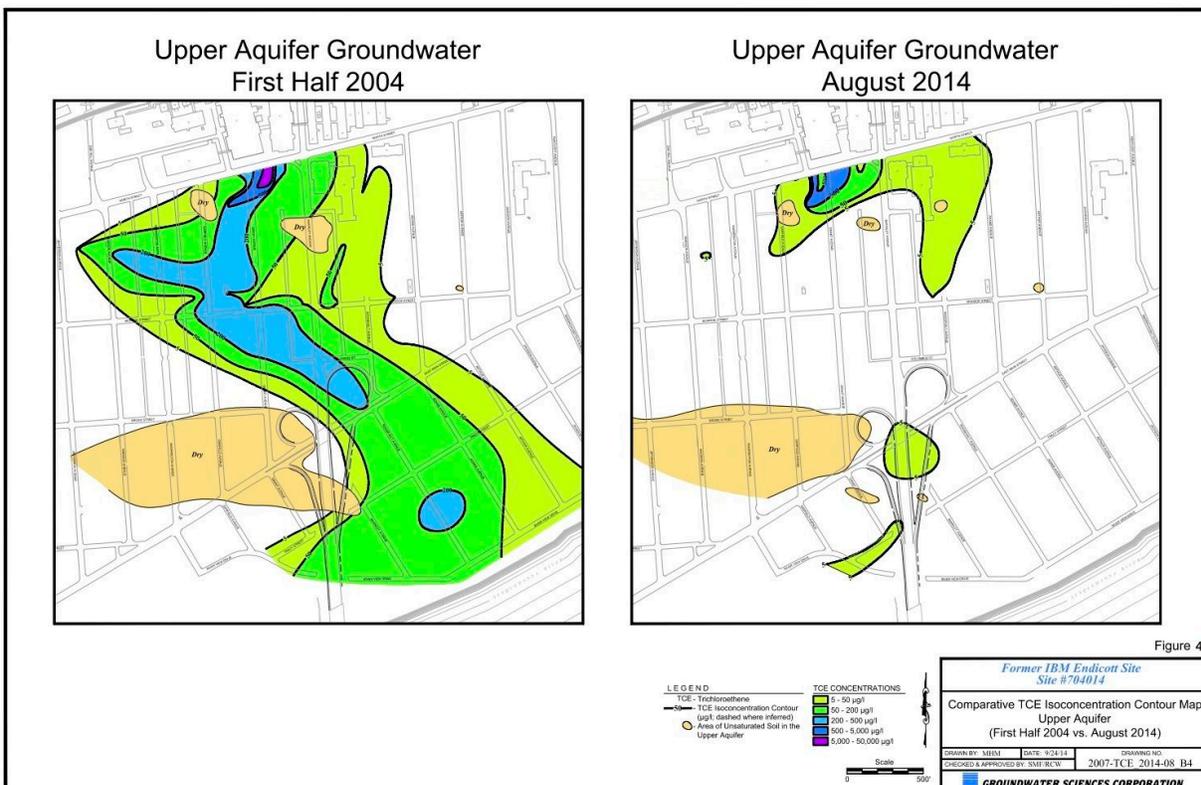
Groundwater Treatment System

Since 1981 IBM has been operating a groundwater extraction and treatment system in this area. “The purpose of the system is to shrink the size of the groundwater plume south of North Street, to reduce contaminant concentrations to below applicable groundwater standards to the extent practicable, and to prevent further migration of site-related contaminants to off-site areas.” The ROD explains further: “to enhance plume reduction and improve contaminant recovery,” in 2008 IBM began re-injecting clean water from some of the extraction wells “to flush clean water through the Upper Aquifer.”

Of the 321.4 million gallons of water extracted by all IBM systems in 2013, 241.7 million gallons came from Off-Site Capture Zone A. That impressive level was achieved by re-injecting 206.5 million gallons of extracted water that had been treated primarily by carbon filtration back into the upper aquifer. Furthermore, the operation of additional extraction wells on the boundary of the upgradient on-site area prevents additional contamination from entering the off-site area.

Consequently, DEC reports, there have been dramatic reductions in TCE, the primary contaminant of concern:

- Ninety-seven (97) percent reduction of the average concentration of TCE in the groundwater plume from 79.5 ppb in 2004 to 2.3 ppb in 2014.
- Ninety-seven (97) percent reduction in the TCE mass dissolved in groundwater within the plume from 89.5 pounds in 2004 to 2.6 pounds in 2014, continuing to exceed the ten-year plume reduction goal of 80 percent that was initially attained in 2012.



DEC describes the reduction of the off-site TCE plume, shown in the figure above:

Concentrations in most areas are below the groundwater standard of 5 ppb. A couple areas have concentrations of 20-30 ppb. In a localized area immediately south of North Street across from Building 18, several wells have TCE concentrations between 1,700 ppb and 13,000 ppb.

