

FOLLOW-UP ON SPRING VALLEY HEALTH STUDY

SUMMARY REPORT

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Prepared by the Johns Hopkins Bloomberg School of Public Health under contract with the District of Columbia Department of the Environment (DDOE).

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EXECUTIVE SUMMARY

Study Background and Objectives

This work builds on the 2007 Public Health Scoping Study data and findings. In 2007, Johns Hopkins investigators completed a Public Health Scoping Study consisting of community outreach, a community health status assessment and an environment and exposure assessment. The main finding of the 2007 Scoping Study was that Spring Valley's overall community health status was very good. However, additional analysis was recommended for several health outcomes. Although cancer rates in Spring Valley were lower than the rest of the country, the scoping study found slightly elevated rates of arsenic-related cancers in Spring Valley as compared to Chevy Chase, DC. Other health conditions of concern to the community and possibly related to exposures from the site included blood disorders and neurological conditions. The 2007 environmental exposure assessment evaluated the extensive soil sampling data available for the Spring Valley Formerly Used Defense Site (FUDS), but did not include the water monitoring effort as it was just getting underway at that time.

This 2013 follow-up study consisted of three components: 1) Community Health Assessment; 2) Community Outreach Survey; and 3) Environment and Exposure Analysis. The data and objectives of each component are presented in Table ES-1.

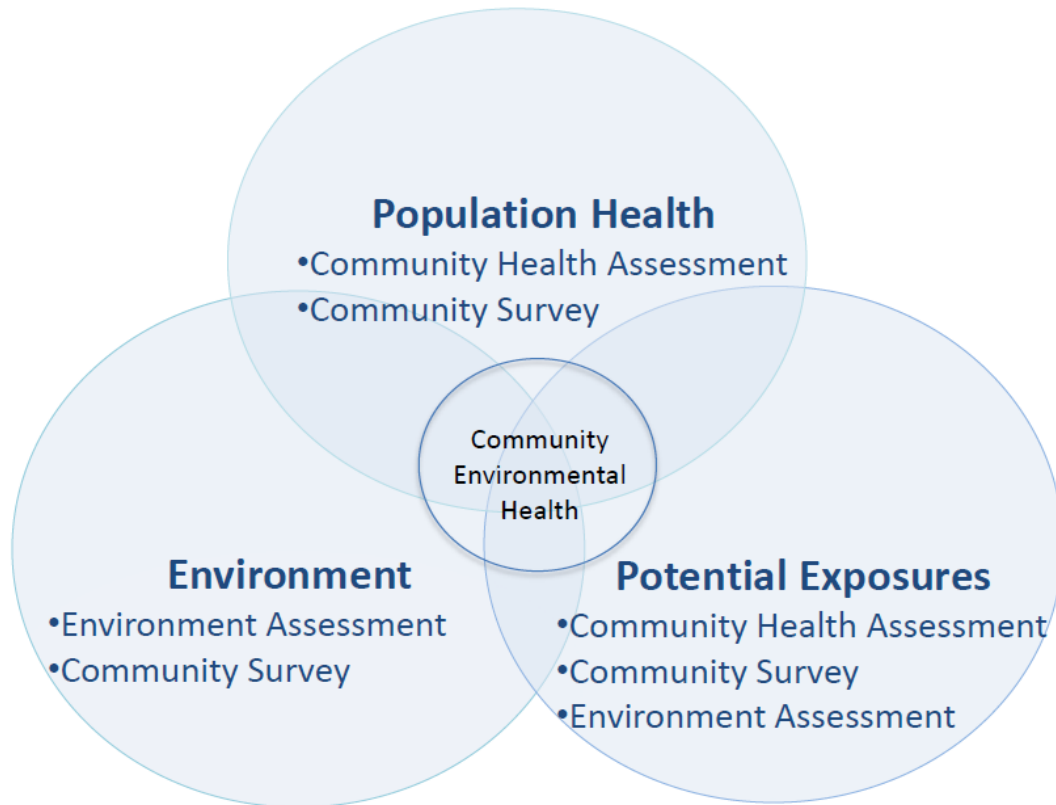
Study findings include documentation of current and ongoing health concerns of residents; information about the potential for exposure to environmental contaminants found at the site; and an evaluation of available data on increased health risks possibly related to environmental contaminants found at the site.

Table ES-1. Components of the Follow-up on Spring Valley Health Study

Study Component	Objectives	Data Sources
Community Health Assessment	• Update 2007 Scoping Study community health assessment • Compare and evaluate general community health and selected cancer statistics in the study areas	• District of Columbia Division of Vital Records and Cancer Control Registry • US Census and American Community Survey • State and national mortality and cancer statistics
Community Outreach Survey	• Gather information from area residents • Include 20015 ZIP Code area to develop comparisons • Distinguish and compare responses from within the 20016 ZIP Code area inside and outside the FUDS	• Self-reported online survey
Environment and Exposure Analysis (Environmental Assessment)	• Assess and compare ambient environmental conditions in study areas • Evaluate exposure pathways including available site-related water sampling • Evaluate water study plans	• DDOE and EPA ambient environmental data • Washington Aqueduct drinking water data • Site-specific data from US Army Corps of Engineers and their contractors

As depicted in Figure ES-1, the three study components relate to three areas of inquiry (population health, potential exposures, and environmental conditions) that collectively inform the core question of potential exposures and health impacts of the Spring Valley FUDS.

