OFFICE OF RESOURCE CONSERVATION AND RECOVERY

WASHINGTON, D.C. 20460

February 6, 2024

MEMORANDUM

SUBJECT: Integrating Climate Change Adaptation Considerations into the Resource Conservation and Recovery Act Corrective Action Process

FROM: Carolyn Hoskinson, Director Digitally signed by CAROLYN HOSKINSON Date: 2024.02.06 12:59:29 -05'00'

TO: Land, Chemicals, and Redevelopment Division Directors, Regions 1-10

PURPOSE

This memorandum[1] conveys the U.S. Environmental Protection Agency's (EPA or Agency) recommendations on how EPA regions and authorized states should work with RCRA facility owners or operators to integrate climate change adaptation considerations into the corrective action process under the Resource Conservation and Recovery Act (RCRA) of 1976 as amended by the Hazardous and Solid Waste Amendments (HSWA) of 1984.[2]

Corrective action is the process under which owners and operators of RCRA treatment, storage and disposal facilities investigate and clean up releases of hazardous waste and constituents into soil, ground water, surface water and air, as necessary to protect human health and the environment.

Climate change can increase the frequency and intensity of extreme weather events, such as heavy precipitation and storms; or can cause more gradual changes such as sea level rise. Seasonal changes in precipitation or temperatures, increasing risk of floods, increasing intensity and frequency of hurricanes and wildfires, and thawing of permafrost in northern regions are additional examples of climate-related changes which could impact RCRA cleanups. These changes can lead to the release of

[1]This document provides recommendations to regional staff and management, as well as state hazardous waste programs authorized under RCRA, regarding how to approach the RCRA corrective action process with respect to climate adaptation. This document does not substitute for applicable statutory or regulatory requirements, nor is it a regulation itself. Thus, it cannot impose legally binding requirements on EPA, states, or the regulated community, and may not apply to a particular situation depending upon the circumstances. Any decisions regarding a particular situation will be made based on the statute and the regulations, and EPA and authorized state decision makers retain the discretion to adopt approaches on a site-specific basis that differ from these recommendations where appropriate.

[2]42 USC §6924 et seq.

hazardous waste or constituents from, or interfere with the operation of remedies at, RCRA corrective action cleanups. Such impacts can pose increased threats to human health and the environment, thereby supporting the need to integrate climate adaptation considerations into RCRA corrective action cleanups.

Although this memorandum addresses integrating climate adaptation into the corrective action process, the Agency also encourages considering climate mitigation, e.g., green remediation strategies, in the RCRA corrective action process, while, of course, assuring that each cleanup is protective.

This memorandum supplements the Agency's existing policy statements and guidance addressing RCRA corrective action cleanups,[3] including guidance on RCRA Corrective Action Decision Documents.[4] However, it does not amend or modify RCRA regulations in any way.

Definitions of key terms pertaining to climate adaptation used in this memorandum and a list of additional resources are included in the Attachment.

BACKGROUND

EPA released a Climate Adaptation Plan (CAP) in October 2021 which laid out five priority actions for the agency to implement in the coming years, including integrating consideration of climate impacts into EPA's programs, policies, rulemaking processes, and enforcement activities.[5]

In October 2022, EPA's Office of Land and Emergency Management (OLEM) released its Climate Adaptation Implementation Plan which included the commitment to develop a memorandum that calls for climate change impacts to be considered as part of the corrective action process for any necessary corrective action at RCRA treatment, storage, and disposal facilities.

Incorporating climate adaptation considerations into the corrective action process for RCRA cleanups will ensure that remedies remain effective and prevent the migration of hazardous waste or constituents. These considerations should be factored into the corrective action process consistent with existing EPA guidance that applies to RCRA corrective action cleanups.[6]

LEGAL AUTHORITY

Under RCRA section 3004(u), each RCRA permit must require corrective action for all releases of hazardous waste or constituents from any solid waste management unit at the permitted facility. EPA has codified this requirement at 40 CFR § 264.101(a) and (b), which specify that permits shall require corrective action as necessary to protect human health and the environment. RCRA section 3004(v) requires corrective action beyond the facility boundary where necessary to protect human health and the environment; EPA has codified this requirement at 40 CFR § 264.101(c). RCRA section 3008(h)

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[3]For additional information, see https://www.epa.gov/hw/documents-pertaining-remedy-implementation-corrective-action-sites

[4]Guidance on RCRA Corrective Action Decision Documents: Statement of Basis and Response to Comments (PDF): https://www.epa.gov/sites/default/files/2013-10/documents/rcradecisiodoc-mem.pdf

[5]For additional information, see https://www.epa.gov/climate-adaptation/climate-adaptation-plan

