

Tranguch Gasoline Site Case History

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ABSTRACT

A team, consisting of the United States Environmental Protection Agency; Pennsylvania Department of Environmental Protection; Pennsylvania Department of Health; Agency for Toxic Substances and Disease Registry; United States Coast Guard and United States Army Corps of Engineers, has completed major steps to provide a safe and healthy environment for the residents of Laurel Gardens, Hazleton, PA. What started as a simple underground gasoline leak took on more serious dimensions when gasoline vapors were found in nearby homes. The investigation and mitigation expanded to include over 400 properties. The remediation consists of a ground water treatment system and a soil vapor extraction system.

This paper and its presenters look at the critical aspects of this case as the investigation went from subsurface soil and ground water contamination impacting surface water to the contamination of indoor air. It examines the impact of preferential pathways that include sanitary and storm sewers as well as a 19th century abandoned coal mine. In addition to the technical aspects, this examination looks at the public health and community issues that have surrounded this case.

BACKGROUND

The Tranguch Gasoline Spill Site (Site) is located in the City of Hazleton and Hazle Township, Pennsylvania, in the Laurel Gardens area. The Site is defined as the area between 17th Street in the South to Black Creek in the North, and from Church Street in the West to Evans Street in the East. Beneath a small portion of the Site is a plume of ground water contaminated by gasoline from previously leaking underground storage tanks.

The United States Environmental Protection Agency, Region III (EPA) and the Pennsylvania Department of Environmental Protection (PADEP) have been performing investigatory and cleanup activities at the Site. State and Federal investigations revealed that four facilities in the area of Laurel Gardens have had leaks from their underground storage tanks. These leaks have left behind an area (plume) of ground water and subsurface soil contamination. Further, gasoline and gasoline contaminated ground water entered the sewer system through cracks and breaks in the pipes. Vapors from the gasoline in the sewers migrated into some homes in the community. Tests in homes found that if no action were taken, these levels could present a threat to the residents' health. Testing also revealed that some homes in the community were affected and some homes were not affected. This overview summarizes the efforts to mitigate the threat posed by the underground contamination. It also discusses the investigation and construction work that has been done.

Investigating the Problem – EPA's investigation began based upon the On-Scene Coordinator's (OSC) observation of a visible sheen of gasoline on Black Creek. To investigate the source of the spill and how it was reaching Black Creek, EPA focused on the following five constituents of gasoline: benzene, toluene, xylene, ethyl benzene (these four are often referred to collectively as (BTEX), and methyl tertiary butyl ether (MTBE). With the exception of MTBE,

one or more of the above compounds are found in many commercial household products. As now documented in Site records, the gasoline-contaminated ground water plume, which extended through part of the Laurel Gardens community, was intercepted by the cracked and broken sewer system and flowed into Black Creek.

Concurrent with investigating the surface water impact, indoor air testing was conducted in response to residents' complaints of gasoline odors in homes. Initial results did not find levels of concern, however, subsequent sampling appeared inconclusive and fluctuated which raised concerns by the Pennsylvania Department of Health (PADOH). EPA and PADEP investigators reviewed published research studies about the presence of benzene in the environment and its effects on human health. The review of these published studies concerning benzene revealed that there are many sources of benzene that may be present in a home. Many household chemicals such as cleaners and paints, as well as nail polish removers and candles can release benzene into the air. Cigarette smoking has been found to be the biggest contributor of benzene to indoor air. In addition, wood burning stoves, fireplaces, and attached garages housing cars, lawnmowers, gasoline storage cans, snow blowers and grass trimmers are other significant sources of benzene vapors. Such other residential sources of BTEX interfered with EPA's ability to determine whether BTEX from the underground spill was getting into a home. EPA, in consultation with the PADOH, prepared and implemented sampling protocols designed to minimize interference from any of the non-spill BTEX compounds. This included a detailed screening of the air in Laurel Gardens homes to isolate and identify these other sources of benzene. If these additional sources of benzene were found, homeowners were asked to remove them before air sampling was performed. The results have been dramatic. After the screening

and removal of potential sources of benzene, the previously elevated benzene levels in all homes retested dropped to or below the action level of 8.3 ug/m^3 set by the PADOH.

