4. DQOs

DQO Step 1 - Overarching Problem Statement

What is the problem described in the EPA Administrator letter (DQO session – April 1, 2021)

> *Cleanup levels for discharges of carcinogens from a NPL site also cannot be less stringent than the CERCLA risk range.4 For these CERCLA on-site landfills at ORR, I have determined that the PRGs at a minimum should reflect a risk level of 10-5, based on the Tennessee General Water Quality Criteria regulations that are used to establish Ambient Water Quality Criteria to protect the designated uses established by Tennessee's Water Quality Standards regulations from pollutants that are carcinogens.*
>
> *The EPA will not require use of default exposure assumptions from CWA guidance documents regarding fish consumption to develop PRGs, or any other default exposure assumptions that are in dispute, such as ingestion. Instead, the DOE will establish PRGs based on site-specific exposure information and will use that information both to develop CWA effluent discharge limits and to apportion the dose of radionuclides among various sources under the NRC regulations.*
>
> *Default assumptions regarding fish consumption do not represent reasonable maximum exposure at ORR and do not appropriately take reasonably anticipated future land use into account. Other default exposure assumptions may present the same issues. It is longstanding EPA policy to consider reasonably anticipated future land use in conducting a baseline risk assessment.7 For the purpose of the FFS, given that the state's most restrictive use designation for the receiving water (Bear Creek for the existing landfill) is recreational (including recreational fishing)8 the individual with the potential maximum exposure to radionuclides in effluent from ORR landfills would be a recreational fisherman who fishes from Bear Creek, if the fish are contaminated by radionuclides. Reasonably anticipated future land use, and thus the location of this exposure, will depend on the DOE's land use designations.*

Develop risk based radiological discharge limits for EMWMF and future EMDF considering site-specific conditions using the EPA PRG calculator, fish tissue radiological data, acknowledging the land use controls placed by TDEC on fishing. DOE will focus on where there are catchable fish and location characteristics. These include BCK 3.3 and EFPC and their characteristics for fishing and fish populations. DOE will establish baseline conditions at potential exposure points and upstream locations in Bear Creek.

Commented [AC1]: and upstream locations in BC.

Therefore, the problem statement is: Discharged radionuclides into Bear Creek may bioaccumulate in fish, causing an increased risk to a recreational fisherman that catches and eats the fish.

This SAP was developed to establish baseline conditions of radionuclides in fish in Bear Creek and to support the collection of data needed for the development of rad discharge limits for EMWMF and EMDF landfill water including finalizing field approach/procedures, analytical methods, and number of samples.

Commented [AC2]: Establish baseline conditions and

Optimization of the SAP will be performed using Step #5 Decision Rules, focusing on collecting data that address data gaps.

DQO Step 2 - Identify the Decisions

Decision 1: What levels of radionuclides in the EMWMF and EMDF discharge water are protective of human health and the environment based on the requirements of CERCLA 10^{-5} risk?

- D1.1 What is likely location where the fisherman catches fish for consumption (e.g., current/future land use)? [POEs].
- D1.2 What other CERCLA inputs are relevant to this decision, such as PRG Calculator inputs/parameters? [e.g., fishing practices, fish ingestion rate, meals per year available at each location (i.e., edible fish distribution to illustrate size of catchable fish that a recreational fisherman is likely to catch)]
- D1.3 What are the list of radionuclides to evaluate in fish? Currently considering list of 20 radionuclides present in edible fish that pose a risk to the recreational fisherman?
- D1.4 What is the existing baseline risk in fish at the point(s) of exposure? Related, what are the radionuclide concentrations in fish from background reference area (Brushy Fork)?