Figure ES-1. Framework for the Follow-up on Spring Valley Health Study



Review of Key Findings

Community Health Assessment¹

Demographics and Major Causes of Mortality (2004-2010)

- Education, income and racial composition of the study areas continue to be largely comparable, although the Chevy Chase area has a larger proportion of population in older age groups.
- Community health in the Spring Valley and Chevy Chase areas continues to be very good. Rates for all of the 15 major causes of mortality in the Spring Valley area were lower than in the US overall. Rates for 14 of the 15 top causes of death were lower in the Chevy Chase area than in the US overall; the mortality rate for heart diseases in Chevy Chase was slightly higher than the US

¹ In the Community Health Assessment, the study areas were represented by ZIP Codes or by census tracts depending on the underlying data analyzed. The Spring Valley area was represented by the 20016 ZIP Code or census tracts 801, 901, 1001, 1002. The Chevy Chase area was represented by the 20015 ZIP Code or census tracts 1100, 1401, 1402, 1500.

rate. Statistical differences between Spring Valley and Chevy Chase mortality rates were noted for heart disease, accidents and homicides; with Spring Valley mortality rates lower than Chevy Chase for all three.

- Rates for major causes of mortality in the study areas were mostly lower than those in DC with the exception that rates of Alzheimer's and Parkinson's Diseases in both study areas were similar or slightly higher than DC rates.

Cancer Incidence and Mortality for Selected Causes (2005-2009)

- Incidence and mortality rates for all of the selected cancers in the Spring Valley area are lower than US rates.
- Incidence and mortality rates of the selected cancers were also very similar when comparing the study areas. Only one statistical difference was found in the analysis of incidence and mortality of selected cancers in the study areas: the incidence of lymphoma in the 2005-2009 period is higher in Spring Valley than in Chevy Chase.
- Incidence rates for all selected cancers in the Chevy Chase area were lower than US rates. Mortality rates in the Chevy Chase area for bladder, kidney and renal pelvis, liver and intrahepatic bile duct, and lung and bronchus cancers were lower than US rates. Rates for leukemia mortality in Chevy Chase were similar to the US; rates for lymphoma mortality were higher than US rates.

Cancer Trends, 1994-2009

- Year-by-year rate trends were highly variable in both study areas, as is typical for small-area analyses. The high variability is due to the small numbers of cases and deaths from year-to-year and the trend data should be interpreted with caution.
- Small positive correlations (increasing trend) were found for bladder and lung and bronchus incidence, and lymphoma mortality in the Spring Valley area. There was a moderate positive correlation (increasing trend) for lung and bronchus cancer mortality in Spring Valley; this is the only statistically significant trend finding.
- Small positive correlations (increasing trend) were found for lung and bronchus and lymphoma mortality in the Chevy Chase area. Small negative correlations (decreasing trend) were found for bladder and lung and bronchus incidence in the Chevy Chase area.

Literature Search on Other FUDS – Findings

- There was little peer-reviewed literature available regarding community health near FUDS sites across the country.
- Former Camp Sibert in Alabama, a WWII chemical weapons training site, was found to have contamination issues similar to those of Spring Valley.
- The potential for community exposure is likely lower in the Former Camp Sibert area because it has not been heavily residential and has been under development only in recent years.
- Education, income and race/ethnicity characteristics of the Former Camp Sibert area are not comparable to the Spring Valley area.
- There was little community health information available for the former Camp Sibert area, but what was available suggested poorer community health there than in the Spring Valley area. For example, cancer mortality rates in the Former Camp Sibert area were higher than US rates while Spring Valley and Chevy Chase study area rates were lower than US rates.

Community Outreach Survey²

- Self-reports of personal health status were better than or equal to the national average.
- Most health conditions reported by ZIP Code 20016 Inside or Outside FUDS respondents were reported with less frequency than general US population statistics.
- 20016 Inside FUDS respondents had a pattern of higher reporting of learning disability, peripheral neuropathy and diabetes than respondents Outside the FUDS and in ZIP Code 20015. 20016 Inside FUDS respondents reported learning disability more frequently than general US population statistics for respondents residing in the area for 6-17 years as well as 18 or more years. These conditions have been associated with arsenic exposure.
- 20015 respondents had a pattern of higher reporting of hypertension, respiratory disease, mental illness and thyroid disease than respondents in 20016 both Inside and Outside the FUDS. In 20015 respondents who have lived 18 or more years in the area, heart disease, hypertension, respiratory disease, thyroid disease and peripheral neuropathy were reported with more frequency than general US population statistics.
- All respondent groups reported concerns about drinking water, chronic conditions, outdoor air quality and nutrition/obesity.
- Respondents inside the FUDS area expressed additional concerns regarding causes of cancer and possible environmental contamination.

Environmental Assessment³

Environmental Health Portraits - Industrial Facilities and Air and Water Quality

- 20016 has a greater density (per square mile) of facilities that report to EPA than does 20015. The greater density of facilities in 20016 may contribute to more ambient environmental pollutant concentrations and population exposures. Most facilities in both areas are minor sources (air pollutants) or small quantity generators (hazardous waste).
- Air quality in the Washington, D.C. area has improved over the past 10 years.
 - Ozone is the only criteria air pollutant found above national standards in the Washington, D.C. area. Ozone exposure could potentially increase all D.C. residents' susceptibility to infection, as well as worsen reactions to allergens and other pollutants.
- Exposures and risks in the study area from air toxics are below those of the District as whole, which are higher than the US average, but typical of US urban areas.
 - There is potential for all D.C. residents to have adverse respiratory outcomes due to air toxics concentrations in ambient air.
 - Estimated cancer risks from air toxics were within EPA's acceptable range for the study areas and D.C. overall.
- Both the 20016 and 20015 ZIP Codes are served by the public water system.
 - Levels of perchlorate and arsenic in drinking water are below existing state⁴ (perchlorate) and national (arsenic) standards.

² In the Community Survey the 20016 ZIP Code represented the Spring Valley area and the 20015 ZIP Code represented the Chevy Chase area. Within 20016, reports from Inside or Outside the FUDS were presented separately.

³ In the Environment Assessment most analyses used the ZIP Codes to represent the study areas. The analysis of air toxics used census tracts (as listed in footnote 1) to represent the study areas.

⁴ California has a perchlorate standard of 6 ppb; Massachusetts has a perchlorate standard of 2 ppb.

