Technical Assistance Services *for* Communities

Tar Creek Superfund Site

Fact Sheet – January 2018

Baseline Human Health Risk Assessment (BHHRA) and Risk Assessment Guidance for Superfund (RAGS) Tables

Introduction

The Local Environmental Action Demanded (L.E.A.D.) Agency, a nonprofit organization that promotes awareness of health and environmental issues related to the Tar Creek Superfund site, requested Technical Assistance Services for Communities (TASC) assistance to review the U.S. Environmental Protection Agency's (EPA's) Risk Assessment Guidance for Superfund (RAGS) tables, which will be used to complete a baseline human health risk assessment (BHHRA) for operable unit 5 (OU5) of the Tar Creek Superfund site.

This fact sheet explains the purpose of a BHHRA, how a BHHRA is performed and how the RAGS tables will be used, and presents exposure assumptions made by EPA. The TASC program prepared the fact sheet, and it is funded by TASC. Its contents do not necessarily reflect the policies, actions or positions of EPA.

Background

The Tar Creek Superfund site consists of areas within Ottawa County impacted by historical mining wastes. It was added to EPA's National Priorities List (NPL) of contaminated sites on September 8, 1983. Since then, investigation and cleanup activities have been ongoing. The site is divided into five OUs:

- OU1 – Surface water/groundwater
- OU2 – Residential areas
- OU3 – Eagle-Picher Office Complex – abandoned mining chemicals
- OU4 – Mine and mill waste and smelter waste
- OU5 – Sediments and surface water in perennially flowing creeks, streams and rivers within the Oklahoma portion of the Tri-State Mining District

Site-impacted waters in OU5 are Elm Creek, Tar Creek (including Lytle Creek), the Neosho River, Beaver Creek, Lost Creek and the Lower Spring River (portion of Spring River downstream of Empire Lake in Kansas and ending at the headwaters of Grand Lake o' the Cherokees).

EPA recently conducted a data gap review and collected additional information to complete the OU5 remedial investigation (RI). The BHHRA is part of the RI.

EPA requests community input on exposure assumptions that will be used in OU5 calculations.

The deadline is January 17, 2018.

To submit comments, please contact:

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What Is the Purpose of a BHHRA?

A BHHRA helps people understand potential risks to human health from exposure to contaminants at a Superfund site (OU5 in this case) and supports site decision-making. Site-specific cleanup levels at Superfund sites are set based on the results of risk assessments (BHHRAs and ecological risk assessments) and are meant to protect human health and the environment.

How Is a BHHRA Performed?

A BHHRA has four steps:

1. Data evaluation
2. Exposure assessment
3. Toxicity assessment
4. Risk characterization

1. *Data evaluation* takes place during the RI at a Superfund site. The investigation identifies contaminants and their locations and concentrations. When EPA evaluated OU5 data, it decided additional sampling was needed. Data gap sampling is now taking place.

2. *Exposure assessment* is also part of the RI. The exposure assessment determines where exposure(s) could happen and who could be exposed to site contaminants, now and in the future. A conceptual model identifies all possible pathways by which a person could be exposed. Exposure pathways include how and where people could come in contact with contaminated soil, sediment, water or air. Examples of these pathways are eating contaminated food and accidentally ingesting contaminated sediment or water.

Exposure point concentrations are the contaminant concentrations used in risk calculations for each exposure scenario. Results of the OU5 data gap and previous sampling events are used to determine exposure point concentrations.

Exposure assessment makes assumptions about the behavior of people who may be exposed. For example, EPA may assume that an average adult eats a certain number of fish meals per week and that each fish meal weighs a certain amount. The exposure pathways, exposure point concentrations and behavior of people are all used to calculate risk.

RAGS Tables

EPA recently shared RAGS tables that show exposure pathways and assumptions about behaviors that led to exposure for each pathway. EPA has requested input from community members on certain exposure assumptions in these tables. Community members can help EPA conduct a more accurate risk assessment by providing information on their possible exposures to contaminated food, sediment and water.

3. *Toxicity assessment* for contaminants at Superfund sites generally consists of two steps: hazard identification and dose-response assessment. Hazard identification documents substances at a site that could cause an adverse health effect if people are exposed to them. Dose-response assessment takes place separately from site-specific investigations. This assessment estimates the relationship between the amount of exposure to a substance and the potential health effect.

Scientists base dose-response determinations on animal studies, limited human health data and assumptions about long-term exposure. Any human health data usually come from industrial accidents or other types of accidental human exposures that provide information about the health effects of different substances. State and federal regulations limiting the amounts or concentrations of contaminants in soil, water and air at the point of exposure are typically based on dose-response assessments.

