Health Consultation

KERR-MCGEE WEST CHICAGO WASTEWATER
TREATMENT PLANT

WEST BRANCH OF THE DUPAGE RIVER

WEST CHICAGO, DUPAGE COUNTY, ILLINOIS

EPA FACILITY ID: ILD980824031

MARCH 10, 2006

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

You May Contact ATSDR TOLL FREE at
1-888-42ATSDR
or
Visit our Home Page at: http://www.atsdr.cdc.gov

HEALTH CONSULTATION

KERR-MCGEE WEST CHICAGO WASTEWATER TREATMENT PLANT
WEST BRANCH OF THE DUPAGE RIVER

WEST CHICAGO, DUPAGE COUNTY, ILLINOIS

EPA FACILITY ID: ILD980824031

Prepared by:

Illinois Department of Public Health
Under Cooperative Agreement with the
U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

Purpose

The Agency for Toxic Substances and Disease Registry (ATSDR) requested a follow-up health consultation of the Kerr-McGee West Chicago Wastewater Treatment Plant - West Branch of the DuPage River site because it had been more than ten years since a public health assessment (PHA) was written for this site (IDPH 1994). This document discusses and assesses the changes that have occurred since the PHA to determine if exposure to radioactive contamination currently poses a health hazard.

Background and Statement of Issues

The Kerr-McGee Radiation Areas

The Kerr-McGee Radiation Areas are sites where environmental media were contaminated by radioactive thorium waste material generated by a processing facility that operated from 1932 to 1973 in West Chicago. Mill tailings, a sand-like waste, were available as free fill material from the 1930s to the 1950s and were used throughout the area (IDPH 1994).

In November 1994, ATSDR released a public health assessment (PHA) for the Kerr-McGee Radiation Areas, which included the West Chicago Wastewater Treatment Plant (WTP) and the West Branch of the DuPage River (IDPH 1994). The Illinois Department of Public Health (IDPH) wrote the PHA, which was released by ATSDR under a cooperative agreement.

The West Chicago WTP and the West Branch of the DuPage River

The West Chicago WTP and the contaminated portion of the West Branch of the DuPage River are in and near the city of West Chicago, DuPage County, Illinois (Figure 1-1). As discussed in the PHA (IDPH 1994), the WTP became contaminated when radioactive thorium material from the Kerr-McGee processing facility were used as fill at the WTP and along an adjacent 320 feet of riverbank of the West Branch of the DuPage River. Some of this contamination entered the West Branch of the DuPage River near the WTP. USEPA defines the site as consisting of the West Chicago WTP and an approximately 1-mile portion of the West Branch of the DuPage River from the WTP to the confluence with Kress Creek (USEPA 2004).

In the 1994 PHA, IDPH concluded that the WTP and the West Branch of the DuPage River were a Public Health Hazard and made the following key recommendations:

- Action should be taken to reduce public exposure in residential areas that still have tailings, including properties along the West Branch of the DuPage River. Highest priority should be given to homes with tailings adjacent to their foundations or under them (e.g., in crawlspaces). If no permanent solution is available, interim measures should be taken.

- The water quality of the West Branch of the DuPage River should be assessed. Additional sampling of the West Branch of the DuPage River should be undertaken to define the extent and nature of radioactive and nonradioactive contamination of sediments and soils in and along the river.

- The concentrations of chemicals in filets of fish from the West Branch of the DuPage River should be determined.

- The possibility that radioactive and nonradioactive contaminants have affected downstream properties in Warrenville and Naperville should be investigated.

Since the release of the 1994 PHA, further sediment and soil samples were collected from the WTP and the West Branch of the DuPage River site. These were analyzed for metals, volatile organic chemicals, semi-volatile organic chemicals, pesticides, polychlorinated biphenyls, and radionuclides (USEPA 2004). Surface water and fish tissue samples also were collected and analyzed for metals and radionuclides. USEPA also collected groundwater samples from the WTP area.

Originally, the U.S. Environmental Protection Agency (USEPA) planned to do a Remedial Investigation (RI) and Feasibility Study (FS) of the WTP and the West Branch of the DuPage River (USEPA 2002). However, USEPA postponed those plans to give the affected communities time to try to reach a cleanup agreement with Kerr-McGee. On June 3, 2002, the DuPage County Board (2002) announced that they, the Forest Preserve District of DuPage County, the City of West Chicago, the City of Warrenville, and the City of West Chicago Park District had reached a conceptual agreement with Kerr-McGee for the cleanup of Kress Creek, the West Branch of the DuPage River, and the West Chicago WTP. U.S. Speaker of the House J. Dennis Hastert, USEPA, the Illinois Environmental Protection Agency (Illinois EPA), the Illinois Department of Nuclear Safety, and the DuPage County State's Attorney also were involved in the agreement.

