

Robert Dodge MD – SSFL Work Group – June 18, 2014

At the last meeting of the SSFL Work Group, on February 5, we had a presentation by USEPA on the results of its radiation survey of the site, in which EPA found several hundred locations contaminated with radionuclides above background. At that meeting I presented some basic information about the medical effects of ionizing radiation.

Tonight you have just heard a presentation on the various ways that people could potentially be exposed to contamination from the Santa Susana Field Laboratory, with a focus on chemically toxic pollutants. These include volatile organic compounds like trichloroethylene (TCE), semi-volatile organic compounds, dioxins, heavy metals, polychlorinated biphenyls (PCBs), perchlorate, and other hazardous materials. As you have heard, these toxic substances have contaminated soil, groundwater, surface water, and been released into the air at the site and some have migrated off the site to neighboring areas.

The presentations that follow will focus on recent data about migration of several of these contaminants with a special focus on three of them: perchlorate, dioxins, and lead. I will provide a brief primer on health effects from each of them.

Perchlorate

Perchlorate is a toxic ingredient in solid fuel for rockets and missiles, used primarily as an oxidizer in solid propellants. Although there are other uses of perchlorate, including in nuclear research, most perchlorate contamination in the U.S. is associated with rocket fuels.

Perchlorate disrupts normal functioning of the thyroid gland, which regulates metabolism in adults and is essential in helping children with normal growth and development. In expectant mothers, impairment of thyroid function can impact the fetus and newborn, resulting in delayed development and decreased learning capacity.

As the California Office of Environmental Health Hazard Assessment has recently written in recommending tightening public health goals for perchlorate in drinking water: Proper functioning of the thyroid, which perchlorate can disrupt, “is necessary for a variety of basic human physiologic functions, including controlling basal metabolic rates; protein, carbohydrate, and fat metabolism; protein synthesis; proper differentiation and development of cells, including neuronal cells; and the cognitive and physical development of the fetus, infant, and child. Decreases in thyroid hormone have been associated with impaired neurodevelopment in children, increases in cardiovascular disease risk factors, and other adverse effects. Importantly, recent research suggests that even small decreases in this hormone during neurodevelopment are associated with significant decreases in IQ and other adverse neurologic effects in the child.”

Perchlorate is a salt and thus dissolves readily in water and migrates very quickly. It generally migrates faster than most other contaminants and thus is often the leading edge of contaminant migration. In other words, perchlorate may arrive at offsite locations faster than many other pollutants, with the slower-migrating contaminants following. It can persist for long periods of time in groundwater and surface water.

Perchlorate is increasingly found as a contaminant in groundwater, surface water, and soil. In the last decade, based on health studies, OEHHA recommended a public health goal of 6 parts per billion in drinking water, and, based on that recommendation, California set the maximum contaminant limit at 6 parts per billion. Massachusetts, by contrast, set its maximum contaminant limit at 2 ppb.

In December 2012, Cal/EPA's Office of Environmental Health Hazard Assessment released a revised draft technical document supporting a revised public health goal for perchlorate of 1 part per billion. This goal was based upon findings that prior research had not properly taken into account the consumption rate per body weight of infants, who are extremely vulnerable to negative health impacts from perchlorate. To date, neither the official public health goal nor the maximum contaminant level have been revised downward to reflect the new science.

These numbers will be important in the presentations of the speakers that follow. So let me reiterate: California currently regulates perchlorate at 6 ppb, based on a public health goal that state scientists have recently recommended be reduced to 1 ppb, and Massachusetts forbids more than 2 ppb in its drinking water.

Dioxins

According to the World Health Organization, “dioxins have the dubious distinction of belonging to what the World Health Organization has the ‘dirty dozen’ - a group of dangerous chemicals known as persistent organic pollutants. Dioxins are of concern because of their highly toxic potential.”

They persist in the environment and concentrate in the food chain. Once in the human body, dioxins tend to stay inside you for long periods of time because they are very stable compounds and are stored in fatty tissue.

The World Health Organization and the U.S. Department of Health and Human Services' National Toxicology Program classify dioxin as a carcinogen. Dioxin can also cause reproductive, developmental, immunological, and endocrine effects in both animals and humans. Long-term exposure is linked to impairment of the immune system, the developing nervous system, the endocrine system and reproductive functions.

Lead

Lead is a naturally occurring element, a heavy metal that is used in many industrial processes and which can cause contamination of air, groundwater, and soil.

Lead exposure has been linked with learning disabilities, infertility, cancer, and increased risk of heart attacks. It can cause serious damage to children's intellectual and behavioral development, and can cause blood and brain disorders. Lead interferes with a variety of body processes and is toxic to many organs and tissues including the heart, bones, intestines, kidneys, and reproductive and nervous systems.

Lead poisoning typically results from ingestion of food or water contaminated with lead, but may also occur after accidental ingestion of contaminated soil or dust.

There is no safe threshold for lead exposure, meaning there is no known sufficiently small amount of lead that will not cause harm to the body.

Our next speakers will discuss migration of these contaminants from the Santa Susana Field Laboratory.