Assessment of Site- Specific Exposure Pathways

- The site conceptual models developed by JHSPH and USACE were generally similar, with two exceptions:
 - JHSPH evaluated a landscaper worker (2007 Scoping Study)
 - JHSPH evaluated particulate inhalation as an exposure pathway for residents (2007 Scoping Study)
- Incidental and recreational exposure to surface water were evaluated; no increased risk was indicated considering sampling data for arsenic, perchlorate and other contaminants detected.

Review of water study plans and approaches

- The types of data and general approaches developed for the water study are adequate to address the stated objectives, however, the methods for analyzing and integrating the data were unclear.
- Data gaps included:
 - Lack of information on biogeochemical processes that may influence contaminant fate and transport; and
 - Potential for contaminated groundwater to seep onto surfaces

Recommendations

Community Health

- Develop a complete profile of cancer incidence and mortality for both study areas including rates and time trends of the all major cancers, as well as cancers selected for site-related or other community concerns.
- Monitor health conditions reported more frequently than US statistics by study area survey respondents including:
 - Learning disabilities (reported more frequently by 20016 Inside FUDS respondents);
 - Thyroid disease, learning disability and peripheral neuropathy (reported more frequently by 20016 Outside FUDS respondents with 18 or more years of residence);
 - Other chronic conditions reported by 20015 respondents including heart disease, hypertension, and respiratory disease.

Outreach

- Monitor and report environment and health status and trends in the 20016 and 20015 ZIP code areas, as well as specifically for the 20016 inside the FUDS area. Findings should be publicly available and disseminated on a regular basis in user-friendly formats, such as neighborhood profile reports or interactive websites.
- Maintain transparency and engagement with the community regarding on-going Spring Valley FUDS remediation activities and potential health risks, as well as FUDS related health concerns.
- Engage with the study area communities to identify opportunities for communication, education and evaluation of reported topics of concern (drinking water quality, chronic conditions, outdoor air quality and nutrition/obesity).

Environment: Water Study Recommendations

Water study methods and approaches were found to be adequate. The following recommendations are offered as water study documents are prepared and data analyses conducted.

- Provide explanation of the site-driven well location strategy, i.e., document why a site-driven strategy was preferred over a systematic approach.
- Assess the role of biogeochemical processes on contaminant fate and transport.
- Evaluate the potential for groundwater seepage onto surfaces and sample soil if seepage is indicated.

Conclusions

In both study areas, personal and community health status determined from survey reports and surveillance data were very good. Death rates for major causes were low and cancer incidence and mortality for selected cancers were mostly below US rates. Cancer data showed some annual rate trends increasing where national rates have been decreasing. Increasing rate trends were found for bladder and lung and bronchus cancer incidence in the Spring Valley area, and for lung and bronchus and lymphoma mortality in both study areas. A cancer profile including rates and time trends of all major causes of cancer is recommended to assess overall cancer risk and burden in the study areas. Concerns raised in the community survey, such as learning disabilities, may be difficult to evaluate but should be monitored and tracked.

Concerns about air quality were explored in the industrial profile (Environment Assessment). Examination of air toxics data found that exposures and risks in 20016 and 20015 were similar and consistent with conditions in other US urban areas. Similarly no differences in exposure were found with regard to drinking water as both areas are served by the public supply. No increased health risks were estimated from exposure to surface water inside the FUDS.

This 2013 Follow-up on Spring Valley Health Study examined population health and potential exposures to site-related contaminants, as well as ambient environmental conditions. Residents can be assured that community health is very good and most environmental indicators are in compliance with established standards or are similar to conditions in other urban areas. In light of the significant limitations of lack of exposure data, disease latency and time elapsed since the WWI-era activities and the findings of continued good health of the study area communities, no further epidemiological investigations are recommended. However, regular cancer, community health and environment updates are recommended as is continued communication and outreach regarding remediation activities.

COMMUNITY HEALTH ASSESSMENT SUMMARY REPORT

Purpose

This summary report provides an update and follow-up to analyses and findings of the 2007 Scoping Study community health assessment. Demographic and health outcome data are updated for the Spring Valley and Chevy Chase areas and District of Columbia and US comparison populations. This study explored concerns raised in the Scoping Study including blood disorders (aplastic anemias) and peripheral neuropathy and evaluates trends in cancer rates over time. Additionally, a literature review was conducted to gather community health information on other Formerly Used Defense Sites (FUDS) that may provide additional context helpful in understanding community concerns and potential risks at Spring Valley. Full details of each analysis are available in the Community Health Assessment Technical Report.

Questions Explored

The analyses addressed the following questions:

1. How does general community health status compare across the study areas, the District of Columbia and the US?
2. How do time trends in selected causes of cancer compare across the study areas and US?
3. Are there lessons about community health to be learned from investigations of other FUDS?

Approach

Study area definitions for the community health assessment

The Spring Valley and Chevy Chase study areas were represented by ZIP Codes and census tracts. The Spring Valley FUDS boundary is contained within ZIP Code 20016 and DC census tracts 801, 901, 1001, 1002; the Chevy Chase area is represented by ZIP Code 20015 and DC census tracts 1100, 1401, 1402, 1500.

Data

The Johns Hopkins 2007 Scoping Study⁵ presented a general assessment of community health indicators for each study area including descriptive demographics from the 2000 Census, data on the top 15 causes of mortality in the United States (US) for 2002-2003, and cancer incidence and mortality for selected causes of cancer for 1994 – 2004.

The updated data were:

- Demographics for 2006-2010 from the US Census;

⁵ 2007 Scoping Study report available at:

http://www.nab.usace.army.mil/Portals/63/docs/HopkinsHealthStudy_2007.pdf

- Mortality data for 2004 – 2010 from the District of Columbia Department of Health (DCDOH) Division of Vital Records; and
- Selected cancer incidence and mortality for 2005 – 2009 from the DCDOH Cancer Registry.

