



# Technical Assistance Services for Communities

## Tar Creek Superfund Site, Operable Unit 5

### Review of Tar Creek Superfund Site Operable Unit 5 Human Health Preliminary Remediation Goals (PRGs)

The community group Local Environmental Action Demanded (L.E.A.D.) Agency asked for assistance from EPA's Technical Assistance Services for Communities (TASC) program. The request was for TASC review and comment on Version 1.1 of the Technical Memorandum: Development of Human Health Risk-Based Preliminary Remediation Goals for Operable Unit 5.

The Technical Memorandum discusses human health risk-based preliminary remediation goals (PRGs) and ecological PRGs. It has nine sections and two appendices. The sections are:

1. Site Background
2. Remedial Action Objectives
3. Overview of the Basis for Preliminary Remediation Goals
4. Summary of Ecological Preliminary Remediation Goals
5. Summary of Human Health Risk Assessment
6. Human Health Risk-Based PRG Development Approach
7. Uncertainties
8. Conclusions
9. References

The appendices are:

- A. Detailed Lead PRG Methodology
- B. Sediment and Aquatic Plant Regression Analysis

### TASC Tar Creek Operable Unit 5 Human Health PRGs Webinar

**Tuesday, March 23, 2021**  
**6:30 p.m. to 8:00 p.m.**

Please join us for a virtual online presentation of TASC's summary and review of EPA's Technical Memorandum on the Development of Human Health Risk-Based PRGs.



**Join by smartphone or tablet:**

[Click here to join the meeting.](#) It may prompt you to download the Microsoft Teams Meetings app.



**Join using a web browser on a computer:**

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**Join by phone:**

1. Call 1-833-676-8347 (toll free).
2. Enter the Meeting ID (279 499 039 #).

This fact sheet summarizes the nine chapters. TASC comments follow the summary.

**EPA asked for comments by April 16, 2021.**  
**Please email comments to EPA community involvement coordinator Janetta Coats at [coats.janetta@epa.gov](mailto:coats.janetta@epa.gov).**

The U.S. Environmental Protection Agency's (EPA's) TASC program funded this fact sheet. Its contents do not necessarily reflect the policies, actions or positions of EPA.

## 1. Site Background

This section provides background information on the Tar Creek Superfund site and operable unit 5 (OU5). The site is located in the Tri-State Mining District (TSMD), a former lead and zinc mining area that includes parts of southwest Missouri, southeast Kansas and northeast Oklahoma. OU5 is the sediments and surface water in continuously flowing creeks, streams and rivers that may be impacted by historical mining activities within the Oklahoma portion of the TSMD and upstream portions in Kansas and Missouri. EPA further refined the definition of OU5 as part of its OU5 remedial investigation to focus on seven watersheds (areas that drain into creeks, streams and rivers) that flow downstream from Kansas and Missouri into Oklahoma (Figure 1). These include:

- Fourmile Creek (a reference or background area unaffected by historical mining)
- Elm Creek
- Tar Creek (including Lytle Creek)

- Neosho River
- Beaver Creek
- Lost Creek
- Lower Spring River (downstream of Empire Lake in Kansas)

## 2. Remedial Action Objectives

This section describes preliminary remedial action objectives identified in the Remedial Investigation Report and in the advanced screening-level ecological risk assessment. Remedial action objectives are medium-specific or OU-specific goals for protecting human health and the environment. They are used to develop cleanup alternatives. Media in OU5 are surface water, sediment, and aquatic plant and animal tissues. Preliminary remedial action objectives are:

### Human Health

- Minimize or prevent human contact with elevated metals in OU5 sediment and

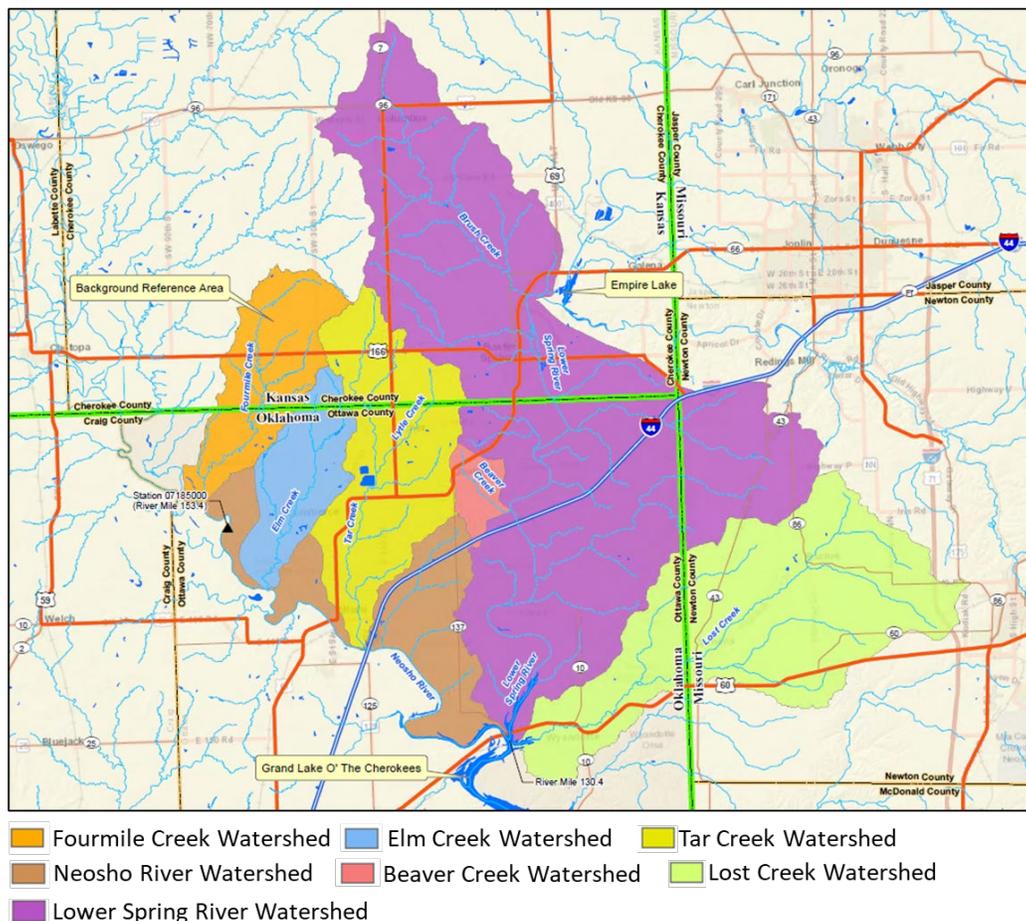


Figure 1. OU5 Study Area Watersheds (adapted from Figure 1-2 of the OU5 Remedial Investigation Report)

surface water that may pose an unacceptable risk.

- Minimize or prevent human exposures to elevated metals found in OU5 aquatic (water) plants and animals that may pose an unacceptable risk.

#### *Ecological*

- Minimize or prevent aquatic plant and animal exposures to sediments and/or pore water (water between particles of sediment) that are sufficiently contaminated to pose moderate or high risk, particularly for fish species that spawn in sediment.
- Minimize risks to sediment-probing birds or plant- and animal-eating mammals that may ingest sediments during feeding activities.

### **3. Overview of the Basis for Preliminary Remediation Goals**

This section presents the basis for EPA's PRGs, which meet EPA's remedial action objectives. PRGs are used in EPA's feasibility study to define the extent of contaminated media (surface water, sediment, and aquatic plant and animal tissues) requiring remedial action. PRGs are media-specific concentrations of chemicals of concern that are not expected to pose unacceptable risks to human health and the environment. PRGs for OU5 sediment were developed considering:

- Chemical concentrations associated with a noncancer hazard index of 1. (A hazard index of 1 means there is little or no risk of a noncancer health effect.)
- A 5% chance of exceeding a target blood lead level of 5, 8 and 10 micrograms per deciliter.
- Toxicity thresholds indicating a significant ecological risk.
- Background concentrations.

#### **Feasibility Study**

**EPA's process for developing, screening and evaluating alternative remedial actions**

PRGs are also developed considering applicable or relevant and appropriate requirements (ARARs), which are federal, state or local regulations. No sediment ARARs are available. EPA will consider surface water ARARs in the feasibility study.

### **4. Summary of Ecological Preliminary Remediation Goals**

This section presents a summary of the ecological risk-based PRGs for sediment. The risk-based concentrations that correspond to a 10% reduction in animal survival or a 10% reduction in plant biomass (noted as T10 in the Technical Memorandum) would reduce current toxicity from about 80% to less than 10%. The Technical Memorandum lists values for the three chemicals of concern, which are the metals cadmium, lead and zinc:

- Cadmium (Cd) – 11.1 milligrams per kilogram of dry weight sediment (mg/kg)
- Lead (Pb) – 150 mg/kg
- Zinc (Zn) – 2,083 mg/kg

The Technical Memorandum also presents a multi-metal risk-based concentration based on the sum of probable effect concentration quotients (PEC-Qs) for each of the three metals:

- $\Sigma\text{PEC-Q}_{\text{Cd, Pb, Zn}} < 6.47$

The PEC-Q is the ratio of the concentration of a chemical in sediment over the concentration that would probably cause damaging effects to organisms in sediment. If the PEC-Q were less than 1 for each metal, then there would be little risk of harm from that metal. This PRG sets the sum of the three ratios, the PEC-Qs, to be less than 6.47.

