RADIUM IN NAVY/GRUMMAN PLUME: NEED FOR AN INVESTIGATION

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Introduction

On behalf of Long Island Pure Water Ltd. we have been asked to review the materials available and evaluate whether an investigation of the radionuclide contamination detected in the groundwater in the vicinity of the Navy/Grumman facility is necessary.

Based on our review of the existing data, for the reasons explained below, we conclude that further investigation of the radionuclide contamination is not only necessary but crucial to ensure the protection of the public health and the drinking water supply. For purposes of this review, radium-228 and radium-226 will be referred to collectively as “radium”.

1. Radium Contamination in Drinking Water Supply Well

In May of 2013, the Bethpage Water District was forced to shut down a drinking water supply well due to the detection of elevated levels of radium. In December of 2015, sampling of the same well revealed levels of radium exceeding the maximum contaminant level (MCL) of 5 picocuries per liter (pCi/L). This well is still not in operation today. In our many years of experience working on Long Island, there has never been another instance in which a drinking water supply well was forced to be shut down due to radium contamination. It has been confirmed that radioactive materials were used by the United States Navy and Northrop Grumman at the Bethpage facilities. Numerous groundwater studies of the area have proven the groundwater flows to the southeast. The fact that this supply well is located southeast of the former Navy/Grumman facilities is highly indicative of radium contamination emanating from the Bethpage facilities. Furthermore, high capacity water supply wells draw water from a large volume around them and dilute contaminants arriving at the well. This strongly implies that there is a high concentration flow arriving at the well from some direction, probably the northwest, and it supports the conclusion that the radium levels in the well may not be natural.

2. Radium Detected Exceeding the MCL In 16 Wells

The NYSDEC, United States Navy and Northrop Grumman conducted sampling upgradient, side gradient and downgradient of the former Bethpage facilities from 2013 to 2017. We reviewed the sampling results of groundwater samples taken by all three entities and were able to map out the locations of each well in which radium was detected exceeding the MCL. The map reveals a pattern of detected radium exceedances downgradient (southeast) from the Bethpage site. (see Attachment 1). Conversely, upgradient concentrations appear to be low compared to downgradient levels and none exceeded the MCL. (see Attachment 2). The pattern of detections above the MCL and the lack of high concentrations upgradient indicate that the potential source of the radium is the former Bethpage facility.

3. The Source of Radium

Based on the October 5, 2016 ARCADIS report, we are aware of Grumman's extensive use of radioactive materials at the Bethpage facilities. While radionuclides were used at Plant 26 and Building 10, we cannot confirm if radionuclide containing materials were used anywhere else or disposed in landfills at the Bethpage site. In the absence of any other evidence to the contrary, it is possible the Bethpage facilities are the source of the radium contamination.

4. The Travel Time and Retardation Rate of Radium

We were not provided with the technical reports that corresponded with the radium sampling results. These reports would likely include critical information, such as pH and well depths and depths to water, which would aid in determining an accurate travel time and retardation rate. What we are able to determine from the information available to us is that the radium has a retardation rate due to its formation of ionic bonds with aquifer materials that would cause the contamination to travel slower than the groundwater, which travels at approximately one foot per day and slower than the VOCs, which travel at about 0.5 to 0.9 feet per day. This would explain why the radium contamination has not spread as quickly throughout the aquifer and does not span the full distance of the delineated VOC plumes. A site specific investigation of the groundwater pH and characteristics of the aquifer materials is necessary to accurately estimate the migration rate of the radium.