The technical Solution was to eliminate exposure and clean up contamination. After EPA and PADEP identified the extent of contamination and routes of exposure, cleanup efforts could begin. Significant effort has been directed toward the installation of a ground water treatment system (GWTS) and a soil vapor extraction (SVE) system. The installation of the ground water and vapor recovery systems has involved placing 6000 feet of piping within the sewer trenches. These pipes are connected to vacuum equipment that collects vapors and ground water from the gasoline spill area, through the recovery system, where they are trapped and treated. During construction, over 5.7 million gallons of ground water have been treated by a temporary system and discharged, and 25,828 cubic yards (about 1300 truck loads) of contaminated soil was removed by EPA contractors. The permanent vapor recovery system and ground water treatment system has been completed and is operational and has treated and discharged 4.7 millions gallons of groundwater. This technology has been successfully used at hundreds of other spill sites.

The installation of collection pipes for the treatment system also resulted in the replacement and repair of the sanitary and storm water sewer systems along 22nd Street in the vicinity of the spill. EPA has replaced over 1500 feet of sanitary sewer pipe and over 1600 feet of storm sewer pipe. EPA also relined several hundred additional feet of storm sewer and sanitary sewer piping using a “cured in place” process that allows workers to line and seal cracked pipes without digging up the street.

EPA and PADEP are continuing to sample the monitoring wells in the area. Recent monitoring well sampling has verified that gasoline vapors from the underground spill, which had previously entered homes through the sewer system, are no longer threatening the homes of

Laurel Gardens. All of the investigations and testing has been evaluated and documented in individual reports prepared by EPA, and provided to each property owner. Each individual report provided the prior and current sampling results for that property, and display the location of the spill in reference to the property discussed in the report. Further, each report evaluated the data to determine whether the spill presents a potential threat to the home, and included EPA and PADEP's findings and conclusions.

The first round of sampling included 368 residences and found that 80% of homes were below the $8.3\mu\text{g}/\text{m}^3$ level of benzene. The latest round of sampling included 300 residences (68 properties did not provide access for sampling) and did not find any homes with benzene levels above $8.3\mu\text{g}/\text{m}^3$. A trend analysis of each round of sample data not only shows a decrease in the average benzene level found in the homes in Laurel Gardens, it also shows a narrowing of the range of levels found in all the homes. The trend analysis shows that the data is more consistent (less variable) now that the preferential pathway for contaminants affecting the homes has been eliminated and a standard sampling protocol is strictly followed.

The Site map was updated to show the area of known subsurface contaminated ground water. In addition, EPA's examination of the mine identified an area along the south edge of the mine where the mine rises above the ground water creating air pockets or voids where vapors could collect. A 150-foot buffer surrounding the plume and the mine voids was drawn, resulting in a revised map showing the potentially affected area. The mine investigation has been completed and only one small mine void had any elevated contamination levels. Sampling has shown that there is no pathway from this mine void into homes, so it has been determined the mine void areas are not a concern.

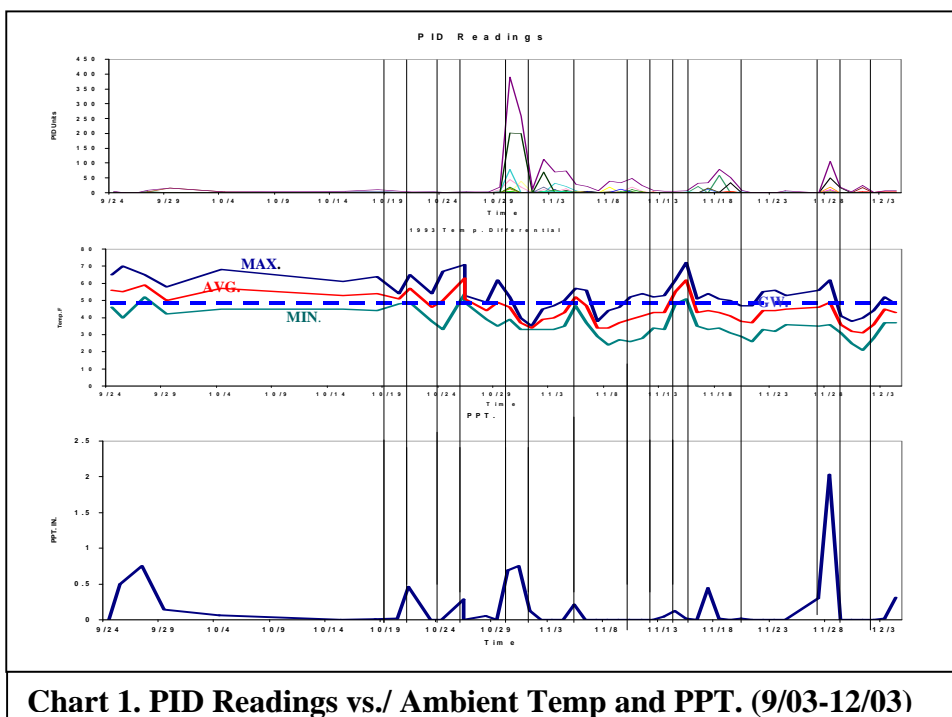
Therefore, overwhelming evidence shows that EPA and PADEP have successfully reduced benzene levels in all the homes tested, through the implementation of a removal project plan. Under the plan, EPA and PADEP regularly tested homes while they assessed the extent of contamination. They then identified and eliminated other possible sources of benzene in homes and cut off preferential exposure pathways by which gasoline fumes could enter homes. Finally, the plan provides for a cleanup system that is removing the spilled gasoline from soil and groundwater.