4. *Risk characterization* calculates the human health risk associated with contaminants at a Superfund site. The calculation is based on information from the first three steps of the risk assessment – data evaluation, exposure assessment and toxicity assessment.

Noncancer health risk is measured by the hazard index (HI). The HI is the sum of the hazard quotients (HQs) for each contaminant of concern in the risk assessment. If the HQ for a substance that a person is expected to be exposed to at a Superfund site is less than 1, no adverse health effect is expected. The HQ is calculated by dividing the concentration or amount of substance a person could be exposed to by a reference dose (RfD) or reference concentration (RfC) determined during the dose-response assessment.

The RfD is the daily oral exposure not likely to cause adverse noncancer health effects in humans over a lifetime of exposure. The RfD usually includes sensitive subgroups such as children, the elderly and pregnant women. The RfC is the concentration in air where continuous inhalation is not likely to cause adverse noncancer health effects over a lifetime of exposure. If the sum of the HQs or the HI at a Superfund site is greater than 1, EPA generally requires further action.

Cancer health risk is calculated differently than noncancer health risk. The BHHRA assumes that any exposure results in increased risk of developing cancer. Cancer risk is expressed as the extra lifetime risk of cancer due to contaminant exposure. It is expressed with numerical values. A cancer risk of 1E-04 or $1x10^{-4}$ means an extra lifetime cancer risk of 1 in 10,000. A cancer risk of 1E-06 or $1x10^{-6}$ means an extra lifetime cancer risk of 1 in a million. If the extra lifetime cancer risk is 1 in a million or less, EPA does not generally require cleanup at a Superfund site. If the extra lifetime cancer risk is greater than 1 in 10,000, EPA generally requires further action to reduce the risk. For cancer risk between 1 in 10,000 and 1 in a million, EPA makes cleanup decisions on a site-by-site basis.

Review of RAGS Tables

EPA provided two sets of RAGS tables for review. One set is for tribal members and one set is for the general public. Exposure pathways and assumptions from these two sets of tables are highlighted below.

Exposure Pathways

Table 3-1 of the RAGS tables indicates that tribal members are potentially exposed to contaminants through eating fish, shellfish, waterfowl, aquatic plants, turtles, frog legs, and aquatic mammals (raccoon, beaver, mink, muskrat, otter) from site-impacted waters, and contact with sediment and surface water. Members of the general public are potentially exposed through eating fish and waterfowl and contact with sediment and surface water during recreation activities, hunting and fishing.

Tribal Member Exposure Assumptions

The RAGs tables for tribal members make the following assumptions:

Fish

- Adults eat an average of 120 grams per day. This is about one 4.2-ounce meal per day, or four 7.4-ounce meals per week.
- Children eat an average of 40.8 grams per day. This is about one 1.4-ounce meal per day, or four 2.5-ounce meals per week.

Shellfish

- Adults eat an average of 12 grams per day. This is about one 3-ounce meal per week.
- Children eat an average of 3.75 grams per day. This is about one 1-ounce meal per week.

Aquatic Plants – Arrowhead Root

- Adults eat an average of 40 grams per day. This is about one 10-ounce meal per week, or two 5-ounce meals per week.
- Children eat an average of 15 grams per day. This is about one 4-ounce meal per week or two 2-ounce meals per week.

Turtles and Frogs

- Adults eat an average of 24 grams per day. This is about one 6-ounce meal per week.
- Children eat an average of 10 grams per day. This is about one 2.4-ounce meal per week.

Aquatic Mammals – Raccoon, Beaver, Mink, Muskrat, Otter

- Adults eat an average of 69 grams per day. This is about two 8.5-ounce meals per week, or four 4.2-ounce meals per week.
- Children eat an average of 28.4 grams per day. This is about two 4-ounce meals per week, or four 2-ounce meals per week.

Non-food Potential Exposures

- Adults and children contact sediment in site-impacted rivers and creeks 126 days of the year. They get sediment on their lower legs, forearms, head and hands, and swallow some sediment.
- Adults and children swim or wade in site-impacted rivers and creeks for one hour, 65 days per year. They swallow some water.
- Adults and children use site-impacted rivers and creeks as a source of potable water for drinking, cooking and bathing. Adults drink 2 liters (2.1 quarts or 68 fluid ounces) per day and children

drink 0.78 liters (0.82 quarts or 26 fluid ounces) per day.
- Adults and children get mine discharge water on their forearms and hands for one hour, 10 days per year. They do not swallow any mine discharge water.
- Adults spend two hours per day and children spend 15 minutes per day every day in a sweat lodge where site-impacted water is used.
- Adults and children use salve made from site-impacted arrowhead root 12 days per year.