5. Radium Decays to Radon Gas

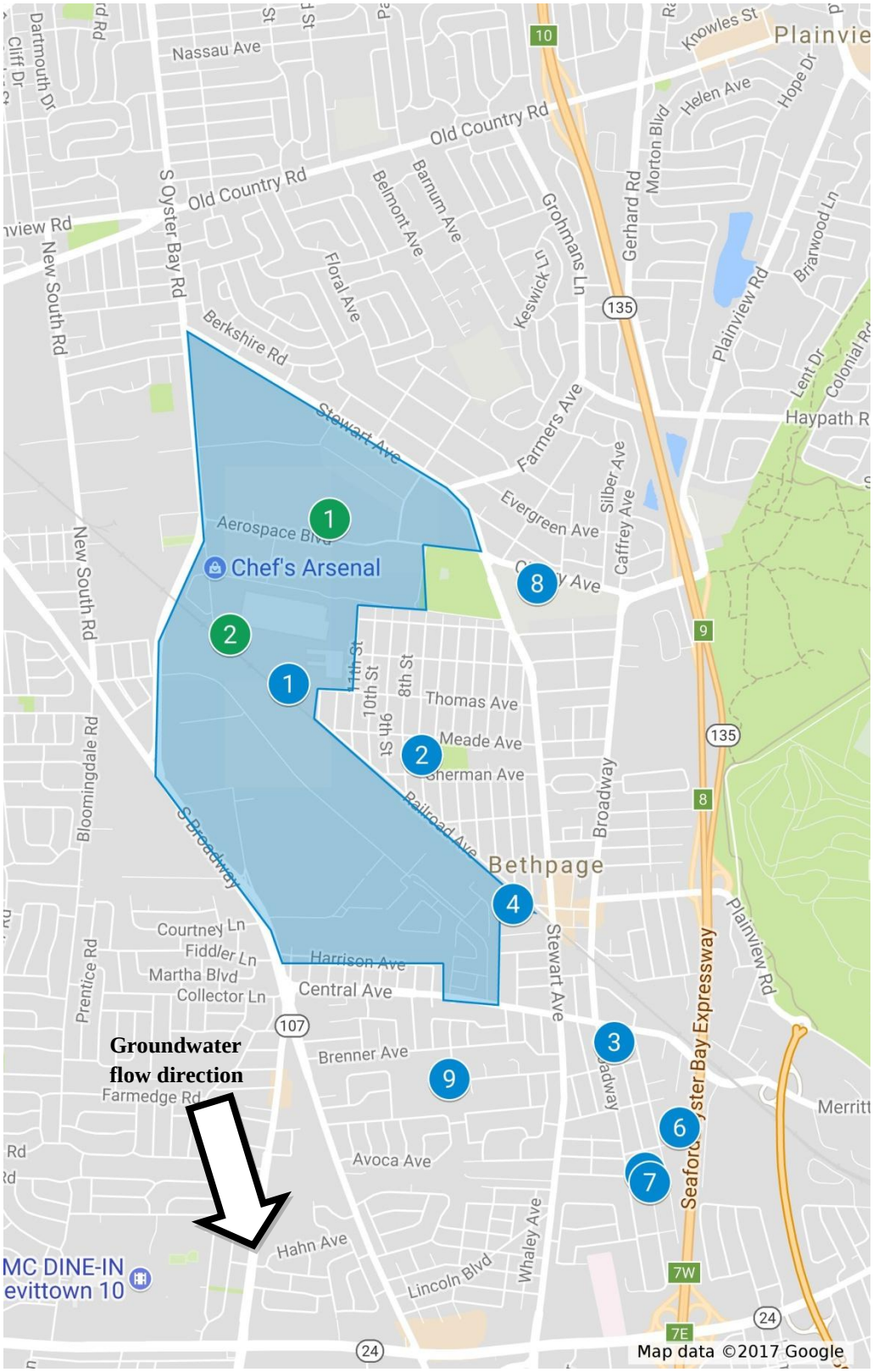
The immediate decay product of radium-226 is the radioactive gas radon. Radon can collect in homes and other buildings through the process of soil vapor intrusion. Radon is colorless, odorless and highly toxic. Radon is not commonly found on Long Island in levels exceeding the recommended federal action level of 4.0 pCi/L and therefore it is rarely tested for as a contaminant of concern. However, the Bethpage High School tested for radon and detected levels as high as 3.8 pCi/L and 3.9 pCi/L. These levels are very close to the federal action level, especially for an area where radon is typically detected in low concentrations in indoor air levels. The elevated levels of radium detected in the groundwater at the Bethpage High School could explain the abnormally high levels of radon gas in the school building. Given the radium exceedances in the groundwater throughout the area, there may be homes and businesses at risk of radon exposure. An indoor air investigation would be required to ensure the health and safety of all residents.