Hydrologists working for the PADEP and hydrologists contracted by the EPA have found BTEX and MTBE in monitoring wells adjacent to the site and in the residential area East of the Site. Sampling has also found high levels of BTEX and MTBE in homes within the project Boundary. Based on the residential sampling, vent and trap systems have been offered to all residents in the project area. Groundwater investigation by the US Army Corps of Engineers (USACE), a plume (see map) of contaminated ground water extends into the residential area following the sewer mains.

In August 1996, the EPA Environmental Response Team (ERT) with their Response Engineering Analytical Contract (REAC) was on site to use the EPA Trace Atmospheric Gas Analysis (TAGA) mobile laboratory within homes in order to monitor for BTEX which are constituents of gasoline. REAC's results showed no elevated levels of BTEX which could not be attributed to a point source such as solvents or paint thinners located within the house.

Later in November of 1996, another indoor air monitoring event was conducted within 30 residential homes within the boundaries of the site. The monitoring was initiated to collect indoor air quality data to determine if benzene was present within the homes. Benzene was chosen as an indicator of the presence of gasoline vapors since it is a known carcinogen and is

harmful at low levels. REAC's monitoring in August of 1996 had also sampled for benzene, as well as other volatile components of gasoline, but their event took place in weather conditions which were not conducive to an accumulation of vapors since many residents had open windows and doors. In addition, the monitoring event was initiated to take advantage of updraft conditions at the interface of groundwater and ambient air. Groundwater temperatures remain at a relatively constant 50 - 55 ° F. In the winter, when most residences are heated to 65 - 75 ° F, it is believed that gasoline vapors will migrate upward toward and then entering these homes (See Chart 1.)



Historically, residents above and adjacent to the underground gasoline plume have complained about gasoline odors inside their homes. The PADEP has placed passive and active barrier systems at a number of homes in an effort to mitigate the odor problems.

DISCUSSION

The EPA began its investigation at the Site when the PADEP requested assistance in 1996. When EPA OSC observed a visible sheen of gasoline on Black Creek, EPA immediately constructed an underflow dam to prevent further contamination of Black Creek and other waterways downstream. To further investigate the source of the leak and how it was reaching Black Creek, EPA examined the subsurface presence of BTEX and MTBE.

EPA's objective was to characterize the extent of the subsurface contamination and identify exposure pathways for the contamination to reach residences in the Laurel Gardens section of the City of Hazleton and Hazle Township. The work performed by EPA, the USACE, and their contractors, and the results of their investigations are described below.

Soil Gas Sampling

Gasoline is a mixture of 250 plus compounds including BTEX that represent the major components of concern. The physical properties of the BTEX compounds have led to the spread of contamination, but also provide a means to solve the problem. The BTEX compounds are all very volatile compounds that readily change phase from a liquid to a gas. Since gasoline constituents have a specific gravity less than water they float on water and are referred to a light non-aqueous phase liquid (LNAPL) and do not readily dissolve into water. The majority of the gasoline has flowed on top of the ground water into the deteriorated sewers, vaporized and then found its way into homes within the community. In addition, as ground water levels fluctuated, the floating gasoline was absorbed onto soil particles leaving gasoline contaminants attached to the soils and trapped in the space between soil particles. This is referred to as the "smear zone".