### **5. Summary of Human Health Risk Assessment**

This section summarizes the human health risk assessment. The human health risk assessment looked at possible exposures to sediment, surface water, mine discharge, and aquatic plants and animals. Groups evaluated were:

- Tribal Lifeway (adults and children)
- Aquatic Workers (fish hatchery or environmental employees)
- General Public (adults and children)

Table 1 of the Technical Memorandum lists the different types of exposures assumed for children of the tribal lifeway and the general public.

Table 2 of the Technical Memorandum lists final chemicals of concern that contribute to unacceptable levels of risk in media (surface water, sediment, and aquatic plant and animal tissues). Unacceptable risks are an excess lifetime cancer risk greater than 1 in 10,000, a noncancer hazard index greater than 1 for any target organ, and a 5% chance of exceeding a target blood lead level of 5 micrograms of lead per deciliter of blood. Final chemicals of concern are:

- Sediment – cadmium, lead and zinc
- Surface water – antimony, arsenic, barium, cadmium, cobalt, iron, lead, manganese, nickel and zinc
- Aquatic plant and animal tissue – barium, cadmium, copper, lead, nickel, silver and zinc

Not all the metals listed above are chemicals of concern for every watershed. Tar Creek and Elm Creek have the highest number of chemicals of concern. No chemicals of concern in sediment are listed for Neosho River or Lost Creek.

## **6. Human Health Risk-Based PRG Development Approach**

This section explains the development of human health risk-based PRGs for sediment. The objective is to develop PRGs that protect people who are exposed directly to sediment, as well as those exposed to surface water and food taken from the affected creeks, streams and rivers. Cadmium, lead and zinc are the main site-related chemicals of interest with regard to human health. They are also the only final chemicals of concern in sediment. Human health PRGs were developed for these three metals.

Table 3 of the Technical Memorandum presents five sets of lead PRGs. The PRGs in Table 3 range up to 3,224 mg/kg of lead in sediment. Calculated values depend on the percent of food intake from OU5, either 25% or 100%, assumptions on the amount of sediment that is ingested, the age at

which children are exposed to OU5 sediment and the target blood lead level. The PRGs are also shown in Figure 2 of the Technical Memorandum. EPA's preferred hybrid method for a target blood lead level of 5 micrograms per deciliter results in a lead PRG of 414 mg/kg. This hybrid PRG assumes that younger children, less than three years old, would not visit OU5 creeks and rivers, therefore would not be exposed to sediment. Younger children's exposure to residential yard soil and drinking water was considered in the PRG calculation. The background threshold level of lead in sediment is 58 mg/kg. The background threshold values represent the background level of a chemical, as established using statistical procedures on the data collected from the background reference area. The background reference area is Fourmile Creek.

Cadmium and zinc were identified as final sediment chemicals of concern only for the tribal lifeway. Cadmium was identified as a final sediment chemical of concern for aquatic workers. Cadmium and zinc in sediment do not present an unacceptable risk to the general public. Table 4 of the Technical Memorandum shows the assumptions and PRG calculations for tribal lifeway children and aquatic workers. Table 5 of the Technical Memorandum lists the cadmium and zinc PRGs for the different human health exposure scenarios considered, as well as two ecological PRGs – one for 10% reduction (T10) and one for 20% reduction (T20) in animal survival or plant biomass. Human health PRGs were calculated for two scenarios for tribal lifeway children: 1) direct contact with sediment; and 2) direct contact with sediment plus consumption of aquatic plants.

Figure 3 of the Technical Memorandum shows the background threshold level for cadmium as 0.70 mg/kg and for zinc as 534 mg/kg. It also shows the human health PRG calculated for each scenario. All the human health cadmium and zinc PRGs are higher than the ecological PRGs for 10% animal survival or reduction in plant biomass, as shown in Section 4.

## **7. Uncertainties**

This section discusses the uncertainties in developing the sediment PRGs. There is uncertainty

in methodologies, assumptions and toxicity information. Even with the uncertainties, EPA expects that cleanup of sediment to the ecological PRGs will sufficiently reduce metals concentrations in surface water and plant and animal tissues to acceptable human health and ecological risk levels. There will be future monitoring and periodic reviews to check whether metal levels are lowered sufficiently to protect human health and the environment.

## 8. Conclusions

This section explains the Technical Memorandum conclusions.