[6]Policies and Guidance Documents that Provide EPA and Authorized States with Assistance Regarding Corrective Action: https://www.epa.gov/rcra/policies-and-guidance-documents-resource-conservation-and-recovery-act-rcra-state-authorization

authorizes EPA to issue orders requiring corrective action as necessary to protect human health and the environment to addresses releases of hazardous waste from facilities that have interim status, facilities that should have had interim status, and facilities that have lost interim status through actions (or a failure to take action) of the owner or operator of the facility. Most states have been authorized for 40 CFR § 264.101, which codifies the permitting corrective action authority in RCRA sections 3004(u) and (v); EPA has not authorized states for RCRA section 3008(h) authorities, which EPA implements. In addition to these corrective action specific authorities, the RCRA "omnibus" permit authority requires EPA and authorized states to include in permits such terms and conditions as EPA or the state determines necessary to protect human health and the environment. RCRA section 3005(c)(3); 40 CFR § 270.32(b)(2).

Under these authorities, EPA, or authorized states, are empowered to impose corrective action requirements that will be protective of human health and the environment taking into account potential climate impacts on the effectiveness of cleanups over time.

CLIMATE ADAPTATION CONSIDERATIONS IN THE CORRECTIVE ACTION PROCESS

EPA regions and authorized states should work with RCRA facility owners and operators during the RCRA corrective action process to identify and address climate-related risks to ensure protection of human health and the environment. Particular consideration should be given to ensuring long-term reliability and effectiveness of selected remedies.

EPA regions and authorized states should consider climate-related risks as they implement the RCRA corrective action process. Considerations for recommended steps in the process are discussed below, although a screening and, if necessary, an assessment, could be implemented at any appropriate point in the corrective action process.

1. **RCRA Facility Assessment, RCRA Facility Investigation, and/or Corrective Measures Study**

   1.1 Climate Vulnerability Screening: EPA Regions and authorized states should work with facility owners and operators to screen RCRA corrective action facilities' vulnerability to any potential climate change impacts that may be relevant, such as:

   Temperature changes: Rising temperatures can influence the efficiency of certain cleanup technologies and treatment processes. It is important to consider how temperature variations might impact the overall vulnerability of RCRA corrective action cleanups to temperature changes.

   Precipitation patterns: Changes in long-term precipitation patterns, including increased rainfall, snow and hail, or prolonged droughts, can affect groundwater elevations and movement and the transport and fate of contaminants at RCRA corrective action cleanups. Where a vulnerability screening indicates the potential for impacts, analyzing potential changes in precipitation in a climate vulnerability assessment will be helpful in understanding how the fate and transport of contaminants may be impacted.

   Sea level rise: If RCRA corrective action cleanups are located in coastal areas, sea level rise caused by climate change can pose significant challenges. Where sea level rise may cause impacts, assessing the potential extent of sea level rise and its impacts on facility

infrastructure, groundwater levels, shoreline erosion, effects of storm surges, and potential contaminant migration can be crucial.

Long-term changes in weather patterns: Reviewing climate models and trends will help identify potential long-term changes in weather patterns, such as shifts in seasons, increased frequency of heatwaves, wildfires, permafrost thaw, or altered storm tracks. These alterations can have indirect impacts on the effectiveness of cleanup activities.

1.2 Climate Vulnerability Assessment: Once the climate vulnerability screening is complete, if there are climate change impacts that could plausibly impact a corrective action cleanup, EPA regions and authorized states may require the facility owners or operators to conduct a climate vulnerability assessment, as appropriate and necessary for the facility's specific circumstances.[7]

2. Remedy Selection

EPA proposed a regulation in 1990 to expand on the codification of RCRA 3004(u) and (v) in 40 CFR § 264.101. 55 FR 30798 (July 27, 1990). The proposal included nine remedy selection criteria. EPA did not finalize that regulation but uses the nine proposed criteria as guidance in remedy selection. 61 FR 19432, 19449 (May 1, 1996).

Following this guidance, selection of final remedies for RCRA corrective action cleanups typically includes a two-phased evaluation. During the first phase, potential remedies are screened to see if they meet four "remedy threshold criteria": (1) be protective of human health and the environment; (2) attain media cleanup standards; (3) control the source(s) of releases so as to reduce or eliminate, to the extent practicable, further releases of hazardous waste and hazardous constituents that might pose threats to human health and the environment; and (4) comply with applicable standards for waste management. Remedies which meet the threshold criteria are then evaluated using five "balancing criteria" to identify the remedy that provides the best relative combination of attributes: (1) Long-term reliability and effectiveness; (2) reduction of toxicity, mobility or volume of wastes; (3) short-term effectiveness; (4) implementability; and (5) cost.