In my comments on the proposed continuation of the remedy, I asked whether DEC had estimated how long it would take to reduce the rest of the plume to acceptable concentrations. I suggested a transition assessment, in which *in situ* technologies might be employed to accelerate completion. DEC defended its approach:

Remedial alternatives were evaluated prior to implementation of the IRMs. These included *in situ* alternatives for both flux control and direct remediation of the off-site plume. The proposed remedy has proven very effective as an interim remedy in reducing the plume, so that is why its continuation has been proposed.

The unusual success of pump and treat at the Endicott off-site plume appears to be attributable to the permeability of the sandy and silty soil along the Susquehanna River.

Off-site Vapor Mitigation

The principal pathway of concern in Endicott is vapor intrusion, the migration of subsurface VOCs such as TCE into overlying buildings. In Endicott, DEC pioneered the *blanket* approach to mitigation, a form of pre-emptive mitigation. It drew a perimeter on the map to identify all off-site structures at risk of vapor intrusion, sampling the indoor air in only a fraction. Beginning 2003, IBM offered to install and maintain vapor mitigation systems in each building, even paying for the cost of the electricity needed to run the fans.



Commercial Building with Vapor Mitigation System

IBM installed 513 ventilation systems at 462 mostly residential properties. Over 400 buildings received subslab or sub-membrane depressurization systems, designed to prevent vapor intrusion by reversing the air flow (from upward to downward) that can pull contaminated soil gas into structures. Other buildings received crawlspace ventilation, pressurization, and other systems

IBM's latest annual report on the Operation and Maintenance of what it calls *ventilation systems* describes what I consider a model program for the long-term management of vapor mitigation. The company conducts annual inspections of each building, and it encourages residents and other occupants/owners to report problems. IBM makes both *improvements* and *repairs*, replacing fans, vent pipes, circuit breakers, and drainjers (vapor resistant floor drains).

Although the vast majority of property owners in the blanket area have welcomed the ventilation systems, IBM still reminds the remainder that its mitigation offer still stands:

Another letter was sent to the seventeen (17) owners of properties where IBM has been unable to install or complete the installation of offered ventilations systems. Those property owners have either

- declined IBM's offer,
- have been unresponsive to IBM's attempts to contact them, or
- there is a condition at the property that has prevented IBM from initiating and/or completing the installation. The letter was designed to remind the property owners of IBM's offer to install (or complete installation of) a ventilation system.

Though indoor monitoring was conducted in a fraction of the buildings shortly after initial installation, IBM apparently relies on system performance to measure protectiveness. It also samples soil gas. Indoor air sampling—every few years, for example—would be a way to assure occupants that the systems are doing what they are supposed to, but the issue may be moot. Very few homes still lie above the remaining shallow TCE plume.

On-Site Vapor Intrusion

IBM sold the Huron Campus to Huron Real Estate on 2002, and it no longer operates there. According to the *Binghamton Press & Sun-Bulletin*, whose reporter, Tom Wilber, has provided comprehensive coverage of the IBM vapor response from the start, 1500 people currently work there for BAE Systems, i3 Electronics (formerly Endicott Interconnect), smaller firms, and Binghamton University.

In the winter of 2005 consultants for Huron sampled indoor air, outdoor air, and subslab soil gas at more than 40 buildings. Under Building 18 they found soil gas as high as 77,000 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$), and in a basement tank room they recorded $150 \mu\text{g}/\text{m}^3$. (At the time New York's TCE exposure standard was $5 \mu\text{g}/\text{m}^3$.) Under Building 46 subslab soil gas reached $120,000 \mu\text{g}/\text{m}^3$, and what appear to be occupied basement areas measured up to $17 \mu\text{g}/\text{m}^3$. Many buildings were well within New York's standards for both soil gas and indoor air, but TCE was present almost everywhere inside. Outdoor TCE was negligible.

In winter 2012 BAE Systems hired another consultant team to sample air in seven buildings, including #18 and #46, and one tunnel. Referring back to the 2005 sampling, the new report explained, “The 2005 investigation concluded that indoor air levels reported did not warrant immediate action, but continued environmental cleanup should continue.” This study found no indoor air readings above the 5 $\mu\text{g}/\text{m}^3$ Air Guidance Value, but several measurements exceeded 2 $\mu\text{g}/\text{m}^3$.

The New York State Department of Health (DOH) reviewed the BAE study, and it concluded:

[T]here is no health hazard associated with the levels of VOCs detected in the indoor air of the buildings currently occupied by BAE employees. The levels detected do not exceed applicable [standards, criteria, and guidance] and are not expected to result in adverse health effects. We do recommend that where VOCs were detected above background levels, reasonable and practical actions be taken to reduce the levels to as close to background as possible.

According to Wilber, “The company retested buildings in 2014 and shared the results with employees but not the public.” There is no public record of mitigation action or employee notification. Indeed, it appears the subslab depressurization, the mitigation approach off site, would be extremely difficult to implement in an old manufacturing complex with a labyrinth of subsurface facilities and infrastructure. However, it is likely the companies have beefed up internal ventilation to try to reduce indoor air contamination.