Methods

This analysis of community-level health data examined the potential health impacts of the American University Experiment Station (AUES)-related contamination by comparing the Spring Valley area (potentially “exposed”) to the Chevy Chase area (“unexposed”). Through these comparisons, we indirectly addressed the possible influence of American University Experiment Station-related contamination. Demographic statistics as well as population-based mortality and disease rates for the two areas were compared. Mortality and disease rates were age-adjusted to allow for comparisons across study areas and population age groups. Statistical differences in mortality and disease rates as well as cancer rate trends between the Spring Valley and Chevy Chase areas were assessed.

The literature review of community health at other FUDS was conducted using PubMed, Scopus, Web of Knowledge and Academic Search Complete publication databases. We requested Health Consultations and Public Health Assessments related to chemical weapons or munitions from the U.S. Agency for Toxic Substances and Disease Registry (ATSDR). We also contacted the US Army Corps of Engineers and reviewed recent Government Accountability Office (GAO) reports to identify other FUDS.

The plans and related data needs for this community health status assessment were reviewed and approved by the Johns Hopkins Bloomberg School of Public Health Institutional Review Board and the DCDOH Institutional Review Board for the Public’s Health.

Findings

1. How does general community health status compare across the study areas, District of Columbia and US?

Comparison of demographic characteristics, 2006-2010

Demographic characteristics of the Spring Valley and Chevy Chase areas were similar with regards to racial and ethnic composition, income and educational attainment. Both study areas are older than the DC and US populations. Chevy Chase is older than Spring Valley with a larger proportion of people over age 40.

Comparison of mortality rates for the top 15 causes of mortality as well as aplastic anemia and peripheral neuropathy, 2004-2010

Comparatively, community health in the Spring Valley and Chevy Chase areas continues to be very good. Rates for all of the 15 major causes of mortality in the Spring Valley area were lower than in the US overall. Rates for all of the 15 top causes of death were lower in the Chevy Chase area than in the US overall, except for heart disease, which had a slightly higher rate. Statistical differences between study areas were noted for heart disease, accidents and homicides; mortality rates for these causes were lower in Spring Valley than rates in Chevy Chase.

Only one death in the category of aplastic and other anemias and no deaths from neuropathy were reported; thus, no rates were calculated. The anemia death was in a teenager which may indicate the inherited form of the disease. Further investigation of these outcomes would require a study where individual patients could be identified and/or patient health records could be reviewed because surveillance systems for these outcomes do not exist.

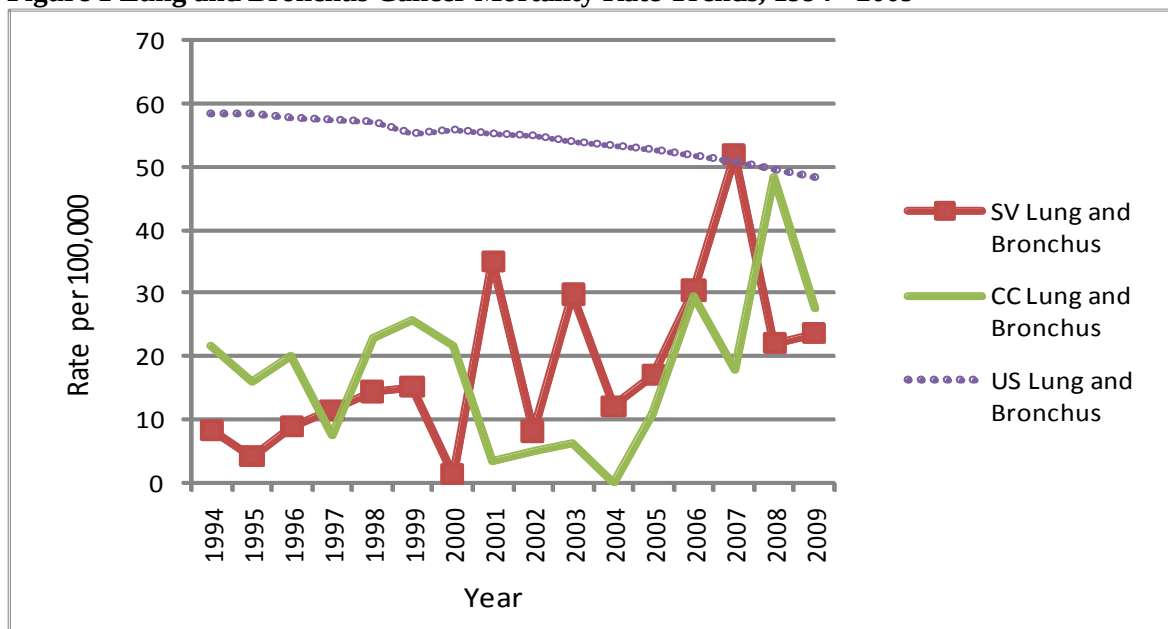
Comparison of rates of selected causes of cancer including known arsenic-related cancers (bladder, kidney and renal pelvis, liver and intrahepatic bile duct, lung and bronchus) and also leukemias, lymphomas and melanoma as outcomes of community concern, 2005-2009

Incidence rates for the all of the selected cancers in both the Spring Valley and Chevy Chase areas are lower than US rates. Mortality rates for the all of the selected cancers in the Spring Valley area are lower than US rates. Mortality rates in the Chevy Chase area for bladder, kidney and renal pelvis, liver and intrahepatic bile duct, and lung and bronchus cancers are lower than US rates. Rates for leukemia mortality in Chevy Chase are similar to the US; rates for lymphoma mortality in Chevy Chase are higher than US rates. Only one statistical difference was found in the analysis of incidence and mortality rates of selected cancers in the study areas; the incidence of lymphoma in the 2005-2009 period is higher in Spring Valley than in Chevy Chase.

2. How do time trends in selected causes of cancer compare across the study areas and US?

Examination of cancer rate trends over time from 1994 – 2009 revealed small increases for bladder and lung and bronchus incidence, and lymphoma mortality in the Spring Valley area. There was a moderate increasing trend for lung and bronchus cancer mortality in Spring Valley; this was the only statistically significant trend finding. Small, non-significant increasing trends were found for lung and bronchus and lymphoma mortality in the Chevy Chase area. These trends run counter to decreasing trends in the US. For example, the trend data for lung and bronchus mortality is shown in Figure 1.