Conclusion

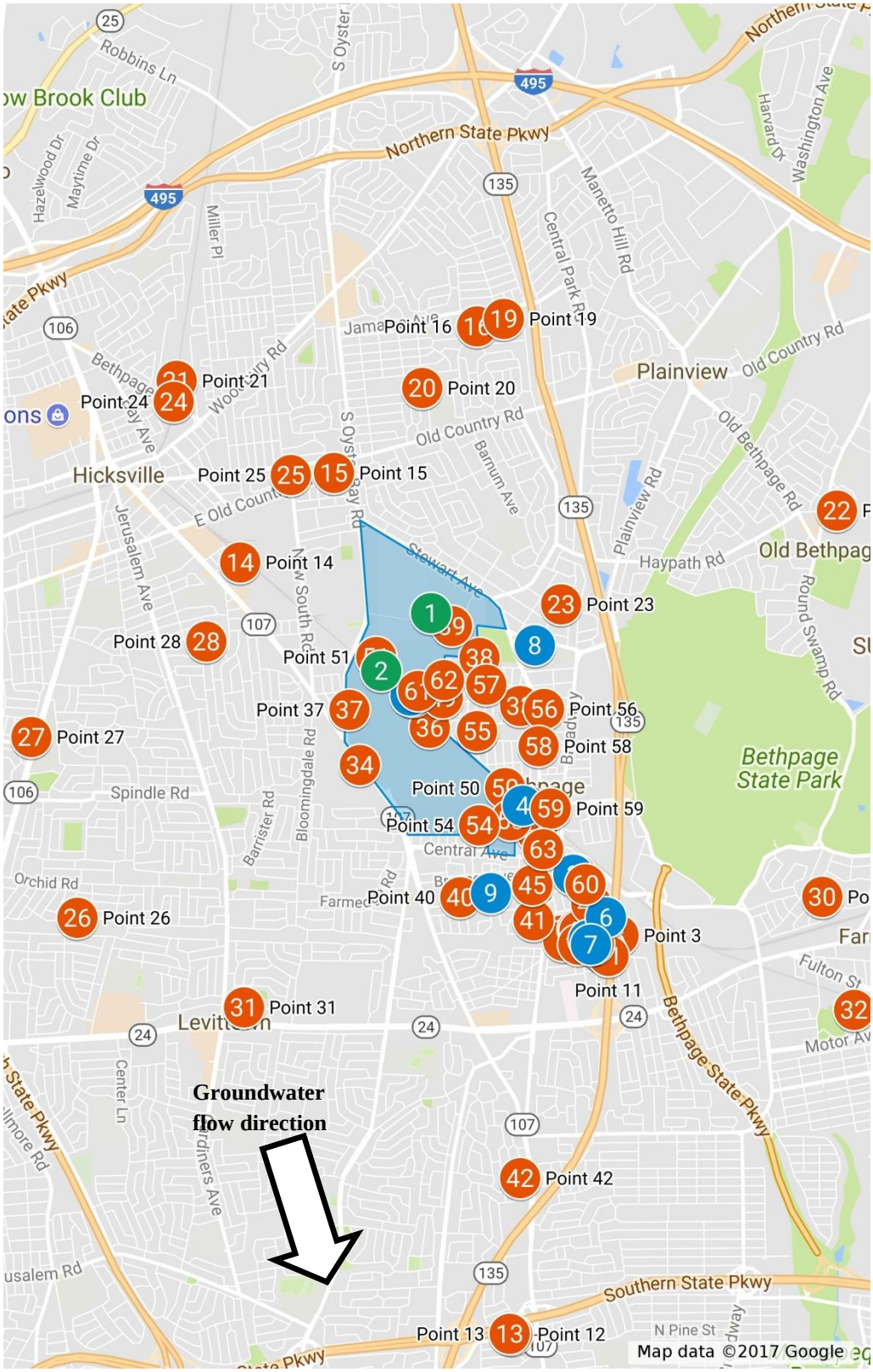
Based on a complete document review and the key findings described above, there is an obvious need for an investigation (including a background investigation to more clearly determine the range of natural levels of radium in the groundwater) to further evaluate this matter. We are able to determine a clear pattern of detections, a likely source, and a possible side effect of the radium contamination. We estimate that a proper investigation of these issues would cost approximately $3 million. A thorough and adequate investigation must be completed as quickly as possible to properly delineate the extent of the radionuclide contamination and protect the health and safety of the public and the environment.

The biographies for Mr. Valkenburg and Mr. Hauptmann, which indicate their career experiences and credentials and demonstrate their qualifications to conduct such a review, are attached.

Attachment 1



Attachment 2



Biographies

NICHOLAS VALKENBURG, CPG, LPG

NICHOLAS VALKENBURG is an expert hydrogeologist with 40 years experience in studying and remediating hazardous waste sites in many areas of the nation, including Long Island. Mr. Valkenburg has worked on numerous Superfund and Resource Conservation and Recovery Act (RCRA) sites throughout his career, focusing on the design of groundwater contamination investigations and remediation projects, and has also assisted several municipalities in the Northeast developing groundwater supplies for potable purposes. He also served as an expert witness in several litigation cases. Mr. Valkenburg runs his own firm, Valkenburg LLC.

