US Army Corps of Engineers
Baltimore District

fact sheet

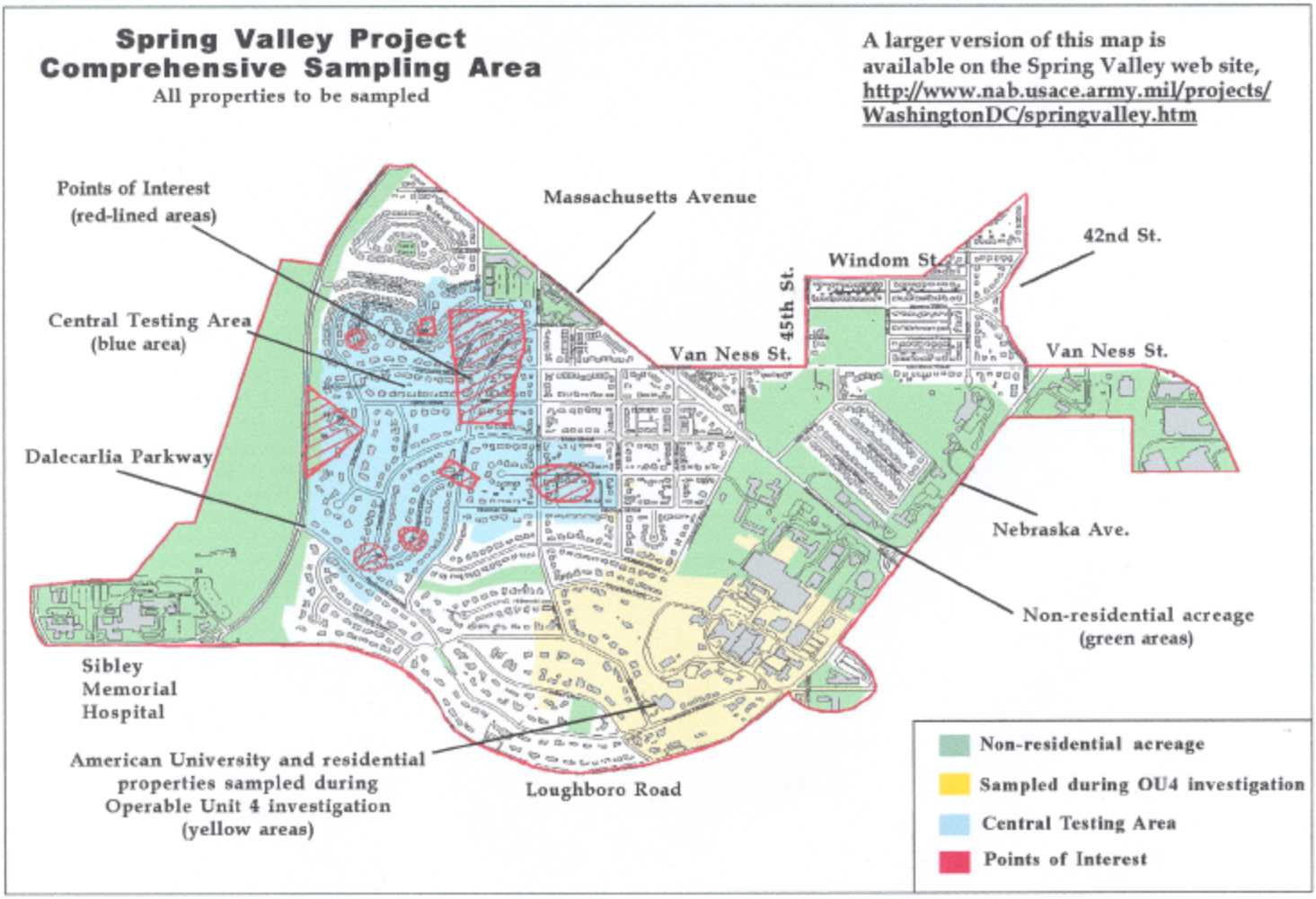
Spring Valley October 2001

Arsenic Sampling and the Removal Decision Process

This fact sheet provides an overview of the process the U.S. Army Corps of Engineers is following to locate possible arsenic contamination and to determine what follow-up actions are necessary as a result of past activities at the American University Experiment Station (AUES).

In this process, the Corps will evaluate soil arsenic concentrations on properties within the Spring Valley formerly used defense site, (FUDS), by comparing sampling results to the predetermined background arsenic concentration for Spring Valley, which is discussed below. For specific properties where arsenic concentrations exceed background, additional sampling and a risk assessment will be conducted to determine whether soil removal is necessary.

Remedial decisions are usually based on risk calculations and the identification of unsafe levels of exposure, the basis for cleanup criteria that has been developed by the U.S. Environmental Protection Agency, (EPA, Region III). Also, hot-spot removal can be conducted at a site to address localized areas of soil that clearly exceed normal background concentrations, even if the calculated risks are deemed acceptable. Both issues have been discussed previously with individual property owners, Restoration Advisory Board (RAB) members and in the larger community meetings.