Figure 1 Lung and Bronchus Cancer Mortality Rate Trends, 1994 - 2009



Abbreviations: CC, Chevy Chase; SV, Spring Valley; US, United States

Figure 1 shows lung and bronchus cancer mortality rates from 1994 to 2009. The range of rates (per 100,000) in the Spring Valley area was 1 to 52; and 0 to 48 in the Chevy Chase area. The US rate has decreased from about 59 to 48 per 100,000.

3. Are there lessons about community health to be learned from investigations of other FUDS?

Only a single site, Former Camp Sibert in Alabama, was found to have contamination issues similar to those of Spring Valley from its use as a WWII chemicals weapons training site. However, the potential for community exposure is likely lower in the Former Camp Sibert area because it has not been heavily residential and has been under development only in recent years. While the contamination concerns are similar to the Spring Valley situation the population and community health data for the Former Camp Sibert area indicated lower socio-economic status and poorer community health.

Conclusions and Recommendations

This health assessment utilized community-level data, and therefore was not designed to evaluate individual-level exposures and outcomes. Community-level data allowed us to examine the question of potential health impacts of AUES-related contamination by making comparisons between the Spring Valley area (potentially “exposed”) and the Chevy Chase area (“unexposed”).

Analysis of the top 15 causes of mortality revealed three statistical differences between the two study areas - all favoring Spring Valley. Rates for heart disease, accidents and homicide were statistically higher in Chevy Chase.

The cancer analysis revealed two statistically significant findings; lymphoma incidence rate differences between the study areas and the lung and bronchus mortality rate trend in the Spring Valley area. Lymphoma incidence in the 2005-2009 period was higher in the Spring Valley area than in the Chevy Chase area; however, based on a review of lymphoma risk factors⁶, lymphoma is not strongly linked to arsenic or other AUES-related chemicals.

Lung and bronchus cancer mortality rates were lower in both study areas than the US on average⁷; however, the increasing rate trends for lung and bronchus mortality are concerning. We looked at the underlying data to see if factors such as age or gender might have contributed to the increasing trend.

The median age for the lung and bronchus cancer deaths reported from 1994-2009 was 78 years for Spring Valley, 76 years for Chevy Chase; and 72 years in the US (for 2005-2009)⁸. US lung and bronchus cancer death rates are higher for older patients⁹. Rates of lung and bronchus mortality in the

⁶ American Cancer Society 2013 Risk factors for Hodgkin and Non-Hodgkin Lymphomas. Available: <http://www.cancer.org/cancer/hodgkindisease/overviewguide/index> [accessed April 23, 2013].
<http://www.cancer.org/cancer/non-hodgkinlymphoma/overviewguide/index> [accessed April 23, 2013].

⁷ See Community Health Assessment Technical Report Table CH-5.

⁸ SEER 2012 SEER Stat Fact Sheets: Lung and Bronchus. Available: <http://seer.cancer.gov/statfacts/html/lungb.html> [accessed April 23, 2013].

⁹ National Vital Statistics System 2010 National Vital Statistics System 2010. Death Rates for 358 Selected Causes by 5-Year Age Groups, Race, and Sex: United States, 1999-2006. Available: http://www.cdc.gov/nchs/data/dvs/MortFinal2006_WorkTable292R.pdf [accessed April 23, 2013].

U.S. overall are declining in men but continue to increase in women¹⁰. Women represent about 55% of the lung and bronchus cancer deaths in the Spring Valley and Chevy Chase areas from 1994-2009. Thus, age and gender may explain part of the rate increase in the study areas.

Lung and bronchus cancer is an arsenic-related cancer, although smoking is the most common cause accounting for about 90% of cases⁶. Arsenic exposure and smoking rates were beyond the scope of this study.

Given the significant limitations resulting from lack of exposure data, disease latency, and time lag (approaching 100 years since AUES activities) it is not possible to make a definitive determination of cause and effect for health outcomes observed in surveillance data or reported by residents. However, the findings are reassuring – community health has remained strong over the years examined in the current and 2007 studies (2002-2010 for top causes of mortality and 1994 – 2009 for incidence and mortality for selected cancers). There were few findings consistent with a hypothesis that residents of the Spring Valley area may have had increased exposure to arsenic or other AUES-related chemicals.

The findings do warrant continued monitoring. However, given the limitations identified above and findings of continued good health in the study areas further epidemiologic investigation is not recommended. The study recommendations focus on ‘tracking’ or regular monitoring and reporting of community and environmental health to follow and update community health status over time.

Public Health Concerns and Recommendations

The findings of increasing cancer incidence and mortality trends running counter to US trends raise a general public health concern for both the Spring Valley and Chevy Chase areas. Understanding these trends may require further analysis of existing data on patient-level factors (e.g., age, gender, smoking), disease characteristics (e.g., type, site and stage of disease) as well as availability, access and use of appropriate treatment.

The selected cancers evaluated in this report account for about 36% of US cancer incidence and about 45% of cancer deaths overall¹¹ but did not include the most common cancers (colon, breast and prostate). A cancer profile for the study areas should be expanded to include the most common cancers as well as those selected on the basis of site-specific or other community concerns.

Recommendation

- Develop a complete cancer incidence and mortality profile for both study areas including rates and time trends of all the major cancers, as well as cancers selected for site-related or other community concerns.

¹⁰ American Lung Association 2013 American Lung Association. 2013. Lung Cancer Fact Sheet. Available: <http://www.lung.org/lung-disease/lung-cancer/resources/facts-figures/lung-cancer-fact-sheet.html> [accessed March 29, 2013].

¹¹ American Cancer Society 2012. Cancer Facts and Figures. Available: http://seer.cancer.gov/csr/1975_2009_pops09/results_single/sect_01_table.01.pdf [accessed April 23, 2013].