ARCADIS US, INC. (1976 to 2015). From 1976 to 2015, Mr. Valkenburg was employed by Geraghty & Miller, Inc. (now ARCADIS) in many capacities. He started as field geologist working his way up to Project Manager, and finally Vice President with responsibilities for the Environmental Division staff in the Northeast US. Notable projects are as follows:

1. Project Officer and Project Hydrogeologist for a very large state Superfund and RCRA groundwater investigation and remediation project on Long Island for an aerospace industry client. Work involved an extensive drilling and sampling program, groundwater modeling, the design and installation of groundwater treatment systems, source and soil remediation, installation of a vapor extraction system, the installation of a sub slab depressurization system, an extensive community relations program and a program to protect public supply wells. The final Record of Decision for the site was issued by the NYSDEC in 2015,
2. Project Manager for the remediation of a large federal Superfund site in Indiana which involved an extensive drilling and sampling program, remediation of soil and groundwater, an air quality investigation, the connection of private wells to a public system to protect human health and a comprehensive community relations program. The USEPA issued the final ROD for the site in the early 2000's.
3. Project Hydrogeologist for a large groundwater investigation in West Virginia that required an extensive drilling and sampling program, aquifer testing and a pumping management plan which successfully prevented contaminants over a large area from discharging to the Ohio River via groundwater flow.
4. The investigation of a site contaminated with chromium that originated in a disposal basin at an auto manufacturing site in Indiana. The project successfully connected local residents with supply wells to a public system, resulted in closing the disposal basin which, in turn, resulted in groundwater concentrations of chromium falling to levels below the MCL.
5. Project Hydrogeologist for a large project in Jamaica, the West Indies, where extensive groundwater contamination from an aluminum smelting plant

threatened the public water supply for the city of Mandeville in a karst terrain. The results of our field investigation, which included installing multiple monitoring wells, aquifer testing, geologic mapping and a sampling program showed that the contamination was unlikely to affect the large public wells supplying drinking water to the city.

EDUCATION AND PROFESSIONAL LICENSURE

- BS in Earth and Space Sciences, Stony Brook University, 1971
- MS in Geology, University of Toledo, Ohio, 1973
- Licensed Professional Geologist, New York State, Missouri
- Certified Profession Geologist, American Institute of Professional Geologists

MICHAEL G. HAUPTMANN, PE, CQA, CSSGB

BROOKHAVEN NATIONAL LABORATORY 1995- Present

Senior Project Engineer for Environmental Restoration

As one of BNL's remediation design and construction engineers was responsible for remediation of organic chemicals, radionuclides, and PCBs in groundwater and soil. As required by USEPA Superfund remediation regulations participated in numerous meetings with the BNL Community Advisory Board and the public to describe the proposed technologies in easily understood terms. Also helped write a periodic community newsletter (*CleanUpdate*) and met individually with interested members of the public to make sure the remedial actions were well understood.

Performed design engineering including plume characterization and prepared specifications for groundwater treatment facilities' construction and operations. Managed budget, scope, and schedule utilizing the Earned Value Management System. Also provided construction management, cost estimating, work plan and report writing, innovative technologies' assessment, waste minimization, training, and communication of results to stakeholders and the public. Managed Environmental, Safety, and Health (ESH) and technical aspects of chemical and radiological soil and groundwater remediation projects in compliance with the principles of Integrated Safety Management (ISM) and CERCLA, RCRA, New York State, and local regulations.

Two notable accomplishments included optimized operation and maintenance of four groundwater treatment systems and getting timely shutdown regulatory approval for the BNL High Flux Beam Reactor tritium plume pump and treat system. This was accomplished by pumping tritium contaminated groundwater from the leading edge of the plume and re-injecting this water at an upgradient location. The reduction in tritium concentration by natural decay resulted in safe concentrations in downgradient locations.

Other assignments as a training specialist, certified quality auditor, and environmental consultant provided opportunities to evaluate environmental data and communicate their significance to clients, news media, regulatory agencies, and members of the public.

GERAGHTY & MILLER, INC. (ARCADIS) 1985 - 1995

Project Director for Environmental Remediation

Responsibilities included groundwater remediation system design and construction management; health and safety compliance; environmental compliance; design and implementation of water supply/aquifer protection projects; cost, schedule, and budget

management; litigation support; construction subcontractor management; client interface; staff management; proposal writing; computer simulations of groundwater flow and transport; and expert testimony. Also provided compliance liabilities cost estimates for manufacturing facilities' legacy issues.

PROFESSIONAL LICENSURE and EDUCATION

Licensed Professional Engineer in New York and Connecticut

Certified Quality Analyst (CQA) and Certified Lean Six Sigma Greenbelt (CSSGB) by the American Society for Quality

M.S.E./Civil & Urban Engineering, University of Pennsylvania

M.S./Regional Planning, University of Pennsylvania

B.A./Biology and Biophysics, University of Pennsylvania