DQO Step 3. Identify Inputs to the Decisions

Table [SEQ Table * ARABIC]. DQO decision inputs

Decision element	Evaluation method	Existing inputs	Additional information needs
D1 – What levels of radionuclides in the EMWMF and EMDF discharge water are protective of human health and the environment based on the requirements of CERCLA 10^{-5} risk?			
D1.1 What is the likely location where the fisherman catches fish for consumption (e.g., current and future land use)? [Point of Exposure]	Evaluate all site-specific information along with controls to develop likely exposure point(s).	Existing CSM Current and future land use controls including CERCLA controls and fish advisories. No locations are within walking distance of Oak Ridge, although one location is near trail. Transportation needed to reach locations, providing opportunity to fish in nearby, much more productive areas.	Results from fish population surveys including 'catchable/edible fish', fish numbers, and types of fish.
D1.2 What other CERCLA inputs are relevant to this decision, such as PRG Calculator inputs/parameters? (e.g., fishing practices, meals per year available at each location [i.e., edible fish distribution to illustrate size of catchable fish that a recreational fisherman is likely to catch])	Evaluate all site-specific information Poplar Creek, EFPC supports a population of edible fish. Water contact and fish consumption advisories are in effect. This location is expected to have the highest number of catchable, edible fish in the study area.	Fish advisories and use controls are in place at all locations. FY20 Bear Creek fish survey ORNL designates catchable fish as at least 30 g (1 oz), ~4.5 in. long (small fish). Edible tissue is between 10 and 12 g (0.3 and 0.4 oz), will require several fish for a meal. 54 g/day (1.9 oz/day) is the default in the OSWER directive, based on approximately two 8-oz (226 g) fish meals/wk. Previous studies (Campbell et al. 2002; Burger and Campbell 2008)	Frequency and meal size will be adjusted by what can be supported by the fishery over the course of a year. How many meals per year are feasible at each location • Need population survey in BCK 0 to 1.6. • EFPC EFK-0 Preliminary PRG Calculator inputs are on Slide 61.
D1.3 What are the list of radionuclides to evaluate in fish? ***Currently considering preliminary list of 20 radionuclides evaluated by DOE and EPA?***	Evaluate all site-specific information along with analytical data	Existing concentration and contaminant data from the EMWMF and projected EMDF. Key COC list for radionuclides agreed upon by the FFA parties and formalized in the EMWMF SAP. Similar waste disposal expected for the EMDF with primary waste from Y-12 and ORNL. Developed as part of the design.	Finalized list of radionuclides.

Commented [AS3]: Specify. If referring to institutional controls such as signage, manned security areas, etc., these should not be factored in the selection of the POE(s).

Commented [AC4]: Please provide a copy

Commented [AS6]: Feasible meals per year implies periodic fish population surveys will be conducted over the course of a year (e.g. Spring and Fall).

Commented [AS5]: Specify what from these studies are being considered when deciding the inputs.

Commented [AS7]: Please provide current and historic data associated with the EMWMF

Commented [AS8]: Does this mean a similar waste stream/radioactive waste between the two landfills and/or similar waste origins (Y-12 & ORNL)?

Table 5. DQO decision inputs (cont.)

Decision element	Evaluation method	Existing inputs	Additional information needs
D1.4 What is the existing baseline level of radionuclides in fish, and the corresponding risk to recreational fisherman in fish at the point(s) of exposure? Related, what are the radionuclide concentrations in fish from background reference area? ***Note: EMWMF radiological discharge already included in the Bear Creek water experienced by the fish.***	Evaluate all site-specific information and analytical data, including from background reference area PRG calculator	Existing frozen fish data from BCK 3.3 and Hinds Ck Existing Clinch River fish data downstream of ORR Identification of Points of Exposure WRRP data Identification of preliminary exposure parameters from previously performed PRG runs Identification of radionuclide COCs from EMWMF and proposed EMDF (D1.3)	Fish tissue collected and analyzed for the radionuclide COCs at the likely Points of Exposure/fishing locations Fish population surveys determining number of catchable and the edible fish by size range at each location. Determine how many fish can be caught/meals possible (D1.1) Input from D1.1

Commented [AC9]: Baseline level of radionuclides in fish (and corresponding risk to recreational fisherman)

Commented [AS10]: Will this be a forward-risk calculation based on measured rad concentrations in fish muscle tissue, which will then be used to back-calculate the PRG?

Commented [AS11]: Suggest providing EPA and TDEC with the PRG calculator inputs/outputs from these previous runs for discussion purposes. These could serve as a starting point for deriving the risk.

BCK = Bear Creek kilometer
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
COC = contaminant of concern
CSM = Conceptual Site Model
DOE = U.S Department of Energy
DQO = data quality objective
EFPC = East Fork Poplar Creek
EMDF = Environmental Management Disposal Facility
EMWMF = Environmental Management Waste Management Facility
EPA = U.S. Environmental Protection Agency
FFA = Federal Facilities Agreement
FY = fiscal year
ORNL = Oak Ridge National Laboratory
ORR = Oak Ridge Reservation
OSWER = Office of Solid Waste and Emergency Response
PRG = preliminary remediation goal
SAP = sampling and analysis plan
WRRP = Water Resources Restoration Program
Y-12 = Y-12 National Security Complex

DQO Step 4. Define the Study Boundaries

The study area is limited to Bear Creek from the intersection of Bear Creek and State Route 95 to confluence of EFPC and Poplar Creek

Commented [AC12]: Update (BCK 12.4 to…)

Temporal limit – one fishing sampling event. A fish tissue sampling event will be performed to obtain analytical results. Flow will be matched to this flow event or an annual average will be selected to account for variation because fish tissue concentrations capture a time-integrated measure of exposure at these sites from surface water.

Commented [AC13]: Update to include fall event.