COMMUNITY OUTREACH SURVEY SUMMARY REPORT

Purpose

A community survey was conducted in follow-up to the Johns Hopkins May 2007 Public Health Scoping Study to further inform current study findings about overall community health status as well as community health concerns.

Questions Explored

The survey analysis explored the following two questions:

1. How does self-reported health status compare across the 20016 (both inside and outside the FUDS) and 20015 ZIP codes?
2. How do public health and community concerns compare across the 20016 (inside and outside the FUDS) and 20015 ZIP codes?

Approach

In an effort to gather input from as many ZIP code 20016 and 20015 current and former residents, workers and students as possible, an online community health survey was available for nine weeks in Fall 2012 (a paper version of the survey was also offered). The survey was publicized and the link disseminated through a variety of communication and outreach methods including press releases, newspaper coverage, community listserves, local neighborhood organization meetings, and social media postings.

Survey Methods

The survey was developed and online submissions completed in the Qualtrics online survey system. All current and/or former residents, workers and students in the 20016 and 20015 ZIP code areas were eligible to complete the survey. Respondents were able to respond for themselves, as well as other members of their household, including children and former household members who may currently live in another location or are now deceased. Respondents were asked to report their residence, employment, and schooling history in the study areas. For each household member, the survey asked for health status and diagnosed conditions. Respondents were also asked to indicate their top five public health and community issues of concern; additionally respondents were able to offer any general comments, questions and concerns.

Survey analysis sought to differentiate responses from three geographic areas (ZIP Code 20015, 20016 Inside the FUDS and 20016 Outside the FUDS). Length of time residing in 20016 Inside the FUDS was analyzed for three time periods (short (0-5 years), medium (6-17 years) and long-term (18 or more years)) as a means to represent potential exposure to FUDS-related contaminants and compared to residence time in the other geographic areas (20016 Outside the FUDS and 20015).

Respondent demographics, self-reported health status, health conditions, and public health concerns were characterized and compared across each of the three geographic areas and length of time of residence.

When available, data from the overall study population areas (ZIP Codes 20015 and 20016), as well as for the nation as a whole are provided for comparison.

Findings

1. How does self-reported health status compare across the 20016 (both inside and outside the FUDS) and 20015 ZIP Codes?

Survey Demographics

Of the 865 individuals represented in the survey, the largest proportion consisted of current or former residents of 20016 inside the FUDS boundary (52%). In comparison to the general population of the study areas, survey respondents were on average older and more likely to be White/Caucasian. On average former residents were older than current residents and longtime residents were older than more recent residents.

Self-Reported Health Status

Survey respondents self-reported equal or better overall health status than the general U.S. population. Residents in 20016 inside the FUDS reported lower average health status than residents in 20016 outside the FUDS and in 20015. Only in the case of residents living in 20016 inside the FUDS for 18 or more years was the proportion of those reporting fair/poor health higher than the national average.

Self-Reported Health Conditions

In all three geographic areas, reporting of health conditions increased with age and correspondingly length of residence, as long-term residents on average were older. 20016 Inside FUDS had higher reporting than 20016 Outside FUDS and 20015 for learning disability (medium and long-term), peripheral neuropathy (short and medium-term) and diabetes (short and medium-term). There was no consistent pattern of higher reporting of conditions in 20016 Outside FUDS. 20015 had higher reporting than 20016 Inside or Outside FUDS for hypertension (medium and long-term), respiratory disease (all three time periods), mental illness (medium and long-term) and thyroid disease (short and long-term).

2. How do public health and community concerns compare across the 20016 (Inside and Outside the FUDS) and 20015 ZIP Codes?

Public Health and Community Concerns

In all three geographic areas, the top reported public health and community concern was drinking water quality. Other commonly reported concerns include chronic conditions, nutrition/obesity, and outdoor air quality. Residents from 20016 inside the FUDS noted concerns about hazardous materials and toxic substances from the Spring Valley FUDS, as well as causes of cancer and soil contamination.

Conclusions and Recommendations

The online survey format, chosen for its ease of use and broad reach to potential eligible participants, has inherent limitations. Survey respondents were anonymous and self-reported their own health conditions and in many cases also reported for family members. Therefore reported health conditions cannot be independently verified. Furthermore, due to an indeterminate denominator, the data could not be age-adjusted or tested for statistical significance—thus, only raw numbers and percentages were reported. As such, the analysis is solely descriptive in nature.

Additionally, due to media and public attention to the FUDS site coupled with increased survey awareness and interest, as well as independent outreach that included a photo of WWI site activity in the 20016 ZIP Code area introduced the possibility for bias in survey response.

Conclusions

Despite the limitations, the survey responses provide helpful insight with regards to residents' self-reported health outcomes, as well as public health concerns. Personal health status and most health conditions reported were better than or equal to the national average, which is similar to the findings from the community health assessment.

There was consistency in concerns across all respondent groups on drinking water, chronic conditions, outdoor air quality and obesity. Inside FUDS area respondents expressed additional concerns regarding causes of cancer and possible environmental contamination.

Recommendations

Building on these findings the following actions are recommended:

- Monitor and report environment and health status and trends in the 20016 and 20015 ZIP code areas, as well as specifically for the 20016 inside the FUDS area. Findings should be publicly available and disseminated on a regular basis in user-friendly formats, such as neighborhood profile reports or interactive websites.
- Maintain transparency and engagement with the community regarding on-going Spring Valley FUDS remediation activities and potential health risks, as well as FUDS related health concerns
- Engage with the study area communities to identify opportunities for communication, education and evaluation of reported areas of concern (drinking water quality, chronic conditions, outdoor air quality and nutrition/obesity).

ENVIRONMENT ASSESSMENT SUMMARY REPORT

Purpose

This summary report provides an update on the 2007 Johns Hopkins Spring Valley Public Health Scoping Study's exposure profile for arsenic, which described risks resulting from contaminant exposures via indoor and outdoor air, water, soil, and food exposure. In this follow-up study, we examine multiple facets of the environment in which the 20016 and 20015 ZIP Codes are situated and describe the manner in which ambient and site-related pollution may contribute to environmental contaminant exposures to residents.