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Brief descriptions of these approaches and criteria are included in this fact sheet. All values listed are in milligrams of arsenic per kilogram of soil (mg/kg), which is commonly referred to as parts per million (ppm).

Sampling overview

Surface sampling **—** The Corps is conducting the current investigation for possible arsenic contamination in Spring Valley soils in two phases.

In the first phase, or the soil screening phase, each property receives composite surface soil sampling, which is a screening approach used to determine the need for more extensive sampling. The exact type of composite sampling for a given property depends on whether it is located inside or outside the Central Testing Area, or CTA, the portion of Spring Valley where AUES testing activities were most likely to have occurred (see map).

Within the CTA, properties are subdivided into four quadrants. Six surface soil samples are collected from random locations within each quadrant, although the Corps considers property owner requests in selecting sample locations. These grab samples (also called sub-samples) are then combined to make one sample per quadrant. Thus, each property within the CTA has four composite samples.

Outside the CTA, properties are subdivided into two half-lots. In this case, eight surface soil samples are collected within each half-lot and combined to make one sample. Thus, each property outside of the CTA has two composite samples.

All surface samples are taken from the 0"- 6" depth in accordance with accepted practice in EPA Region III. This depth range represents the most significant pathway for a resident's potential contact with contaminated soil.

If the soil screening phase results reveal an arsenic concentration greater than 12.6 ppm, then the second phase of sampling is implemented at that property.

In the second phase, known as follow-on grid sampling, the entire property is divided into a series of 20-foot by 20-foot grids, with one discrete sample being collected from each grid for individual analysis. Again, these samples are usually taken from the 0"- 6" depth range, but actual depth may be adjusted on the results of the soil boring described below.

Grid sampling results provide the information necessary to adequately assess potential health risks associated with the arsenic levels found at a site.

Soil borings **—** While exposure to arsenic in surface soil is the exposure pathway of greatest concern, soil borings are also being collected to assess concentrations in the subsurface. Within the CTA, each property will receive a soil boring. Outside the CTA, approximately 15 percent of the residential properties will receive soil-boring analysis. Samples are collected from each foot of soil within the boring and analyzed.

Given that arsenic in the subsurface poses much less of a risk to a person, concentrations in the subsurface will be assessed differently from surface sampling results.

In an effort to clearly convey the overall process and the pertinent information for the exposure pathway of greatest concern (surface soil), the subsurface evaluation will not be discussed further within this specific fact sheet.

Decision process

Assessment of risk**—** The grid sampling results for a property will be used in a risk assessment to examine the health risks from exposure to arsenic at the property.

The risk assessment evaluates the statistical distribution of arsenic concentrations on the property to determine whether there is an increased risk of adverse health effects (cancer and non-cancer) as a result of this arsenic distribution. The results of the risk assessment are used in determining whether or not remediation is necessary.

Cleanup**—** Remediation for arsenic typically entails excavation of the contaminated soil, although other forms of remediation, including no action, will be evaluated for effectiveness and feasibility using the nine criteria in the National Contingency Plan.

Any remedial action implemented based on the risk assessment would aim to remove enough arsenic contamination so that the mean (e.g., average) concentration of arsenic remaining in the soil would be statistically indistinguishable from the mean background concentration of arsenic. In other words, where an unacceptable increased cancer risk (defined below) exists prior to remediation, the goal of the remediation would be to reduce the cancer risk to what it would have been without any influence from AUES activities.

After the selected response action, confirmatory samples are collected to ensure the response action has accomplished its goal.

It is important to remember the

actions described above only proceed with the permission of the property owner. In the absence of such permission, the Corps will not proceed with any action.

Observed background range: 3 - 18 ppm

The background concentration range of arsenic is the arsenic concentration "expected" to be present in the Spring Valley vicinity assuming AUES activities had not occurred.

This soil concentration range includes arsenic naturally present in soil and rock, as well as arsenic added to the environment from past (e.g., coal burning) and current (e.g., pressure-treated lumber, pesticides) man-made products and activities. The Corps, EPA and D.C. Health agreed upon this range, which was determined by collecting 42 samples at locations outside of the Spring Valley project boundary. EPA collected the samples in February 1994 and August 1999.

This range is in general agreement with information from the *Toxicological Profile for Arsenic* produced by the Agency for Toxic Substances and Disease Registry (ATSDR), which states, "The concentration of arsenic in soil varies widely, generally ranging from 1 to 40 ppm with an average level of 5 ppm." The average soil arsenic concentration for Spring Valley calculated from the background range is 5.9 ppm.

Threshold for grid sampling: 12.6 ppm

An arsenic concentration of 12.6 ppm represents the 95th percentile of the background distribution, meaning that 95 percent of the background samples collected contained 12.6 ppm of arsenic or less.

