



The Background on Background: Naturally Occurring Metals at Travis AFB

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This fact sheet is one of a series prepared for RAB members about the Travis Air Force Base (AFB) Installation Restoration Program (IRP).

AN INTRODUCTION TO BACKGROUND

In a restoration program such as the IRP, one of the questions investigators must answer is if the analytical results of their investigation represent contamination. Industrial and waste disposal activities can cause a variety of contaminants to be released to the environment. Some of these compounds do not occur in nature but are only produced by human activities. These compounds are generally *organic compounds*, such as solvents (also called volatile organic compounds or *VOCs*), fuel-related compounds, and dioxins. For such compounds, the answer is usually pretty easy: a positive analytical result (a "hit") generally indicates contamination.

But industrial activities can also cause the release of metals to the environment. Metals are *inorganic* constituents that occur naturally in soil and groundwater and will, therefore, be detected in any soil or groundwater sample analyzed for metals. So, do those results indicate contamination? Before that question can be answered, the concentrations of metals that occur naturally in soil and groundwater must be determined. The same is true for radionuclides. The naturally occurring concentrations are called *background*. Only concentrations of metals or radionuclides that are inconsistent with background, using the procedures described below, are considered contamination.

The concentrations of metals in soil and groundwater can vary considerably from one geographic area to another. This is because the geologic history of the areas may differ, and so

the amounts of various metals in the soils may differ. For example, the Coast Ranges of California are known to have high concentrations of chromium, mercury, arsenic, selenium, and antimony, among others. During the 1800s, chromium, mercury, and selenium were mined from the Coast Ranges not far from Travis AFB. The soils at Travis AFB consist mostly of sediments that eroded from the Coast Ranges over the last several million years. It is likely, therefore, that the soils at Travis AFB also naturally contain higher concentrations of chromium, arsenic, mercury, and selenium than would other locations in the Central Valley that were not formed from Coast Range sediments.

The significance of determining whether a concentration of a particular metal exceeds background is that a concentration consistent with background is not considered contamination and does not need to be remediated. Concentrations greater than background that pose a health or environmental risk may require remediation.

HOW BACKGROUND CONCENTRATIONS ARE DETERMINED

In the summer of 1994, Travis AFB investigators collected samples from locations that were considered free of contamination. These samples, therefore, represent background concentrations of metals in the vicinity of Travis AFB. Samples of surface soil, subsurface soil, sediment, surface water, and groundwater were collected and analyzed for metals. These data are called the *background reference data set*.

RI SAMPLE RESULTS: DO THEY REPRESENT CONTAMINATION?

During an RI, samples are collected from areas where contamination is suspected. Armed with the background reference data set, investigators can determine if concentrations of metals from samples in the Operable Units (OUs) represent contamination or not.

To do this, they use a technique called the *preponderance of evidence*. First, the results of all the samples in the OU are plotted on a graph in order of increasing concentration and compared to a plot of the background results (see below). This technique allows investigators to quickly determine which samples may contain contamination. Results that greatly exceed background reference data concentrations may indicate contamination.

If one or more samples contain data that may exceed the reference data concentrations, investigators next ask a series of questions:

- Could activities at Travis AFB have caused this contamination? If activities at Travis AFB did not make use of that metal, then it probably represents natural variation in background concentrations.
- Are organic contaminants (such as solvents) present at the sample location? If so, this

would tend to indicate contaminants were released to the environment and the metal could be contamination.

- Does the metal pose an unacceptable risk? If so, and no other organic compounds contribute to the risk, additional evaluation may be warranted.
- Does only one sample exceed background concentrations, or does a cluster of results exceed background? A cluster would be more indicative of contamination.
- Was the sample collected at or near a source of contamination? If not, the results may represent background.
- Can geologic conditions explain a relatively high concentration of a metal?

If the answers to these questions, taken together, indicate that the concentration of the metal is consistent with background, then the sample location will not be considered further. If the individual sample represents a sporadic hit of metal with minor contamination, the location will not be considered in the FS. If the preponderance of evidence indicates that the metal is a contaminant, and that the metal potentially poses a threat to human health and the environment, the location will be included in the Feasibility Study (FS).

A plot of NOU data and background data. The curves are in close agreement, indicating that, overall, concentrations in the NOU are not higher than the background data, and therefore do not represent contamination. The one "outlier" in the NOU data requires further evaluation to determine if it represents contamination or not.