Questions Explored

The analysis addressed the following questions:

1. How does environmental quality compare across the 20016 and 20015 ZIP Codes?
2. What types of environmental exposures should be considered to understand risks within the FUDS?
3. Considering new site-specific data, how does our estimate of site risk change?
4. Were approaches used to understand groundwater contamination and related public risk appropriate?

Approach

Study Area Definitions for the Environmental Profile

Throughout this report, the communities within the Spring Valley ZIP code of 20016 and Chevy Chase ZIP code of 20015 are compared. These communities are referred to by ZIP code to avoid any confusion about to which geographic areas findings apply. While 20016 encompasses the entirety of Spring Valley, it is important to note that the Chevy Chase neighborhood includes additional ZIP codes beyond 20015, which were not examined in this report.

Data and Methods

We developed a comparative portrait of environmental quality in the 20016 and 20015 ZIP Codes. In this comparison, we attempted to characterize environmental pollution unrelated to the FUDS site in the 20016 ZIP Code. The comparative portrait spans environmental media and pollutants (air toxics, criteria pollutants, and drinking water) and also examines the density of industrial facilities in operation in the two ZIP codes.

We identified air quality monitoring stations and examined air quality monitoring data produced by the District of Columbia Department of the Environment and made available by the Metropolitan Washington Council of Governments' Department of Environmental Programs. We also compared cancer risks and non-cancer hazards from air toxics based on data from the EPA's 2005 National-scale Air Toxics Assessment. Data produced by the US Army Corp of Engineer's Washington Aqueduct were reviewed and compared to federal and state standards for the water quality assessment. To understand the impact of

industrial activities, we searched data available in the EPA *Envirofacts* database on industrial facilities required to report to states or the Federal government within the 20016 and 20015 ZIP Codes as of March 2013. The *Envirofacts* database covers EPA reports regarding air quality, toxics, hazardous waste generation, radiation, and water quality. We then compared the reported releases in *Envirofacts* among the facilities in each ZIP Code area.

To determine environmental exposures to consider to further understand site risks, we reviewed USACE site characteristic and environmental media information. We also examined USACE site conceptual models for the purpose of comparison.

Next, based on EPA guidance, we proposed a framework for understanding exposures to site-related contamination and compared it to conceptual site models used in both the US Army Corp of Engineers (USACE) and Johns Hopkins 2007 site assessments. We also quantitatively characterized risks related to exposure to contaminants present in onsite surface waters, were they to be used for swimming or other recreational purposes. Recently generated USACE surface water contaminant sampling data were provided to facilitate this risk estimation.

The adequacy and rigor of the USACE's water sampling protocols, as well as the data generated under these protocols, were assessed in this report. Four water monitoring study planning documents from 2005 - 2009 were provided by the URS Group, a USACE contractor, for evaluation of approaches used to understand groundwater contamination and related public health risks. These documents included work management and quality assurance project plans.

Findings

How does environmental quality compare across the 20016 and 20015 ZIP Codes?

Industrial Profile

The comparative industrial profile revealed that the 20016 ZIP Code has a larger land area (4.5 vs. 3.4 square miles) and threefold more facilities that report to EPA under federal statute than the 20015 ZIP Code. But the distribution by industry sector of reporting entities was similar across ZIP Codes, with the exception of a select group of industries (Health Care and Social Assistance - 20016, Information - 20016, and Arts, Entertainment and Recreation- 20015), which occurred in only one ZIP Code. We suspect that these types of facilities, despite being reportable to the EPA, are not contributing substantially to localized pollution. In terms of environmental media-specific reporting, the 20016 ZIP Code had more facilities reporting air, hazardous waste, and water releases. The Spring Valley FUDS is the only facility that is being addressed under the requirements of the National Contingency Plan¹² in the two ZIP Codes. The greater density of facilities in 20016 ZIP Code may contribute more to ambient environmental pollutant concentrations and population exposures. Estimating the specifics of increases of localized environmental pollution in a specific ZIP Code area is not possible from these data.

Air – Criteria Pollutants and Air Toxics

There are six criteria pollutants (carbon monoxide, lead, nitrogen dioxide, ozone, particulate matter [PM] and sulfur dioxide), which are considered harmful to public health and the environment. Criteria air

¹² National Oil and Hazardous Substances Pollution Contingency Plan Overview, Available: <http://www.epa.gov/osweroe1/content/lawsregs/ncpover.htm>

pollutants are monitored at a regional level; therefore, ambient data specific to the 20016 and 20015 ZIP Codes is not available. However, air quality in the Washington, D.C. area has improved over the past 10 years. In the Washington, D.C. area, ozone is the only criteria air pollutant found above national standards. Ozone is a respiratory system irritant, which causes symptoms including coughing, shortness of breath and pain on deep inhalation.¹³ Elevated levels of ozone in 20016 and 20015 could potentially increase area residents' susceptibility to infection, worsen reactions to allergens and other pollutants, and exacerbate asthma symptoms.

Air toxics – of which there are 187 – are pollutants known or suspected to cause serious environmental and health effects including cancer, and neurological, reproductive, developmental, respiratory and other health effects (United States Environmental Protection Agency 2013a). Exposures and risks from air toxics in the study areas are higher than the US average and slightly lower than the DC average but typical of US urban areas.

Water Quality

In both the 20016 and 20015 ZIP Codes, drinking water is sourced from the Potomac River. It is treated by the Washington Aqueduct in compliance with all EPA drinking water standards and distributed by regional utility company, DC Water. Levels of perchlorate and arsenic in drinking water are below existing state¹⁴ (perchlorate) and national (arsenic) standards.

What types of environmental exposures should be considered to understand risks within the FUDS?