Ecological sediment T10 PRGs presented are:

- Cadmium – 11.1 mg/kg
- Lead – 150 mg/kg
- Zinc – 2,083 mg/kg
- $\Sigma$ PEC-Q<sub>Cd, Pb, Zn</sub> – <6.47

The T10 cadmium PRG is 16 times greater than its background threshold level. The lead PRG is three times greater than its background threshold level. The zinc PRG is four times greater than its background threshold level.

Final proposed OU5 sediment PRGs will be presented in a Proposed Plan for public review and comment.

## 9. References

This section lists the references used.

### TASC Comments

TASC comments are for L.E.A.D. Agency members and the community to support understanding of the sediment PRGs and to improve communication with EPA. TASC does not provide comments directly to EPA on behalf of the L.E.A.D. Agency or the community. People who live and work near the site are best equipped to share their own concerns.

- In Table 2 of the Technical Memorandum, no chemicals of concern were identified for the sediment in Neosho River and Lost Creek. Only lead in sediment is identified in Lower Spring River. EPA will evaluate final proposed remedial goals and remedial

alternatives during the feasibility study. EPA will present a Proposed Plan, including final remediation goals, for public review and comment. *Community members may want to follow EPA's progress and submit formal comments during the Proposed Plan public comment period.*

- It is unclear how site cleanup will be staged and whether runoff from mine wastes on surrounding land are expected to significantly affect the long-term success of a sediment cleanup. This may be evaluated during the feasibility study. *Community members may want to ask EPA to discuss how long-term maintenance of sediment PRG levels will be evaluated in the feasibility study.*
- It may be appropriate to set variable PRGs for sediment. Background values could be appropriate for settings where sediment is being washed downstream and deposited as soils due to flood scour. During flooding, OU5 sediments could be deposited along creek shorelines or even on the Grand Lake shoreline. *Community members may want to ask EPA if it can work with interested parties to identify stream reaches that are susceptible to flood scour and to set stream-specific or stream reach-specific PRGs.*

### Flood Scour

**Flood scour is the erosion of a riverbed or riverbank by fast-flowing floodwater.**

- There is substantial uncertainty in the protectiveness built into the model-derived PRG values. There are more contaminants present in sediment from Elm Creek, Tar Creek and Beaver Creek that may affect the potential toxicity of the sediments. Acid mine drainage and runoff could make metals in surface water and sediment more bioavailable. *Community members may want to ask EPA how it will determine if sediment*

*PRGs are suitably conservative to account for these additional sources of possible chemical exposure and toxicity.*

- Lead PRGs were derived using multiple exposure pathways and exposure setting assumptions. Cadmium and zinc PRGs focused on a subset of these pathways and excluded the pathway of surface water ingestion. EPA plans to further review surface water in comparison to federal, state and local regulations during the feasibility study. *Community members may want to ask how EPA will ensure that cadmium and zinc sediment PRGs are protective enough to address the surface water ingestion pathway.*
- The conclusions drawn from this document appear to lead toward the use of the ecological-based T10 PRGs. It seems appropriate to conduct a literature-based evaluation of other sediment PRGs from comparable sites to assist EPA in selecting PRGs that are suitably conservative (protective). *Community members may want to ask EPA to compare site specific PRGs with PRGs from other sites with similar watershed characteristics and exposure concerns.*
- It is not clear if or how ΣPEC-Q could be used as one of the human health PRGs. *Community members may want to ask EPA how this PRG will affect cleanup decisions and the levels of cadmium, lead and zinc in sediment after remedial action.*
- The presented ecological (T10) PRGs are several times greater than background levels for cadmium (16 times), lead (3 times) and zinc (4 times). The Technical Memorandum indicates that these ecological PRGs would also protect human health for cadmium and zinc, and when compared with the hybrid lead PRG. In an EPA webinar and discussion about the PRGs on February 23, 2021, it appeared that Quapaw tribal leaders may prefer the sediment PRGs to be the

same as background levels. Setting PRGs to be the same as background could be more protective. However, there are likely tradeoffs, such as cost or the amount of time needed for completion of remedial activities. *Community members may want to provide their opinions about this issue to EPA.*

### EPA's PRG Technical Memorandum Overview in Brief

EPA developed PRGs to address human health and ecological remedial action objectives previously identified by EPA for OU5.

The ecological PRGs calculated for OU5 sediment are lower than the PRGs calculated for human health.

Final proposed OU5 sediment PRGs will be presented in a Proposed Plan for public review and comment.

### For More Information, Please Contact:

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EPA asked for comments on the PRGs Technical Memorandum by April 16, 2021. Please email comments to Janetta Coats.