Under the conceptual agreement, the cleanups of these sites by Kerr-McGee will use the same cleanup criterion used for the Residential Areas and Reed-Keppler Park (DuPage County Board 2002), which was 7.2 picoCuries per gram (pCi/g), and is based on federal and state standards of 5 pCi/g greater than background levels (USEPA 2005).

USEPA selected the final cleanup plan for the site in a record of decision (ROD) signed in September 2004 (USEPA 2005). About 4,000 cubic yards of contaminated soil were removed from the WTP in 2003 and 2004. No further soil removal is deemed necessary at the WTP, and the WTP will no longer be a source of radiological contamination for the river (USEPA 2005). The plan approved by USEPA calls for contaminated riverbank soil and river sediment to be removed and disposed of in an approved facility not on the site.

USEPA issued a Human Health Risk Assessment for this area in May 2004. In August 2005, Kerr-McGee, with the oversight of USEPA, released a proposed cleanup schedule for radioactive contamination in and around the West Branch of the DuPage River. Cleanup of one section began in the summer of 2005 and the proposed schedule calls for the cleanup of the river

upstream of Kress Creek to be completed by late 2006. The plan approved by USEPA calls for contaminated riverbank soil and river sediment to be removed and disposed of in an approved facility not on the site (USEPA 2005). Beginning in upstream areas, contaminated areas will be dewatered and contaminated soil and sediment will be removed. After cleanup, Kerr-McGee will restore and replant the affected areas.

Site Visit

IDPH staff most recently visited the site in August 2005 to confirm the site conditions. About 20,000 people live within a 3-mile radius of the site. A few unincorporated residential properties exist along the 1-mile portion of the West Branch of the DuPage River from the WTP to the confluence with Kress Creek. Most area residents obtain their drinking water from a public supply unaffected by the contamination of soil and sediments in the West Branch of the DuPage River. Those with private wells draw water from an aquifer deeper than that potentially affected by soil and sediment contamination.

Discussion

Chemicals of Interest

IDPH compared the results of each environmental sample with the appropriate comparison values used to select chemicals for further evaluation for carcinogenic and non-carcinogenic health effects. Chemicals found at levels greater than comparison values or those for which no comparison value exists were selected for further evaluation. A brief explanation of each comparison value used is found in Attachment 1.

Comparison values do not represent thresholds of toxicity. Although some chemicals may exist at levels greater than comparison values, adverse health effects require human exposure at sufficient doses. The amount of a chemical, the duration and route of exposure, and the health status of exposed individuals are important factors in determining the potential for adverse health effects.

Radionuclides associated with past activities at the former thorium processing facility are the chemicals of interest. Specifically, radium-226, radium-228, thorium-232, uranium-235, and uranium-238 are the radioisotopes of interest (USEPA 2004). As discussed below, this health consultation focuses on soil and sediment contaminated with these radionuclides.

Air

The PHA (IDPH 1994) discussed the airborne concentrations of radon-220 and radon-222 at the WTP, which were not greater than background levels. Given the concentrations of radionuclides in the tailings that remained until cleanup was completed in 2004, elevated outdoor radionuclide concentrations in air were not expected. As discussed in the PHA (IDPH 1994), elevated airborne radionuclides also are not expected near the West Branch of the DuPage River.

Biota

Contaminants have been detected in fish collected from the West Branch of the DuPage River north of Kress Creek. Table 1 shows the levels detected in fish from this section of the river.

Groundwater

Private wells serve homes along the contaminated parts of the West Branch of the DuPage River. The PHA (IDPH 1994) discussed the past sampling of private wells around the City, which found no radioactive contamination. Because of the small amounts of radioactive materials in the creek and river, groundwater contamination should not occur. Residents with private wells draw water from an aquifer deeper than that potentially affected by soil and sediment contamination.

Sediments

The PHA (IDPH 1994) discussed radioactive contamination in sediments of the West Branch of the DuPage River. Residents and recreational users could come into contact with radionuclides in sediment if not remediated.

Soils

The PHA (IDPH 1994) discussed radioactive contamination in soils along the West Branch of the DuPage River. Residents and recreational users could come into contact with radionuclides in floodplain soil if not remediated.