For the fifth time in a dozen years I visited Endicott in April 2015 at the invitation of the Western Broome Environmental Stakeholders Coalition. I conducted a workshop at which I explained U.S. EPA’s new standards for TCE exposure. At the one-in-a-million excess lifetime cancer risk target, the exposure threshold is about 2 $\mu\text{g}/\text{m}^3$ in occupational settings, and the short-term non-cancer risk level associated with cardiac birth defects is 7 or 8 $\mu\text{g}/\text{m}^3$ for pregnant women.

I called for more testing and full disclosure of the results, particularly to women of child-bearing age who might choose to make personal decisions—about where not to work—based on EPA’s findings, as opposed to New York’s less stringent standards. Soon after my visit, the *Press & Sun-Bulletin* editorialized that Huron Campus workers needed better protection. It called for more sampling and full disclosure.

The birth-defect action level is important because government toxicologists believe heart malformations can occur due to exposures as brief as one day during the first trimester of pregnancy, a time when most women do not know that they are pregnant. Though corporate interests are challenging EPA’s findings, Endicott is sensitive to the impact of TCE exposure on the children of women exposed to TCE. A study of 1090 births from 1978-2002 to women living on the Endicott plume found elevated levels of cardiac birth defects, as well as elevated rates of low birth weight and fetal growth restriction. Today Endicott is waiting for the publication of a massive federally funded study of birth outcomes for the children of thousands of IBM-Endicott workers over a period of decades.

In August, 2015 DOH lowered its TCE Guidance Value to $2 \mu\text{g}/\text{m}^3$. It agreed with EPA:

In particular, NYSDOH has concerns about exposure during pregnancy, particularly during the first trimester, to air concentrations higher than $20 \mu\text{g}/\text{m}^3$ because the major steps of heart development occur during this period and TCE may be a risk factor for fetal heart defects in humans. Thus, NYSDOH recommends taking immediate and effective action to reduce exposure when an air concentration is equal to, or above $20 \mu\text{g}/\text{m}^3$.

According to DOH, they are still working on an update of their TCE risk management Matrix, a table that uses both soil gas and indoor air measurement to guide mitigation decisions.

Even before DOH announced the change, one of Huron's major tenants, i3, announced plans to move its 400 employees. The most recent announced sampling results showed concentration in BAE buildings, some of which were apparently shared with i3, above the new Guidance Value. The newspaper reported:

Factors other than TCE came into play regarding i3's decision to look for a new home, including a desire to improve the company's energy and operational efficiencies. But minimizing risks from TCE exposure in light of the new guidelines was an important factor.



Contaminated Buildings on the Former IBM Property

The Source Areas

While the off-site groundwater cleanup has been successful, DEC officials say it will be a long time before they even figure out what the full remedy should be for groundwater in the source areas on the former IBM property. IBM excavated contaminated soil in 1980, soon after it discovered a massive TCE release, and since 1980 it has been pumping and treating contaminated groundwater from under its plant. Wilber reports that over 70,000 gallons of VOCs have been removed, but that appears to be the tip of the toxic iceberg.

Despite the decades of remediation, the same facilities that make on-site mitigation difficult make achievement of the remedial action objectives an enormous challenge. Wilber reported:

Situated over and near the source area, and blocking access to cleanup, are dozens of buildings, most of them massive, bunker-like, cement structures built during the Cold War era and some well before. The contaminated ground is dense with tunnels, boiler rooms, tank rooms, crawl spaces, cables, pipes and conduits. "There is just so much infrastructure there," [DEC's] Czuhanych said. "Trying to get anything in there (to remedy the problem) is difficult, at best."

Furthermore, the high levels found in the slab soil gas under a number of the buildings suggest that groundwater is not the only source of intruding vapors. It is likely that spills and leaks occurred in those buildings, and that TCE and other contaminants remain, above the water table, in the soil. That soil contamination is a likely source of much of the indoor contamination.

Local Assemblywoman Donna Lupardo, a long-time leader in the effort to address IBM's Endicott mess, told Wilber:

"I think a lot of businesses have been nervous about moving into that facility," said Lupardo, a long-time advocate for lower TCE thresholds. She welcomed the new guideline as a positive step, though it's higher than legislation she has authored to set the level below 1.

The new guideline, coupled with i3 possibly leaving, is a chance to advance efforts to clean the campus, Lupardo said, even if that requires demolishing unused buildings to get at the pollution underneath. "It will give us a chance to see what it will take to get this site back on line," she said.

There are probably hundreds, if not thousands, of old industrial complexes across the country comparable in size, complexity, and contamination to the Huron Campus in Endicott. Perhaps it's time to redevelop these sites, removing not only buildings but also subsurface infrastructure, so remediation can take place. Reuse without removal makes cleanup next to impossible and may put new occupants, such as employees, at serious risk due to vapor exposure.

Not too many former owners of these old industrial centers still have the resources that IBM has invested in the Endicott cleanup. But in many areas new commercial entities may find that industrial-era strategic locations make investing in new buildings worth their while.