In accordance with standard practices, the 95th percentile was selected as the threshold for the composite sampling results, above which follow-on grid sampling (phase II) would be conducted.

Selecting the 95th percentile instead of the mean background concentration helps avoid unnecessary phase II sampling at properties where the overall arsenic concentrations are what one would expect for the Washington, D.C. area. In other words, this value helps the Corps screen out arsenic that is most likely attributable to natural and non-military sources.

Also in accordance with standard practices, the Corps will ***not*** use the high-end of the background range (18 ppm) as the trigger for phase II sampling. This protects the community against any possible uncertainty associated with whether 18 ppm is truly reflective of background in Spring Valley.

EPA's emergency response guidance: 43 ppm

The emergency response guideline of 43 ppm was calculated by EPA Region III and corresponds to the excess lifetime cancer risk of 1 in 10,000 or 1 x 10^{-4}.

This value was calculated using various residential exposure assumptions and is the guiding value in determining when remediation is necessary for arsenic in soil.

To better understand the significance of this guidance value, one must be aware of how and why risk is calculated.

The Defense Environmental Restoration Program is guided by the principle of protecting human health and the environment. In accordance with EPA regulations, the risk to human health is managed in terms of excess cancer risk.

Excess cancer risk from exposure to a contaminant is the additional risk, above one's background cancer risk, of developing cancer as a result of the specific exposure in question. Through the calculation of risk, the EPA decides whether a specific exposure poses an *acceptable* or *unacceptable* risk.

Excess risk is expressed in terms such as one in one million (one additional case of cancer per 1,000,000 people). This can also be expressed as 0.000001 (1 divided by 1,000,000) or 1 x 10^{-6}. Any excess cancer risk that is less than 1 in 1,000,000 is not considered to be important and, thus, is considered an *acceptable* risk.

As the calculated cancer risk from a specific exposure *increases*, the reported exposed population size associated with one additional cancer case *decreases*—such as one excess cancer case in 100,000 people (1 x 10^{-5}), one excess cancer case in 10,000 people (1 x 10^{-4}), etc. Risks greater than 1 in 1,000,000 (1 x 10^{-6}) but less than 1 in 10,000 (1 x 10^{-4}) are within the EPA's target risk range. Risks within this target range may or may not be addressed with a remedial action.

If the additional lifetime cancer risk is greater than 1 in 10,000 people or 1 x 10^{-4}, it is generally considered *unacceptable*. Thus, calculated risks greater than 1 in 10,000 generally warrant a remedial action.

The EPA Region III value of 43 ppm reflects the 1 in 10,000 additional lifetime cancer risk for residential exposure to arsenic. To ensure community safety, the EPA makes several conservative, residential exposure assumptions in calculating this value. Based

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on these conservative calculations, EPA Region III typically requires some form of intervention or remediation for arsenic soil concentrations above 43 ppm due to *unacceptable risks* to the resident. In cases where site specific exposure information is available, the EPA may alter such guidance values.

Hot-Spot removal

Even if the overall health risk at a property is considered *acceptable*, isolated "hot spots" of elevated (above background) arsenic levels may exist at a property.

As an extra safety measure, the Corps is considering the remediation of hot spots identified by grid sample results. Before any such hot spot removals can be conducted, an appropriate threshold concentration for a background-based removal must be selected, and the property owner must provide permission to conduct such a removal.

The Corps, EPA and D.C. Health, also referred to as the Spring Valley partnership, are currently evaluating the hot-spot removal issue, as well as other risk considerations, in light of forthcoming results from arsenic speciation and bioavailability studies. Such information will allow the partnership to better assess risks to an individual exposed to arsenic bound to soil.

The Corps is actively discussing removal issues with community members via the Spring Valley RAB. (The RAB meets on the second Tuesday of each month and is open to the public.)

Permission from a property owner to conduct any removal will be pursued on a property-by-property basis once a determination is made that remediation is needed.

Summary

The conservative nature of the area-wide arsenic sampling plan will probably identify several properties for phase II grid sampling that ultimately will be found ***not*** to pose an unacceptable health risk, commonly referred to as a false-positive in the assessment process.

The Corps has made an effort to design this sampling plan to minimize such false positives, which can inconvenience property owners through unnecessary follow-on sampling. Nonetheless, it is better to conduct a few unneeded follow-on samplings rather than run a higher risk of missing a property that should be cleaned up.

Results to date indicate the effectiveness of the Corps approach. In general, there has been good correlation between the composite and grid sampling results.

Properties identified for follow-on grid sampling based on the initial composite sampling results subsequently revealed elevated arsenic concentrations.

Conversely, the Corps conducted grid sampling on one property even though it had normal composite sampling results. This was done due to the property's proximity to other "contaminated" areas.

In agreement with the initial composite results in this case, the grid sampling results did not reveal any hot spots.