The location of each well was selected based on the purpose each well would serve. Deep wells were drilled to sample ground water under the Site and the area of known contamination. Some wells were placed hydraulically up gradient of the Site to isolate potential sources of contamination. Wells were recently drilled into the abandoned deep coal mine, which is filled with water and referred to as a “mine pool”, to determine whether contamination had reached the mine, and if so, how far it may have traveled. As wells were drilled and sampled, EPA gained an understanding of the extent of the plume of ground water contamination.

Indoor Air Sampling

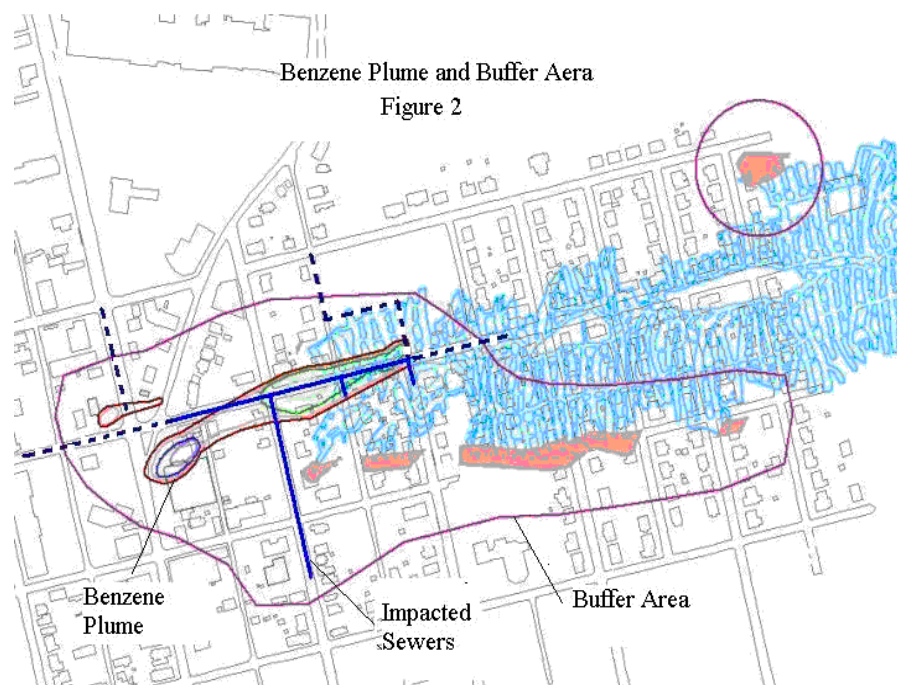
In the Spring of 2000, EPA and PADEP discovered gasoline vapors in homes distant from the area of subsurface contamination. In response, EPA and PADEP commenced a program of indoor air sampling that looked for BTEX in the lower (basement) and the upper levels (first floors) of homes. In homes where sampling results indicated a risk EPA began installing sewer vents and traps (discussed below) in those homes.

EPA and PADEP investigators reviewed published research studies about the presence of benzene in the environment and its effects on human health. The review of these published studies concerning benzene revealed that many sources of benzene might be present in a home. The other residential sources of BTEX interfered with EPA’s ability to determine whether contamination from the underground leak entering a home. EPA, in consultation with the PADOH, prepared and implemented sampling protocols designed to minimize interference from any of the non-spill BTEX compounds, such as a lawn mower or gas can stored in an attached garage. This included a detailed screening of the air in Laurel Gardens homes to isolate and identify these other sources of benzene.

If these additional sources of benzene were found, homeowners were asked to remove them before air sampling was performed. As previously discussed, the removal of potential sources of benzene resulted in a dramatic drop in benzene levels in the homes.

