

# Polycythemia Vera

## *Polycythemia Vera Cancer Cluster Investigation in Northeast PA*

### *Exposure assessment of groundwater for the polycythemia vera cluster in northeast Pennsylvania*

#### **Study Purpose**

The purpose of this study was to examine the hydrogeology of the study area and to evaluate possible relationships between present and past PV case residences and the sources of drinking water. The PV cluster area (study area) is approximately 200 square miles in size, comprising portions of three Pennsylvania counties (Carbon, Luzerne, and Schuylkill) with a population of about 75,000 people. ATSDR also conducted an air exposure assessment of area residents' past and present exposures to local and regional air pollution sources. The findings of the air exposure evaluation are summarized in a separate report and fact sheet.

#### **Background**

In 2006, Pennsylvania Department of Health asked ATSDR to help study PV patterns among residents in northeast Pennsylvania. ATSDR reviewed medical records and conducted genetic testing for the *JAK2V617F* mutation and confirmed the presence of a cluster of PV at the center of three counties (Carbon, Luzerne, and Schuylkill) in northeast Pennsylvania.

In 2009, ATSDR received funding to continue the PV cancer cluster investigations. In this component of the overall PV investigation, ATSDR worked with a contractor (Equity Environmental Engineering) to evaluate the hydrogeology of the study area and to investigate the possibility of a relationship between drinking water and residential locations of PV patients.

Because of the large amount of information available and the complexity of the task, the study was divided into the following components:

- Mapping of area sources of contamination and natural landscape features  
A Geographic Information Systems (GIS) map was created to determine if spatial relationships exist between PV cases and various features of the landscape around the study area. The GIS map included information about the area's soil and water contamination sources (e.g., mine pools, mine overflows, municipal waste operations) and also information about the area's hydrogeology (e.g., water bodies, streams), bedrock geology, and soil types.
- Evaluation of the area's geology, hydrogeology, and sources of soil and water contamination  
Scientists evaluated the flow patterns of surface water and groundwater around the study area and the effect historic mining activities had on these patterns. Scientists identified area sources of contamination and determined if the contamination could affect drinking water supplies (surface and groundwater).
- Environmental sampling events  
In the study area, a limited number of soil, water, and indoor air samples from residences and public areas were collected. Scientists analyzed the samples for multiple contaminants including volatile organic compounds (VOCs), pesticides, metals, and radionuclides. Indoor air samples were analyzed only for radon, a gas released through breakdown of uranium in the soil, drinking water, and indoor air.



## Gathering and Analyzing the Sampling Data

Data used for this study came from reviews of historical records as well as some targeted recent environmental sampling events. Information about contamination sources and natural landscape features came from regulatory and non-regulatory environmental agencies (state and federal). Equity Engineering LLC and the Pennsylvania Department of Environmental Protections (PADEP) conducted the sampling events between 2010 and 2012, collecting soil and water samples from the residences of known or suspected PV cases, frequently visited public areas, and known or suspected contaminated areas.

The 2010–2012 environmental sampling events included analysis for the following contaminants: VOCs, semi-volatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), metals, radionuclides, and pesticides. Not all samples were analyzed for all chemicals. The total number of samples collected per media type was as follows:

- 129 water samples (68 drinking water, 19 groundwater, 42 surface water)
- 27 soil samples (6 public spaces, 21 residential locations)
- 11 sediment samples
- 28 indoor air samples (residential)

To help identify the types of chemicals found most often by media type (e.g., soil, groundwater), the scientists summed the frequencies with which they detected chemicals in the sample results. Using geographic information systems, the scientists then “overlaid” chemicals found most frequently with the residences (both current and historical) of PV cases to identify any spatial relationship between the occurrence of PV cases and environmental exposure sources. Chemical concentrations were also compared with risk-based screening levels established by Pennsylvania and federal environmental agencies.

## Conclusions and Key Results

- No spatial relationship was identified among the past and present residences of PV cases and various environmental and geographic features (e.g., drinking water source, soil type, industry, or hazardous waste site type) around the study area.
- Indoor air concentrations of radon were elevated in the sampled residences of both PV cases and non-cases.
- Approximately half of the residences tested for this study had indoor air radon levels above the U.S. Environmental Protection Agency’s suggested limit of 4 pCi/L.
- Contaminated water from mine pools is not affecting water supply systems in the study area.
- Because of the study area’s large geologic scope and varied topographic structure, no single regional groundwater flow system exists in the entire area. Instead, a series of smaller groundwater flow systems operate within the individual valleys.
- Only two water reservoirs are located in coal-bearing areas; most drinking water supplies in the study area are located in non-coal mining areas where the water is of better quality. Additionally, the surface water intakes are located upstream from the mining areas and acid mine drainage affected waters.

- The levels of gross alpha radiation in groundwater that Equity Environmental Engineering LLC detected in 2012 were higher than the levels PADEP reported in 2010. A portion of these radiological data were evaluated in a separate ATSDR health consultation report released July 2014.
- When the results from all of the ongoing research projects for ATSDR's PV investigation are publicly available, ATSDR will review this information and hold a public forum to share and discuss the results with interested stakeholders.

### **For More Information**

Visit ATSDR's Web page on PV: [http://www.atsdr.cdc.gov/sites/polycythemia\\_vera/index.html](http://www.atsdr.cdc.gov/sites/polycythemia_vera/index.html).

Call ATSDR's toll-free PV information line at 866-448-0242, or email Dr. Elizabeth Irvin-Barnwell, ATSDR Division of Toxicology and Human Health Sciences, at [jcx0@cdc.gov](mailto:jcx0@cdc.gov).

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