POLLUTION-PATHWAY-PEOPLE

OVERVIEW

Central to Pure Earth's approach is the model of Pollution-Pathway-People as the basis for understanding and assessing risks at a particular site. This model is consistent with risk assessment approaches used internationally (by USEPA, WHO and so on) but is very much simplified for use at our practical level.

Pure Earth is focused on population health. However, many pollution-related health impacts are chronic and are difficult to attribute directly to one source. In the context of a site screening it is unusual to be able to demonstrate clearly the health consequences of a particular site. What can be done is to show that there is a credible risk attached to the site and that this risk deserves further investigation and possibly intervention and/or remediation.

The existence of the risk depends on all three components: there must be a source of pollution (at a high enough level to be hazardous); there must be a population in a nearby area who are potentially exposed to the pollution; and there must be a pathway for the pollution to impact the people.

Preparation of the Initial Site Screening is the process by which these components are identified and assessed at any site.

POLLUTION

There are many substances which are hazardous to peoples' health. In Pure Earth's work on legacy industrial and mining sites, there are a relatively small number of key pollutants which occur repeatedly. These include heavy metals and some organic chemicals.

The form and characteristics of the pollutant are important (mercury, for example, is relatively harmless as a metal but toxic as a vapor and bio-accumulates in methyl compounds) in addition to the amount of pollutant. Investigators try to estimate the total volume of the hazardous material and the level of contamination. A key factor here is the concentration, which is measured on site using an XRF if possible, or determined through sampling and subsequent lab testing. The critical parameter is the "over-standard" – the factor by which the concentrations of the pollutant exceed relevant national or international standards. This is the quantitative indicator of the hazard posed by the site.

POPULATION

A challenge for the investigator is to identify the relevant population, as the levels of contamination, substance toxicity, migration routes and pathways that exist will determine the exposure. The first step is to identify all population groups within the probable area of influence of the polluted site, starting with

populations immediately adjacent to the site, as well as those downstream and downwind from the site. This is best done using a local map and local information to identify nearby villages and urban areas (with estimated populations). Not all of these people will be at risk: that depends on the pollutant, migration route and pathways.

PATHWAY

A pathway is a physical mechanism by which the pollution can enter the body. Examples include through ingestion (swallowing, often in food or water), through inhalation (as dust or vapor), or by direct contact (typically on the skin). Note that most dust, unless of a very small size (less than 2.5 microns), actually enters the body through ingestion. Dust that is breathed in is often caught on nose, throat and lung tissue and then coughed up and swallowed.

In practical terms, people can be directly exposed to toxic chemicals from a waste site if they inhale or ingest dust or vapor from the site, get dust or vapor from the site on their skin, or drink groundwater or surface water flowing under or through the site. People can be indirectly exposed if they eat food (plants or animals) grown on land contaminated by dust or vapor from the site or irrigated with water contaminated with toxic chemicals from the site.

EXPOSURE

The overall result of going through this logic is to be able to identify the populations that are potentially affected though the Pollution-Migration-Pathway-People connection. These people are the population at risk.

Public health risk is easier to demonstrate when the migration routes are direct, the pathways are clear, and the data on contamination is good. However, the objective of the ISS is not to conclusively prove or quantify a specific health impact. It is to identify a credible and significant risk to a population. Further studies are generally necessary to evaluate and quantify the risks and health impacts, with an ultimate goal of developing and executing intervention plans to reduce the risks and impacts. Note that interventions can be focused on any or all of the components creating a toxic contamination problem. These could include: elimination of the source (such as waste removal or elimination of use of a toxic substance in a process); control of migration routes (such as installation of pollution control equipment or covering waste piles); elimination of pathways (such as covering or paving contaminated areas or providing clean drinking water sources); or reducing the people in contaminated areas (such as by fencing off disposal sites).