Primary Exposure Pathway

Early in the investigation, EPA and PADEP identified the 22nd Street sewer system as a pathway for gasoline fumes to enter Laurel Gardens homes. This sewer ran through soil and groundwater that were contaminated by the gasoline spill. This is apparent in Figure 2, which shows the benzene plume in relation to the sewer lines. Normally, gasoline cannot enter a sewer system where the pipes are intact. However, the storm and sanitary sewer pipes in this area were cracked and in some places were collapsed. These openings allowed gasoline/contaminated groundwater to enter the pipes. Upon entering the sewer system the volatilization of the contaminants permeated throughout the sewer system that serves Laurel Gardens and into homes not protected by lateral traps.



During its investigation, EPA and PADEP representatives found that few of the homes in the Laurel Gardens area had sewer traps between the house and the street. This lack of sewer traps allowed gasoline vapors in the damaged sewer system to enter homes. The small drain traps, especially those in basements or garages that often dry out from non-use, became an open pathway for sewer vapors to enter a home. Therefore, the sewer system initially defined the area potentially affected by the gasoline spill. To remedy this situation, EPA offered sewer vent traps to all residents in the affected area, and eventually installed 292 sewer vent traps.

Prior to the PADEP and EPA response to this Site, it could not be determined how many homes were affected by gasoline vapors. The record shows that both PADEP and EPA responded to a number of complaints of gasoline vapors in homes. The extensive testing over the last year and a half has found that the average level in the homes tested has dropped significantly.

Potential Exposure Pathway

One other possible route for the Tranguch Gasoline to travel into the community, was an abandoned coalmine that lies under a portion of the Site as depicted in Figure 1 above. According to historic records, this mine has been inactive since the late 1800's. EPA investigated into whether this abandoned coal mine underlying part of the Laurel Gardens Community was affected by the spill or could act as a preferential pathway for contaminants to threaten nearby properties. Monitoring wells and soil gas samples were analyzed to determine whether gasoline has infiltrated the flooded mine. The results did not find significant ground water contamination in the mine. The effect of the coal mine on ground water movement was also examined.

EPA and USACE collected samples from the mine to determine whether there is air movement between the portions of the mine that rise above the water table, known as “mine voids”. EPA has found that only one mine void has gasoline vapors at elevated levels. EPA did not find gasoline contamination in other parts of the mine and tests have determined that air pathways do not exist between voids.

Public Health

EPA and PADEP have determined that a portion of the ground water in the Laurel Gardens Community has been contaminated with a plume of gasoline. PADEP and EPA found BTEX and MTBE in monitoring wells adjacent to the Site and in the residential area east of the Site. Air sampling found BTEX and MTBE vapors in a few homes within the Site boundary and these five compounds are components of gasoline products. Health action levels have been established for each of the five compounds, and are set forth at the end of this section.

Benzene was the primary indicator because of concern that it is a human carcinogen. One of the first steps taken was to determine the appropriate “health action level” for benzene, i.e., the level at which benzene poses “no apparent health hazard”. The PADOH guidelines had set the benzene action level at 32 micrograms per cubic meter (32ug/m³). However, because of variability of residential data and citing the incomplete characterization of the plume, PADOH in consultation with EPA and the Agency for Toxic Substances and Disease Registry (ATSDR) set a more conservative (lower) action limit of 8.3 micrograms per cubic meter (8.3ug/m³) for benzene in Laurel Gardens’ residences as an added precaution. This limit was well below the State and Federal guidelines of 32mg/m³.

The University of Pittsburgh and PADOH prepared independent health-data studies for properties in the project area. An additional study by the University of Pittsburgh is underway that will include properties in the City of Hazleton, Pennsylvania. In addition, ATSDR published a health consultation on the Site. All three organizations' documents provide a discussion of the potential health hazards associated with BTEX compounds and information on the commercial use of these compounds.

The current PADOH recommended Site specific health action levels for indoor air in homes affected by the Tranguch Gasoline Site are:

- 32 – micrograms of benzene per cubic meter of air ($\mu\text{g}/\text{m}^3$)
- 300 – micrograms of toluene per cubic meter of air ($\mu\text{g}/\text{m}^3$)
- 4340 – micrograms of ethylbenzene per cubic meter of air ($\mu\text{g}/\text{m}^3$)
- 437 – micrograms of xylene per cubic meter of air ($\mu\text{g}/\text{m}^3$)
- 2524 – micrograms of MTBE per cubic meter of air ($\mu\text{g}/\text{m}^3$)

Community Issues

The Laurel Gardens community has been very involved in the cleanup process at the Site. A community group called Group Against Gas (GAG) formed during the early days of the spill when complaints of gasoline odors were first reported locally. This group was revived when in 1993 the spill surfaced and the State began its initial response efforts. Later GAG affiliated themselves with local, state and even federal politicians and attracted media attention to the Site as EPA took over the lead for the site. Local newspapers and news broadcasts featured stories on the Site nearly every day beginning in the Winter of 2000. This attention culminated

when local officials declared the site a disaster because of the spill and the community group requested a buyout by the Federal government.

