Hello, this is Rebecca Wilson and I'd like to welcome you to the National Institute of Environmental Health Sciences Superfund Research Program Monthly Research Brief Podcast.

I'm coming to you this month to explore research that pairs GIS data with estimated historic contaminant exposure to find links between that exposure and cancer.

The research brief, number 189, was released on September 1, 2010, and was written by SRP contractor Maureen Avakian in conjunction with SRP-supported researchers Doctors Ann Aschengrau and Thomas Webster from Boston University.

Since 1995, researchers at the SRP at Boston University have used Geographic Information System (GIS) data and increasingly sophisticated statistical methods to examine the geographical distribution of disease, which can provide important clues to the origins of the disease. These environmental epidemiological studies are complicated by factors including small sample size for case populations; the fact that disease registries only contain data on where people lived at the time of diagnosis, which may not be the time of exposure; and methodological problems of understanding, estimating and evaluating potential biases.

Boston University SRP research teams, led by Drs. David Ozonoff, Ann Aschengrau, Tom Webster, and Veronica Vieira, have developed new approaches that allow them to:

- Map disease "hot" and "cold" spots while accounting for known risk factors such as age and smoking. Using these tools, they identified lung cancer and breast cancer "hot spots" associated with two pollution plumes near the Massachusetts Military Reservation.
- They have also been able to Establish a link between prenatal perchloroethylene (PCE) exposure and adverse birth outcomes including cleft lip and neural tube defects.
- In addition, they have determined that women living in more northern latitudes may be at greater risk for rheumatoid arthritis.

Drs. Aschengrau, Webster, and Vieira recently conducted an analysis to test the hypothesis that drinking water contaminated by municipal wastewater effluent from the Barnstable Water Pollution Control Facility is associated with breast cancer incidence in upper Cape Cod, Massachusetts. Surveys of the wastewater and groundwater found suspected endocrine disruptors, including alkylphenols and other estrogenic phenolic compounds. The researchers' approach included methods for analyzing the distribution of disease in both space and time.

They assessed exposure based on three sets of information:

- First, the research group conducted Residential histories of both the case and control groups. These data identified which participants were living at residences during years when drinking water was impacted by effluent.
- Second, they collected Questionnaire data that identified the drinking water source-whether or not it was public or privately maintained--from the participants for each of their residences and whether women ever regularly used bottled water.

- Then they collected Information on the public water distribution systems, which was used to determine when the drinking water wells were impacted by effluent from the water pollution control facility.

The researchers used MODFLOW, a modular software program publicly available from the USGS Web site, and modified the program to examine historical groundwater movement.

Their groundwater models showed that contamination of drinking water by effluent from the water pollution control facility was plausible and indicated that effluent from the facility reached drinking water wells as early as 1966. The researchers found statistically significant positive associations between breast cancer and exposure to drinking water impacted by wastewater effluent from the water pollution control facility. The associations were strongest among women who were not regular bottled water users and among women exposed for long durations when latency periods were taken into account.

In summary, the researchers integrated groundwater modeling, residential mobility, and information about public water systems in GIS to assess exposure to drinking water impacted by wastewater effluent. Their historical groundwater model provided a method to explore the spatial and temporal relationship between a source of contamination and a possible exposure route for study participants.

When cancer clusters are discovered, there are many possible environmental factors that could be investigated. While a spatial relationship alone does not establish exposure, this study was able to determine a plausible route of exposure by also taking time into account. The researchers demonstrated that by incorporating additional data, such as residential histories of the participants and contaminant movement over time, hypotheses generated by spatial analyses can provide additional insights into the environmental etiology of breast cancer.

If you're like to learn more about this research, visit the Superfund Research Program website at www.niehs.nih.gov/srp. From there, click on "Who We Fund" and follow the links to Boston University's research summary. If you have any questions or comments about this month's podcast, or if you have ideas for future podcasts, contact Maureen Avakian at avakian@niehs.nigh.gov.

I'd like you invite you to join us next month as we take a look at pesticide exposure and the health effects faced by workers who are exposed through their jobs.