We constructed a site conceptual framework to understand possible risks from site-related contamination using EPA risk assessment guidance and approaches. Once completed, we examined similarities and differences between our site conceptual framework and previous work conducted by USACE. Generally, we found that our site conceptual models were in good agreement, though we identified some key differences that we felt would better guide risk estimations. Among these were two concerns: 1) the selection of types of persons who may come into contact with site contamination (receptors), and 2) identification of the means by which people come into contact with chemicals (exposure pathways). In addition to the receptors proposed by USACE (child and adult residents and construction workers), we felt that landscape workers should be independently considered, as their activities and time in contact with the site are likely different from all other receptors. For the resident receptors, USACE evaluated exposure pathways for incidental soil ingestion, dermal contact while gardening, and ingestion of homegrown vegetables. The JHSPH model also considered particulate inhalation for resident receptors.

Considering new site-specific data, how does our estimate of site risk change?

Using new surface water data provided to us by a USACE contractor, we estimated the contaminant-associated risks incurred by children and adults who use site surface water recreationally. Most surface water on the site is very shallow and unsuitable for recreational use, so risk estimates developed under this scenario will likely overestimate true risks. Assuming recreational surface water users are exposed to surface water contaminants through accidental ingestion of water while swimming and dermal contact with water, we calculated cancer risk and non-cancer hazard estimates. Using a worst case (high exposure) scenario, we found that the rate of expected cancers would be less than 1 case per million people exposed over a lifetime for adults and children. Based on these modeled hazards, we would not expect to see any additional non-cancer health effects associated with exposure to contaminants in surface water.

¹³ Kelly and Fussell 2011. Air pollution and airway disease. *Clinical & Experimental Allergy* 41(8):1059-1071.

¹⁴ California has a perchlorate standard of 6 ppb; Massachusetts has a perchlorate standard of 2 ppb.

Were USACE approaches to understand groundwater contamination and related public risk appropriate?

We reviewed 2005 and 2009 planning and quality assessment documents produced by USACE contractors to assess the adequacy of the water sampling plan approach with regard to public health risk. Since groundwater is not a drinking water source in the study areas, contact with groundwater is expected to be limited. Therefore, we would not anticipate residual groundwater contamination to pose meaningful public health risks. Groundwater quality, however, can serve as a useful measure of site remediation activities. We found that the types of data collected and the general approaches developed for the water study were adequate to address the stated objectives. On the other hand, the methods for analyzing and integrating the data could have been presented more clearly in the planning documents reviewed. The greatest gaps identified in the review were the lack of information on biogeochemical processes that can govern how contaminants move within hydrogeologic systems, and inadequate detail on the potential for contaminated groundwater to seep onto surfaces.

Conclusions and Recommendations

The purpose of this assessment was to examine available data on both site-related and ambient pollution to evaluate the potential for environmental exposures in the 20016 and 20015 ZIP Codes. Understanding these exposures allows us to draw inferences about their influence on risks.

We were able to draw from a number of data sources to examine differences in factors that influence environmental exposures for residents, students, and workers in the 20016 and 20015 ZIP Codes. The data available indicate similar risks and hazards across the study areas; in fact, both areas had lower cancer risks from air toxics exposure than the greater Washington, D.C. population.

Existing data for some environmental media (like air and drinking water) did not support comparisons of hazard and risk between ZIP Codes. These data, however, can facilitate an exploration of the influence of those media on the collective exposure of residents in both ZIP Codes. Of the data that are available, it is clear that air quality in the region is comparable to other major metropolitan areas around the US. One criteria pollutant (ozone) was out of compliance for the most recent year data were available; ozone exposures have been linked to respiratory outcomes like asthma exacerbation, which tend to occur frequently in urban areas.

Data limitations also precluded comparisons across ZIP Code for drinking water quality, as the entire Washington DC metropolitan area is served by the USACE Washington Aqueduct. Despite these limitations, all water quality measures indicated that pollutant concentrations were below federal standards, suggesting that current pollutant exposure through drinking water is of little or no concern.

In addition to examination of non-site related pollution, we also considered the influence of site contamination on environmental exposures in the 20016 ZIP Code. In this assessment, we compared site conceptual models to examine how the pathway/receptor combinations that we felt were important to quantify matched with those used by the USACE in previous assessments. The emphasis of this analysis was to extend the 2007 Scoping Study with data from the water monitoring study. We modeled scenarios that were highly conservative, using assumptions regarding residential surface water recreational use that were highly unrealistic and likely to dramatically overestimate use. Under these artificial circumstances, we found that chemical exposures incurred would still be within acceptable limits for cancer risks and non-cancer hazards.

The review of USACE plans for the water study indicated that the general approach was sound. Some concerns were identified (how well locations were determined; the methods and approach to integrate and interpret data to address stated objectives; potential for biogeochemical processes to influence contaminant fate and transport; and potential for contaminated groundwater to seep onto surfaces). As with many of the Spring Valley FUDS activities, the water study is ongoing and presents something of a ‘moving target’. It can be challenging to get a full understanding of water study activities at any given time. USACE and contractors present data and analyses as they become available but the final results and implications are unknown at present. The recommendations below may be helpful as water study documents are prepared and data analyses are conducted.

To remedy concerns with the water study, it would be useful to:

- Provide justification of the site-driven well location strategy;
- Assess of the role of biogeochemical processes on contaminant fate and transport; and
- Characterize the potential for groundwater seepage onto surfaces, and to sample soil if seepage is possible or likely.

Overall Study Summary

This 2013 Follow-up on Spring Valley Health Study examined population health and potential exposures to site-related contaminants, as well as ambient environmental conditions. Residents can be assured that community health is very good and most environmental indicators are in compliance with established standards or are similar to conditions in other urban areas. In light of the significant limitations of lack of exposure data, disease latency and time elapsed since the WWI-era activities and the findings of continued good health of the study area communities, no further epidemiological investigations are recommended. However, regular cancer, community health and environment updates are recommended as is continued communication and outreach regarding remediation activities.