

RCRA FIRST TOOL 7: Developing Corrective Action Objectives

What are Corrective Action Objectives?

RCRA FIRST addresses two phases of corrective action: facility investigation and remedy selection. The goal of a facility investigation is to determine the impact of a facility on human health and the environment. During remedy selection, the goal is to identify an effective remedy to protect human health and the environment. EPA, states, and facilities should work together to develop objectives for each of the two phases to meet these goals, consistent with EPA regulation, policy, and guidance. Objectives for facility investigation may initially be more generic and open-ended, as less is known about the specific environmental conditions prior to investigation; however, the findings of the investigation will form the basis for establishing the Corrective Action Objectives (CAOs) for remedy selection.

What Should Objectives for RFI Include?

Objectives for RFI should:

1. Determine nature and extent of contamination in all media
2. Identify current and potential routes of exposure
3. Identify current and potential receptors, human and ecological
4. For contaminated groundwater in an aquifer used or potentially used as a source of drinking water, determine the horizontal and vertical extent to a concentration less than maximum contaminant levels (MCLs), or tap-water based regional screening tables (RSLs).
5. For contaminated soil, determine extent to a concentration less than residential soil RSLs.
6. Identify and delineate contaminant source areas
7. Determine whether vapor intrusion from contaminated soil or groundwater is occurring or could occur in the future

What are Corrective Action Objectives for Remedy Selection?

CAOs for remedy selection are medium-specific or unit-specific goals that a cleanup alternative must achieve to protect human health and the environment. These objectives should be as specific as possible, but not so specific that the range of alternatives that can be developed is unduly limited. For example, here are two objectives developed for a site with lead contaminated soil:

1. Remove all soil contaminated with lead > 400 mg/kg
2. Prevent residential exposure to lead in soils > 400 mg/kg

The first unnecessarily limits the remedial actions only to how the soil would be removed. The second allows the consideration of other remedies, such as capping and land use restrictions.

CAOs should specify the following:

1. The contaminant(s) of concern
2. The exposure route(s) and receptor(s)
3. An acceptable contaminant level or range of levels for each exposure route

CAOs are developed from:

- EPA law, policy, and guidance
- Threshold criteria: Protect HH&E, Achieve Media Cleanup Objectives, Control Sources
- Conceptual Site Model
- Current uses and exposures
- Reasonably-expected future uses and exposures
- Resource values (ecological, groundwater, etc.)

Although current exposures often will have the highest priority for corrective action, CAOs should also address reasonably-expected future uses and exposures as well as resource values and environmental protection. For example, a site with a Trichloroethylene (TCE) groundwater contaminant plume that extends offsite and impacts private wells could have the following CAOs, all of which need to be addressed by the remedy (or specific components of the remedy):

1. Prevent current and future human drinking water exposure to TCE in groundwater > 5.0 ug/l (the MCL)
2. Prevent current and future vapor intrusion exposure to TCE in groundwater
3. Return the contaminated aquifer to maximum beneficial use (TCE < 5.0 ug/l) throughout the contaminant plume

A single remedy would not necessarily address all three of these objectives in a reasonable timeframe. A groundwater pump and treat system, for example, might be able to return the aquifer to drinking water use eventually, but may not address current drinking water or vapor intrusion exposures. Future exposures could occur if new wells or homes were constructed prior to cleanup of the groundwater. Providing treatment for impacted wells would address current exposures, but would not restore the groundwater for future drinking water use.

How Should Corrective Action Objectives Be Documented?

Remember that the outcome of the Remedy Selection Process (RSP) meeting is for all parties to agree on the Corrective Action Objectives. It is important to carefully work through and consider all the contaminated media, sources, exposure pathways, and receptors evaluated during the RFI (which should have been memorialized in an updated Conceptual Site Model). You can use the following worksheet as a basis for discussion to document those media/source/pathway/receptor combinations that are relevant, and to record the specific Corrective Action Objectives for each. Note that it is also important to agree to and record those media/source/pathway/receptor combinations that are not at issue for your facility. For example, if everyone agrees that the remedy does not need to consider human health or ecological exposures to surface water (because the site has not impacted surface water), then that decision should be documented with “not applicable” rather than leaving the space blank. Also note that, although the most common media/source/pathway/receptors are listed in the table, your facility may need to develop objectives for specific units, sources, media, pathways, or receptors not listed. Develop a table specific to your facility with as much detail as needed to address all concerns.