Community concerns were widely reported during the closure of 22nd and Laurel Streets and the associated sewer replacement/repair project. EPA worked diligently to alleviate added stress to the residents' daily routines. All residents adjacent to the construction were offered temporary carbon air filters and temporary daytime relocation at a local hotel during construction work hours. Several residents were temporarily relocated, and others received temporary air conditioning units so that windows could be shut to block out the noise and dust from construction. Media coverage of the Site has slowed since the construction project was completed, but small stories do appear once in a while.

The community's other main concern was that not enough information about the spill and the health effects of long term exposure to gasoline vapors was being disseminated. In response to this concern, EPA brought a full-time Community Involvement Coordinator and Community Involvement Contractors to the Site in the Fall of 2000 to staff a Community Information Center. Weekly fact sheets were mailed to the residents of Laurel Gardens, local media, elected officials, and other interested parties. Press releases were distributed to local media and officials as major events occurred. A total of four public meetings and three public availability sessions were held. A website and an information repository were established and updated on a weekly basis with new information.

CONCLUSIONS

The primary corrective action has been to stop the gasoline from entering the sewers. The installation of ground water collection and soil vapor extraction pipes for the

treatment system resulted in the replacement and repair of the sanitary and storm water sewer systems along 22nd Street in the vicinity of the spill. This direct action prevents gasoline-contaminated ground water from entering the sewers and thus prevents vapors from entering homes and precludes the gasoline-contaminated groundwater from discharging from the sewers to Black Creek. EPA and PADEP's characterization of the extent of contamination and routes of exposure confirmed the primary exposure pathway, documented its elimination, and is the basis of the remaining cleanup efforts.

In response to requests from residents for buyouts by the federal government, the OSC determined that buyouts are not warranted because the data documents that the corrective action underway has eliminated the primary exposure pathway for BTEX vapors migration into the community.

In addition to stopping the discharge of gasoline into Black Creek, the discovery that gasoline vapors from the underground leak were getting into homes in the community required prompt action by the government to protect the public health. This case was complicated by the fact that BTEX vapors appeared to persist even after efforts to vent the vapors from the sewers before they reached the homes. The indoor air sampling and analytical methods were sensitive enough to pick up the presence of BTEX from sources commonly found in homes, this along with recommendations from health officials for lower than usual action levels added to the confusion. Sampling protocols to discriminate spill and non-spill sources of BTEX were implemented to adequately assess the impact of the spill on individual homes in the community. With the exposure pathway eliminated and the sampling protocol in place to minimize the contribution of contaminants from other sources, all homes were determined to be safe for the resident to live in.

The lessons learned are being compiled and will be documented in the After Action Report. Suffice to say the importance of identifying the exposure pathway, segregating non-spill sources of BTEX from the structure, and establishing well-defined action levels are critical as one prepares to conduct indoor air sampling. Also important is that your Risk Communication needs to address the wide variety of commercial and household items that give off petroleum hydrocarbons. When it comes to petroleum hydrocarbons there is no such thing as zero.

References:

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2. Craig Joss, Ph.D., P.E., Applied Geosciences, Inc., – “22nd St. Cleanup Report”.
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4. Evelyn O. Talbott, Dr.P.H., Joseph J. Schwerha, M.D., M.P.H., Jeanne V. Zborowski, Ph.D., Kathleen P. McHugh-Pemu, M.P.H., Danielle M. Dell, M.P.H., Ami S. Patel, B.S., University of Pittsburgh – “Hazle Township Health Effects Study, 1990-2002 Preliminary Findings” August 29, 2001.
5. U.S. Army Corps of engineers – “Ground water Modeling Reports”

*All these reports are available from the Tranguch Site file by contacting EPA Region III FOIA Office, 1650 Arch Street, Philadelphia, PA 19103-2029