Exposure Pathways

A hazardous chemical can affect people only if they contact it through an exposure pathway at a sufficient concentration to cause a toxic effect. This requires five components:

- A source of exposure,
- An environmental transport medium,
- A route of exposure, and
- A receptor population
- A point of exposure

A pathway is complete if all of its components are present and exposure of people occurred in the past, is occurring, or will occur in the future. If (1) parts of a pathway are absent, (2) data are insufficient to decide whether it is complete, or (3) exposure may occur at some time (past, present, future), then it is a potential pathway. If a part of a pathway is not present and will never exist, the pathway is incomplete and can be eliminated from further consideration.

Radiation

The emission of alpha, beta, and gamma radiation depends on the radionuclide involved. Some radionuclides emit only one type of radiation, but others emit more than one type. The emissions of some radionuclides have more energy and thus can do more damage to the body than others. Shorter-lasting radionuclides emit more radiation in a given amount of time than longer-lasting radionuclides.

Radiation spreads in all directions from a source. Radiation exposure depends on time (exposure duration), distance from a source, and shielding (attenuation by materials through which it passes). The intensity of radiation decreases with increasing distance from a source. Alpha and beta particles cannot travel far through the air; consequently, exposure to them requires that a radionuclide be ingested, inhaled, or contact the skin (or come near the skin, for beta emitters). Some alpha particles and many beta particles can penetrate the skin, but others cannot. Gamma radiation can travel easily through low-density materials, such as air, and it can pass through the body. However, it can lose much of its energy in thin layers of high-density material (Hobbs and McClellan 1986, Jensen 1992).

Everyone is exposed to background levels of alpha, beta, and gamma radiation from naturally-occurring radionuclides in the environment. People also are exposed to radiation through human-generated sources, mainly medical in nature. People who receive repeated x-rays or radiation therapy are exposed to more radiation than most people. Smokers expose their lungs to radiation levels up to 56 times background because tobacco plants accumulate naturally-occurring polonium-210 from the soil, which is then present in the smoke (BEIR V 1990).

It takes about 14 billion years for half of thorium-232 to decay. Consequently, the tailings from the processing facility will remain radioactive essentially forever.

Soil and Sediment

USEPA considered exposure to gamma radiation to be the primary exposure pathway for the Kerr-McGee Residential Areas. The incidental ingestion of soil and the inhalation of dust from soil contributed negligibly to exposure (USEPA 1997b). The same would be true for exposure to soil and sediment along the West Branch of the DuPage River. Persons contacting and playing in contaminated soils and sediments would have exposure to radionuclides and the radiation they emit.

On-site workers may contact contaminated soil and sediment, particularly if they do excavations. This warrants the use of personal protective equipment by remediation workers.

Fish

Radionuclides may accumulate in aquatic animals, such as fish. IDPH has observed people fishing in the West Branch of the DuPage River. The radionuclides in the tailings tend to

accumulate in bone rather than in meat. The available data (Table 1) are whole fish data, which would have higher radionuclide concentrations than the fish filet portion alone. Consequently, using whole fish data rather than filet data would overestimate health risks.

For exposure calculations, IDPH used estimated consumption rates of an average or 95th percentile recreational angler published by USEPA (1997). The 95th percentile is the amount that only 5% of the population would exceed. A small stream the size of the West Branch of the DuPage River probably could not support a subsistence angler, so IDPH did not consider that scenario.

Radon

Radium in the tailings decays into radon, a gas that may move through soil gas or dissolve and move in groundwater. Elevated outdoor radon levels are unlikely, given the radium concentrations in the wastes. Radon may enter buildings constructed on soil with elevated radium levels. Currently, no buildings exist along Kress Creek or the West Branch of the DuPage River where radon could accumulate; however, given that thorium remains radioactive for billions of years, the possible future construction of buildings along the creek or river cannot be excluded. The removal of the contaminated sediments and soils will remove this potential future pathway.

Public Health Implications

Studies have observed chromosomal aberrations in humans and animals exposed to high doses of radiation. Depending upon the absorbed radiation dose and exposure duration, ionizing radiation can cause cancer. Cancers caused by radiation cannot be distinguished from cancers that occur spontaneously. Also, cancers caused by radiation usually occur 10 or more years after exposure.

Although high doses of radiation can cause mutations and cancer in animals and humans, the effects of low doses are less certain. As for chemical carcinogens, some researchers believe that body repair mechanisms can handle low doses of radiation, and that higher doses are needed to cause cancer. To be protective, USEPA assumes that any increased exposure to radiation increases the cancer risk, and they have classified all radionuclides as known human carcinogens.

Because background radiation results in an increased risk of cancer (about 5 in 10,000 according to USEPA and about 7.3 in 10,000 according to the International Commission on Radiological Protection), there is some debate about what risk above background is acceptable (Charp 1996). In this document, cancer risks from radiation exposure along Kress Creek and the West Branch of the DuPage River are compared to the risk from background radiation exposure.