Corrective Action Objectives Worksheet

The following table provides a format to document corrective actions objectives based on the environmental media, sources, pathways, and receptors relevant to a facility. Each objective statement should include the contaminant, acceptable concentration (or performance metric), and a time frame (or priority) for action.

Table A.2 Corrective Action Objectives Worksheet

Environmental Media	Human Health Residential	Human Health Non-Residential	Ecological Receptors	Cross-media Transfer	Resource Restoration
Groundwater					
Soil					
Surface Water					
Air					
Waste					
Other					

Example Worksheet

The following table presents example CAOs for an active industrial facility with TCE in waste, soil, and groundwater on site; TCE in soil and groundwater in a residential area off site; and no impacts to surface water.

Table A.3 Corrective Action Objectives Worksheet Example

Priority/Time Frame: 1 = Short-term; 2 = Intermediate; 3 = Long-term final cleanup; 4 = existing control in place
(MCL = maximum contaminant level, TR = carcinogenic target risk)

Environmental Media	Human Health Residential	Human Health Non-Residential	Ecological Receptors	Cross-media Transfer	Resource Restoration
Groundwater	Prevent drinking water exposure to TCE above 5 ug/l (the MCL). Timing: 4 (well treatment in place)	Prevent future drinking water exposure to TCE above 5 ug/l (the MCL). Timing: 2 or 3 (GW not currently used on site)	Not applicable (NA)	Prevent vapor intrusion from TCE in groundwater to occupied buildings (see Air for levels). Timing: 1	Attain 5 ug/l TCE or less in all groundwater downgradient of surface impoundment boundary Timing: 3
Soil	Prevent direct exposure to TCE > 0.94 mg/kg (10 ⁻⁶) in offsite area Timing: 1 (current exposures)	Prevent direct exposure to TCE > 6 mg/kg (10 ⁻⁶) for onsite workers Timing: 1 (current exposures)	Not applicable (no eco-exposures identified)	Prevent TCE in soils from leaching and impacting GW > MCLs (develop soil cleanup level in CMS) Timing: 2	NA (no sensitive soil resource identified)
Surface Water	NA – surface water and sediments not contaminated with TCE	NA	NA	NA	NA
Air (Indoor)	Prevent exposure to TCE > 0.48 ug/m ³ (10 ⁻⁶) in living space Timing: 1 (current exposures)	Prevent exposure to TCE > 3 ug/m ³ (10 ⁻⁶) in office space of occupied buildings Timing: 1 (current exposures)	NA	NA	NA
Waste (TCE sludge impoundment)	NA (no waste off-site)	Prevent direct exposure to TCE waste in surface impoundment Timing: 1	Prevent direct exposure to TCE waste in surface impoundment Timing: 1	Prevent migration of TCE from surface impoundment to groundwater > MCL Timing: 2	NA
Other	NA	NA	NA	NA	NA

Additional Resources for Developing Corrective Action Objectives

- EPA provides additional discussion of groundwater cleanup objectives in the “Handbook of Groundwater Protection and Cleanup Policies for RCRA Corrective Action,” available at: <http://www.epa.gov/epawaste/hazard/correctiveaction/resources/guidance/gw/gwhandbk/index.htm>
- Additional discussion of CAOs for remedy selection is available in Chapter 4 of “Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA.” The guidance document describes how to develop Remedial Action Objectives—the Superfund equivalent to RCRA CAOs. Available at: <http://semspub.epa.gov/src/document/HQ/174075>
- Federal Register Notice, Advanced Notice of Proposed Rulemaking on Corrective Action for Releases from Solid Waste Management Units at Hazardous Waste Management Facilities, May 1, 1996, available at <http://www.gpo.gov/fdsys/pkg/FR-1996-05-01/pdf/96-9707.pdf>