DQO Step 5. Develop the Decision Rules

The fifth step of the DQO process converts the decision statement into a decision rule, with the decision rule based on the expected inputs to the decision. The decision rules are presented in the following paragraphs.

D1.1 What is likely location where the fisherman catches fish for consumption (e.g., current/future land use)?

IF the candidate point of exposure produces the highest risk to the recreational fisherman based on combination of fish tissue concentrations, availability of edible fish, and dilution factor,

THEN it is the point of reasonable maximum exposure, and will be identified as the point of exposure for determining rad discharge limits for landfill wastewater.

Commented [AS14]: The dilution factor does not play a role in the derivation of risk from fish consumption. However, the flow rate or size of the mixing zone may have a direct influence on the availability of fish (interference with spawning or nursery areas and fish migratory routes) at the POE.

D1.2 What other CERCLA inputs are relevant to this decision, such as PRG Calculator inputs/parameters? [e.g., fishing practices, fish ingestion rate, meals available per year at each location (i.e., edible fish distribution to illustrate size of catchable/edible fish that a recreational fisherman is likely to catch)]?

IF the current available data for determination of site-specific parameters (e.g., fish ingestion rate, meals per year, etc.) is sufficient at a candidate POE,

THEN proceed with the determination of site-specific parameters based on existing information.

IF the available data for determination of site-specific parameters is inadequate or does not exist,

THEN conduct fish population surveys of "catchable fish" (fish numbers and species of fish) at identified POE locations to determine the site-specific parameter.

Note: Few fish may be present at any given POE, limiting sample size.

D1.3 What are the list of radionuclides to evaluate in fish? [Currently considering preliminary list of 20 radionuclides evaluated by DOE and EPA]

IF the list of ~20 radionuclides is adequate, appropriate and complete based on current and anticipated radionuclide concentrations in landfill discharge water,

THEN determine rad discharge limits for those radionuclides.

IF the list of ~ 20 radionuclides is determined to be inadequate/incomplete based on current and anticipated radionuclide concentrations in landfill discharge water,

THEN define approach for how radionuclides can be added to or removed from the list. Determine rad discharge limits for new radionuclides.

D1.4 What is the existing level of radionuclides in fish in Bear Creek, and what is the corresponding baseline risk ~~in fish~~ to a recreational fisherman at the POEs?

Commented [AC15]: Update to include – establishing current level of radionuclides in fish in BC

Commented [AC16]: concentrations of radionuclides in fish in Bear Creek, and the associated baseline risk to recreational fisherman?

IF the current available data for radionuclide concentrations in fish is sufficient at a candidate POE,

THEN proceed with the determination of baseline risk from current fish tissue concentrations at the POE based on existing information.

IF the available data for radionuclide concentrations in fish is inadequate or does not exist,

THEN conduct fish tissue sampling of "catchable fish" at identified POE locations for radionuclide analyses at analytical labs that ensure detection limits satisfy measurement quality objectives.

IF radioanalytical data are generated for fish tissue samples,

THEN calculate mean concentrations and uncertainties for each radionuclide of concern, and calculate risk based on measured fish tissue concentrations.

Commented [AS17]: Specify (e.g., arithmetic means, geometric means, surface-weighted means, 95% UCL, 95% USL, etc.) or state that an estimate of the mean will be calculated

IF team determines existing baseline risk should be assessed relative to background reference location,

THEN conduct sampling and analysis of fish tissue from Brushy Fork background reference location to provide a comparison of baseline risk to POE locations.

DQO Step 6. Specify Performance or Acceptance Criteria

This step specifies the probability limits for false rejection and false acceptance decision errors and develops performance criteria for new data being collected or acceptable criteria for existing data being considered for use.

Probability limits will be difficult to meet based on the likely paucity of available consumable fish at some locations which limits the sample size.

Errors in sampling and analysis will be minimized to the extent practicable by attempting to collect sufficient mass and numbers of samples to obtain a statistically valid sample population and using well established laboratories and QA/QC requirements

Verification and validation of the data ensures that the requested analyses have been reported using the correct analytical methods, reporting limits, and units. This process will include also ensuring that the documentation in the data package is complete and consistent with the electronic data deliverable provided by the laboratory. Validation of the data examines the data from a technical perspective.

The fish tissue study will ~~be~~ help bound uncertainties associated with the PRG Calculator parameter, meals per year. This parameter value depends on the number and size of "catchable and edible" fish at each candidate POE. Relevant literature (Burger studies) and expert judgment (ORNL ESD) will be used to help assess meals per year parameter uncertainties.

DQO Step 7. Optimize the Design

The final step of the DQO process takes the results of the first six steps, and uses them to prepare a SAP that achieves the desired goals for this project.