For a high exposure recreational scenario, IDPH assumed that a person spent 3 hours per day, 3 days per week, for 20 weeks of the year at the most contaminated location along the West Branch of the DuPage River. This most likely would require access by canoe. It also would result in negligible radiation exposure compared to natural background exposure.

For exposure to reach levels that could cause adverse health effects, exposure duration would need to increase considerably. That would require the construction of a home or other building on contaminated soils along the river. Construction of a WTP building on the most contaminated area along the river and occupational exposure for 8 hours per day, 5 days per week, 50 weeks per year, for 30 years would result in an estimated cancer risk of about 30% above background to twice background. Continual lifetime inhabitation of the location with the highest concentrations of soil radionuclides would result in an estimated cancer risk about eight to 12 times background; however, actual residential exposure probably would result in a smaller risk.

Some people may eat fish from the West Branch of the DuPage River. For an average recreational angler or upper 95% percentile recreational angler, the risk from consuming radionuclides in fish from the West Branch of the DuPage River would be negligible.

Gamma Radiation

High dose exposure to gamma rays can cause leukemia and non-Hodgkin's lymphoma, as well as cancers of the brain and central nervous system, bladder, bone, breast, colon, esophagus, kidney, lung, parathyroid, rectum, salivary glands, skin, stomach, and thyroid (BEIR V 1990). Hodgkin's disease has not been associated with radiation exposure (BEIR V 1990). However, the health effects of low levels of radiation, such as occurring in the Kerr-McGee areas, are less certain. Some areas of the world have natural radiation levels about two to six times average background levels. Health studies of people in those areas have not observed increased cancer rates (Ghiassi-nejad et al. 2002, Tao et al. 2000, Cheriyan et al. 1999, Nair et al. 1999, BEIR V 1990). One study of people in those areas found no increase in birth defects in newborns (Jaikrishan et al. 1999).

Child Health Considerations

IDPH recognizes that children are especially sensitive to some contaminants. The radiation levels at the WTP and along the West Branch of the DuPage River were much less than levels associated with birth defects and reproductive effects. One study of people in an area with naturally high background radiation found no increase in birth defects (Jaikrishan et al. 1999). Studies have found that children exposed to x-rays in the uterus were more susceptible to leukemia and neurological cancers later in life (BEIR V 1990). Subsequent studies found lower risks, corresponding to the use of lower doses for medical x-rays. Similarly, studies of children irradiated for ringworm between 1948 and 1960 found increased rates of leukemia and thyroid cancer (Richardson et al. 2001). However, the medically-irradiated people received much higher doses than people in the Kerr-McGee Residential Areas. Health risks from low-dose exposure to radiation are less clear.

Conclusions

Currently, the West Chicago WTP and the West Branch of the DuPage River pose no apparent public health hazard because exposure durations are short, resulting in negligible exposure. For exposure at levels of concern to occur, exposure duration would need to increase considerably. That probably would require the construction of a building on contaminated soils along the river. Considering that the contaminated soils will remain radioactive essentially forever, this possibility cannot be excluded unless the contaminated soils are removed. Therefore, IDPH concurs with the decision to remove contaminated soil from the WTP and the plan to removed contaminated soil and sediments with radiation levels greater than 7.2 picoCuries per gram (pCi/g) from the West Branch of the DuPage River.

Some people may eat fish from the West Branch of the DuPage River. For an average recreational angler or upper 95% percentile recreational angler, the risk from consuming radionuclides in fish from the West Branch of the DuPage River would be negligible.

Recommendations

IDPH recommends that:

- Kerr-McGee remediate the contamination along the West Branch of the DuPage River with USEPA oversight. Cleanup efforts have begun and are scheduled to continue through 2006.

- USEPA will ensure that the final cleanup plan for Kress Creek and the West Branch of the DuPage River will be protective of public health. The established cleanup level of 7.2 pCi/g should be protective of public health.

Preparers of Report

Thomas A. Baughman, Ph.D.
Ken Runkle, MA, LEHP
Environmental Toxicologists
Illinois Department of Public Health

References

BEIR V. 1990. Health Effects of Exposure to Low Levels of Ionizing Radiation. National Research Council.

CH2M Hill. 1996. Data Quality Evaluation Technical Memorandum, NAREL Samples. March.

Charp, P. 1999. Comments on Initial Release of the Public Health Assessment: Argonne National Laboratory, Site A, and Plot M.

Charp, P. 1996. Phone Log Sheet of September 11.

