Risk-based Considerations for Establishing Alternative Groundwater Standards at Coal Combustion Product Sites

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Abstract

The 2015 Federal Coal Combustion Residual (CCR) Rule prescribes that the detection of constituents listed in Appendix IV of the CCR Rule above their respective Groundwater Protection Standards (GWPS) triggers groundwater corrective action and/or closure for unlined surface impoundments. Corrective action is considered complete only when groundwater constituent concentrations are returned to levels below the GWPS. Several regulatory updates over the past several years affecting implementation of the CCR Rule, however, may provide more flexibility in how potential GWPS exceedances trigger corrective actions, as well as how cleanup goals are set. Specifically, using risk-based approaches to develop alternative groundwater standards may be permitted under state regulatory permit programs as long as those standards are "as protective as" those specified in the CCR Rule. Also, according to the Phase 1 Rule, the United States Environmental Protection Agency (US EPA) continues to "evaluate technical issues" associated with setting GWPS for Appendix IV constituents. This presentation discusses risk-based approaches that can guide the selection of alternative groundwater standards. It also discusses some of the modifications to corrective actions that are being actively considered by US EPA. These risk-based approaches consider the development of alternative standards for the protection of human health and the environment based on the most scientifically supportable information, current and future uses of groundwater near coal combustion product management units (CCP MUs), and potential attenuation that may occur between the current point of compliance and a relevant point of exposure.

Extended Abstract

In July 2018 the United States Environmental Protection Agency (US EPA) passed an amendment to the 2015 CCR Rule (Phase one, Part One) (US EPA, 2018). One of the key provisions of this amendment specifies that the GWPS for cobalt, lithium, and molybdenum be based on their Regional Screening Levels (RSLs) of 6, 40, and 100 μg/L, respectively, rather than background. US EPA also indicated that it will continue to evaluate technical issues associated with GWPS when there is no maximum contaminant level (MCL) and also pointed out that "a State Director may always seek approval for alternative State criteria as part of the process under the WIIN Act; this could, for example, include the establishment of alternative GWPS for the constituents listed in Appendix IV" (83 FR 36444; US EPA, 2018). Other parts of the proposed
amendment are still under consideration by US EPA but signal a shift to a greater reliance on risk-based approaches.

In response to this shift to more risk-based approaches, and for consideration for site-specific conditions, we have supported the Electric Power Research Institute (EPRI) development of step-wise framework that may be considered for the identification and/or development of groundwater standards that are scientifically supportable, consistent with existing regulatory programs, and achieve outcomes that are protective of human health and the environment. In this context "alternative standards" can refer to groundwater protection standards (GWPSs), alternative compliance limits (ACLs), cleanup goals (CUGs) or other terms used to specify concentrations that trigger specific actions or used as a remediation goal.

The framework is not a prescriptive guide for establishing alternative standards; rather, it serves as a structured roadmap for building scientific support around various remediation options and guiding discussions with competent authorities and other stakeholders. The steps for establishing alternative standards at a specific site are presented in Figure 1 (Steps for Establishing an Alternative Standard for Groundwater) and Figure 2 (Steps for Establishing an Alternative Standard for Surface Water), with some further explanation of the key concepts below each figure. Overall, the steps are ordered such that approaches that require limited site-specific data and analysis (and hence are less resource intensive) are preferentially used to establish the alternative standard. Moving through steps of the framework, the approaches to establish acceptable alternative standards increasingly require more data and analysis and are more resource intensive.

The deviation of alternative standards for groundwater and surface water is conceptually similar but requires different risk-based considerations and resources. For those reasons there is a separate step-wise process for the groundwater that discharges to surface water. It is important to appreciate, however, that establishing an alternative standard for both groundwater and surface water may be considered at a single site.
Description of Steps for Establishing an Alternative Standard for Groundwater

**Figure 1 Steps for Establishing an Alternative Standard for Groundwater.** CCP MU = Coal Combustion Product Management Unit; GWBU = Groundwater Bearing Unit; POC = Point of Compliance; POE = Point of Exposure; US EPA = United States Environmental Protection Agency. 
(2) Site-specific assumptions may be needed to develop value.
**Human Health Considerations**

**Step 1a. Does the groundwater concentration at the point of compliance (POC) exceed a relevant state health-based drinking water level?**

Many states develop their own health-based drinking water levels; although many do not. These levels can differ depending on individual state risk assessment policies and scientific judgments of the available toxicological data. The first step in the framework is to consider the state level if it is scientifically supportable, especially if it varies from standards established on a national level (e.g., MCL or RSL), see below.

**Step 1b. Does the groundwater concentration at the POC exceed a scientifically supportable health-based drinking water level?**

If a state has not developed their own health-based drinking water level or the value developed is based on outdated science or assumptions that are subject to revision, it may be possible to identify or develop a scientifically supportable value. Existing authoritative values that can be considered for use as an alternative standard include those developed by US EPA (e.g., RSLs) or agencies of other states that publish the scientific bases of their derivation. In some cases, it may be appropriate to independently develop a health-based drinking water limit with appropriate scientific justification and documentation.