The tribal member RAGS tables assume that adults weigh 80 kilograms (176 pounds) and children weigh 15 kilograms (33 pounds).

EPA is requesting input on:
- Amount and frequency of fish, shellfish, turtle/frog and aquatic mammal meals from site-impacted waters eaten by tribal members. Information for young children (0 to 3 years old) and the elderly (older than 70 years) is particularly important.
- Number of days per year that tribal members swim or wade in site-impacted rivers and creeks.
- Frequency of use of site-impacted water in sweat lodges.
- Use of plants from site-impacted rivers or creeks in salves or other medicines.
- Parts of the body that come in contact with mine discharge water when people encounter mine discharge.

General Public Exposure Assumptions

The RAGs tables for the general public make the following assumptions:

Fish
- Adults eat an average of 61.6 grams per day. This is about 2.2 ounces per day, or three 5-ounce meal per week.
- Children eat an average of 16.5 grams per day. This is about 0.6 ounces per day, 4 ounces per week, or two 2-ounce meals per week.

Non-food Potential Exposures
- Adults and children swim or wade in impacted rivers and creeks for one hour, 28 days per year. They swallow some water.
- Adults and children get mine discharge water on their forearms and hands for one hour, 10 days per year. They do not swallow any mine discharge water.
- In the future, people will use area surface water for drinking, cooking and bathing. Adults will drink 2.5 liters (2.6 quarts or 85 fluid ounces) per day and children will drink 0.78 liters (0.82 quarts or 26 fluid ounces) per day.

The general public RAGS tables assume that adults weigh 70 kilograms (154 pounds) and children weigh 15 kilograms (33 pounds).

EPA would like input on the amount and frequency of fish meals, the fraction of total fish meals that come from site-impacted waters, and the number of days per year that people swim or wade in rivers and creeks affected by the site. EPA would also like information about which parts of the body come in contact with mine discharge water when people encounter mine discharge.

Summary

EPA is using available information from EPA guidance documents, other scientific studies and site-specific information to determine likely exposures to site-impacted foods, sediments, rivers and creeks, and mine discharge areas. EPA would like to receive information from tribal members and other people who use site-impacted resources or recreate in areas affected by the site.

To Submit Comments, Please Contact:

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The deadline is January 17, 2018.

The two tables below are provided for your convenience if you decide to comment on EPA's exposure assumptions for OU5 at the Tar Creek Superfund site.

EPA Assumption for Tribal Member Exposure to Site-Impacted Resources	Is This Reasonable? (Yes or No)	If No, Please Provide Additional Information
Fish – Adults eat an average of 120 grams per day*		
Fish – Children eat an average of 40.8 grams per day*		
Shellfish – Adults eat an average of 12 grams per day*		
Shellfish – Children eat an average of 3.75 grams per day*		
Aquatic plants – Adults eat an average of 40 grams per day*		
Aquatic plants – Children eat an average of 15 grams per day*		
Turtle meat and/or frog legs – Adults eat an average of 24 grams per day*		
Turtle meat and/or frog legs – Children eat an average of 10 grams per day*		
Aquatic mammals – Adults eat an average of 69 grams per day*		
Aquatic mammals – Children eat an average of 28.4 grams per day*		
Sediment – Adults and children contact site-impacted sediment 126 days per year		
Surface water – Adults and children swim or wade in site-impacted rivers and creeks for one hour, 65 days per year		
Potable water – Adults and children currently use site-impacted rivers and creeks as a source of potable water		
Mine discharge – Adults and children get mine discharge water on their forearms and hands for one hour, 10 days per year		
Sweat lodge – Adults spend two hours per day every day and children spend 15 minutes per day every day in a sweat lodge using site-impacted water		
Salves – Adults and children use salve made from site-impacted arrowhead root 12 days per year		

* Quantities are averaged over one year. Average consumption of 120 grams per day = 97 pounds per year. Average consumption of 40.8 grams per day = 33 pounds per year. One pound = 453.6 grams.

EPA Assumptions for Members of the General Public Exposure to Site-Impacted Resources	Is This Reasonable? (Yes or No)	If No, Please Provide Additional Information
Fish – Adults eat an average of 61.6 grams per day*		
Fish – Children eat an average of 16.5 grams per day*		
Surface water – Adults and children swim or wade in site-impacted rivers and creeks for one hour, 28 days per year		
Mine discharge – Adults and children get mine discharge water on their forearms and hands for one hour, 10 days per year		

* Quantities are averaged over one year. Average consumption of 61.6 grams per day = 50 pounds per year. Average consumption of 16.5 grams per day = 13 pounds per year. One pound = 453.6 grams.