Cheriyan, V. D. et al. 1999. Genetic monitoring of the human population from high-level natural radiation areas of Kerala on the southwest coast of India. II. Incidence of numerical and structural chromosomal aberrations in the lymphocytes of newborns. Radiat. Res. Suppl. 152:54-58.

DuPage County Board. 2002. Agreement Reached to Remove Thorium from Kress Creek and DuPage River. June 3. <http://www.co.dupage.il.us/cbpress/020603.html>

Frey, R. 2003. Email of January 23.

Frey, R. 2002. Email of December 20. USEPA.

Ghiassi-nejad, M. et al. 2002. Very high background radiation areas of Ramsar, Iran: preliminary biological studies. Health Phys. 82:87-93.

Hobbs, C. H. and McClellan, R. O. 1986. Toxic Effects of Radiation and Radioactive Materials. In Casarett and Doull's Toxicology: The Basic Science of Poisons, 3rd ed., Klaassen, C. D. et al., editors. McMillan Publishing Co., New York

IDPH. 1994. Public Health Assessment for Kerr-McGee Radiation Areas, West Chicago, DuPage County, Illinois. November 14.

Jaikrishan, G. et al. 1999. Genetic monitoring of the human population from high-level natural radiation areas of Kerala on the southwest coast of India. I. Prevalence of congenital malformations in newborns.

Jensen, L. 1992. Comments on Draft Kerr-McGee Health Assessment. November 13.

Nair, M. K. et al. 1999. Population study in the high natural background radiation area in Kerala, India. Radiat. Res. Suppl. 152:145-48.

Tao, Z. et al. 2000. Cancer mortality in the high background radiation areas of Yangjiang,

China during the period between 1979 and 1995. J. Radiation Res. Suppl. 41:31-41.

USEPA. 2002. NPL Factsheets for Illinois: Kerr-McGee (Sewage Treatment Plant) EPA ID# ILD980824031. May. <http://www.epa.gov/R5Super/npl/illinois/ILD980824031.htm>

USEPA. 2004. Final Human Health Risk Assessment. Kress Creek/West Bank DuPage River Site and Sewage Treatment Plant Site. May.

USEPA. 2005. Cleanup Schedule Announced for Contaminated River and Creek. Kerr-McGee Kress Creek/West Branch of DuPage River Site. August.

Table 1. Levels of radionuclides in whole fish from the West Branch of the DuPage River near the WTP upstream of Kress Creek (USEPA 2004).

Radionuclide	Concentration Range in pCi/g	Frequency of Detection
Radium-228	0.013 - 0.068	8/8
Thorium-227	0.0027 - 0.010	9/9
Thorium- 228	0.00039 - 0.015	6/6
Thorium-230	0.0017 – 0.014	8/8
Thorium-232	0.00015 - 0.012	8/8
Uranium-234	0.0015 – 0.0070	9/9
Uranium-235	0.0002 – 0.0007	8/8
Uranium-238	0.0007 – 0.0034	9/9

pCi/g = picoCuries per gram

Attachment 1

ATSDR Comparison Values Used in Screening Contaminants for Further Evaluation

Environmental Media Evaluation Guides (EMEGs) are developed for chemicals based on their toxicity, frequency of occurrence at National Priorities List (NPL) sites, and potential for human exposure. They are not action levels but are comparison values. They are developed without consideration for carcinogenic effects, chemical interactions, multiple route exposure, or exposure through other environmental media. They are very conservative concentration values designed to protect sensitive members of the population.

Reference Dose Media Evaluation Guides (RMEGs) are another type of comparison value. They are developed without consideration for carcinogenic effects, chemical interactions, multiple route exposure, or exposure through other environmental media. They are very conservative concentration values designed to protect sensitive members of the population.

Cancer Risk Evaluation Guides (CREGs) are estimated contaminant concentrations based on a probability of one excess cancer in a million persons exposed to a chemical over a lifetime.

Maximum Contaminant Levels (MCLs) have been established by the U.S. Environmental Protection Agency (USEPA) for public water supplies to reduce the chances of occurrence of adverse health effects from use of contaminated drinking water. These standards are well below levels for which health effects have been observed and take into account the financial feasibility of achieving specific contaminant levels. MCLs are limits that public water supplies must meet, and they are enforceable by USEPA.

Lifetime Health Advisories (LTHAs) USEPA has established LTHAs for drinking water. LTHAs are concentrations of specific chemicals in drinking water that are not expected to cause any adverse, noncarcinogenic health effects over a lifetime (70 years) of exposure. These are conservative values that incorporate a margin of safety.