**Current and Future Use Considerations**

**Step 2a. Does the groundwater in a relevant groundwater bearing unit (GWBU) meet potability criteria?**

US EPA and some states have standards for what constitutes potable groundwater. If the groundwater in the GWBU is naturally saline or has background contamination, it may be considered non-potable. When a groundwater source cannot be used as a drinking water supply, some jurisdictions may allow the use of an alternative standard that is less stringent than a health-based drinking water standard. Step 2a differs from the CCR Rule provision allowing use of background if it is higher than the MCL, because a GWBU may not be potable based on constituents that are not part of the assessment monitoring program such as high sodium and chloride in saline groundwater or organic compounds when there is contamination from an off-site source. An adjustment used in some jurisdictions is to increase the alternative standard using a multiplier.

**Step 2b. Does the groundwater in a relevant GWBU meet acceptable yield criteria?**

Yield refers to the amount of water that can be extracted or produced from the GWBU. Determining acceptable yield will be most straightforward if there are state or local criteria to this effect. If a determination can be made that the GWBU does not have
sufficient yield, then consideration could be given to developing an alternative standard reflecting that the groundwater is not a potential source of drinking water. An adjustment used in some jurisdictions is to increase the alternative standard using a multiplier.

**Step 2c. Is there a current or future potential that groundwater in the GWBU could be used for drinking water?**

The current and potential future use of groundwater in the vicinity of a CCP MU site can be evaluated to determine whether groundwater is used for residential or non-residential purposes, and whether any activity and use restrictions exist that restrict the use of groundwater for drinking water. If groundwater will not be used as a residential drinking water supply, then it may be appropriate to develop an alternative standard that is based on non-residential uses. This is typically accomplished by using exposure assumptions relevant to the long-term downgradient land use if there is any potential for groundwater usage. If there is no potential for groundwater usage, for example if the CCP MU abuts a river, then alternative standards based on surface water ecological receptors may be appropriate.

**Attenuation Considerations**

**Step 3. Is there potential for significant attenuation between the POC and point of exposure (POE)?**

This step is not relevant if the POC and POE are the same. In the CCR Rule, the POC is at the waste boundary of the CCP MU. However, the waste boundary can be some distance from the POE, whether that point is a drinking water well or the property boundary. Since health-based drinking water levels assume that the water is at the POE, a more relevant assessment of risk would evaluate risk potential at the POE. The relevant location is site specific, and in other regulatory applications the property boundary is often used as a relevant POE for determining the need for corrective action. In this case, the alternative standards could be adjusted to account for attenuation between the POC and POE.

*Implement groundwater monitoring to verify attenuation assumptions.*

This step is not relevant if the POC and POE are the same. Additional groundwater monitoring can be considered to verify that assumptions of attenuation between the POC and POE are achieved and to address the uncertainty associated with modeling future attenuation.
Description of Steps for Establishing an Alternative Standard for Surface Water

**Figure 2** Steps for Establishing an Alternative Standard for Surface Water. CCP MU = Coal Combustion Product Management Unit; POC = Point of Compliance; POE = Point of Exposure; US EPA = United States Environmental Protection Agency.

2. Site-specific assumptions may be needed to develop value.

**Human Health Considerations**

**Step 1. Does surface water currently serve as a drinking water source, and is it reasonably expected to be affected by constituents from the CCP MU at the drinking water intake point?**

If constituents from a CCP MU have the potential to affect the quality of surface water that can be used for drinking water, a state-established or other scientifically supportable health-based drinking water value can be used. This process is identical to the “Human Health Considerations” for groundwater described above. Even if a surface water criterion is developed based on a drinking water receptor, it would be appropriate to calculate an alternative standard based on surface water exposure for other receptors and use the most stringent value as the final alternative standard to ensure the developed value is protective of all receptors.
**Step 2. Is surface water in the vicinity of the CCP MU used for recreation or fishing?**

A surface water body may also be used for fishing or recreational use (i.e., swimming, wading, boating). Federal and state agencies often do not have established health-based criteria for recreational exposure scenarios because they are dependent on site-specific conditions that can alter the exposure assumption (i.e., climate, geography, location, land use). Resources and exposure inputs, however, are available from US EPA and other states' agencies to calculate health-based criteria for these pathways.

**Ecological Considerations**

**Step 3. Select an appropriate surface water criterion protective of ecological receptors.**

Surface water ecological criteria are developed to be protective of the growth, survival, and reproduction of aquatic receptors such as fish, amphibians, and benthic invertebrates, and may be available from several sources. Standard practice is to identify ecological criteria from any available sources that are applicable to the facility’s location, which may include state, regional, or federal criteria. The available criteria are then reviewed to determine the value that is the most relevant and supportable based on date, robustness of underlying dataset, and status (i.e., final vs. draft).

**Attenuation Considerations**

**Adjust standard to account for attenuation between the POC and POE.**

Once an appropriate surface water criterion is selected, the final alternative standard may need to account for attenuation between the POC and POE (e.g., surface water), and dilution, if allowed under the relevant regulatory authority, when groundwater discharges to surface water.
References