During remedy selection, the adaptive capacity of the remedial alternatives to potential adverse impacts of climate change should be considered, as relevant based on the climate vulnerability assessment. Consideration should be given to building adaptive approaches into remedies, so that the remedies can be evaluated and adjusted over time, if necessary, based on updated climate-related information. Where climate-related risks are a concern, such risks might weigh in favor of selecting remedies that leave less waste in place.

3. Remedy Implementation

During remedy implementation for RCRA corrective action cleanups, EPA regions and authorized states should work with facility owners or operators to ensure that adaptation

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[7]Vulnerability Assessment: https://www.epa.gov/superfund/superfund-climate-resilience-vulnerability-assessment#vulnerability

measures are implemented to ensure the long-term integrity of constructed remedies and their protectiveness of human health and the environment, consistent with any adaptive approaches included in the remedies and with authorities for the modification of remedies. Multiple adaptation measures may be appropriate based on evaluation on a case-by-case basis.

4. **Long-Term Stewardship**
   For remedies already in place, long-term stewardship reviews can provide opportunities to assess the adaptive capacity of the remedy considering new information regarding potential (or actual observed) climate change impacts. Any vulnerabilities identified that may not have been known during remedy selection should be considered and addressed as appropriate, consistent with any adaptive approaches included in the remedies and with authorities for the modification of remedies.

EXAMPLES OF CLIMATE ADAPTATION STRATEGIES THAT CAN BE IMPLEMENTED IN THE CORRECTIVE ACTION PROCESS

A facility-by-facility analysis is required to properly determine the specific climate-related risks that may need to be mitigated for each corrective action. Measures[8] that can be taken to address climate-related risks include:

- Constructing physical barriers to contain contaminants (e.g., sand cap, retaining wall) that are impervious to the identified climate threat (e.g., flooding, intense storms, fire).
- Placing engineering controls (e.g., pumps, electrical equipment) that are necessary for properly managing and containing hazardous wastes or constituents in locations not likely to be impacted by identified climate threats.
- Designing containment, monitoring and treatment systems, and subgrade infrastructure to withstand changing conditions from identified climate threats.
- Designing caps to be impervious to identified threats, e.g., by use of drought-resistant plants for a vegetated soil cap for long-term erosion control.
- Incorporating climate resilience into the design and construction of waste containment systems, infrastructure, and remediation technologies.
- Considering flexible and adaptive design approaches to accommodate changing climate conditions.
- Implementing measures to enhance resilience, such as reinforced barriers, improved stormwater management, or enhanced erosion control.
- Establishing or enhancing monitoring systems, including those for groundwater, air quality and weather, by integrating parameters to detect climate-related changes and potential impacts on cleanups.
- Developing early warning systems to anticipate and respond to climate-related events that may affect facility integrity or increase the risk of releases of hazardous wastes or constituents.
- Implementing adaptive management approaches that allow for adjustments to remediation strategies based on changing climate conditions.

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[8]Adapted from Vulnerability of Waste Infrastructure to Climate Induced Impacts in Coastal Communities: https://www.epa.gov/sites/default/files/2019-11/documents/vulnerability_of_waste_infrastructure_to_climate_induced_impacts_in_coastal_communities.pdf

- Regularly reassessing the effectiveness of remedies considering climate change impacts and adapting as necessary.
- Developing contingency plans to address potential climate-related disruptions to remediation efforts.

Additional examples of climate adaptation strategies may be found in the resources list in the Attachment.

CONCLUSION

Integrating climate change adaptation considerations into the RCRA corrective action process provides for the protection of human health and the environment by ensuring the integrity and effectiveness of the remedy and preventing or limiting exposure to hazardous wastes or constituents.

Throughout the RCRA corrective action process, EPA regions and authorized states should work with owners or operators to ensure that climate adaptation considerations that ensure protection of human health and the environment are implemented.

EPA regions and authorized states should continue to use the existing corrective action process consistent with RCRA and relevant EPA guidance and policies.

If you have questions about this memorandum or would like assistance with evaluating climate vulnerabilities and adaptation strategies during the RCRA corrective action process, please contact Seun Akinlotan (akinlotan.seun@epa.gov), Office of Resource Conservation and Recovery (ORCR).

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ATTACHMENT

KEY TERMS PERTAINING TO CLIMATE ADAPTATION

For purposes of this memorandum, key terminology[9, 10] includes:

Climate change or climate adaptation means taking action to prepare for and adjust to both the current and projected impacts of climate change.

Adaptive capacity is the ability of a human or natural system to adjust to climate change (including climate variability and extremes) by moderating potential damages, taking advantage of opportunities, or coping with the consequences.

Climate change refers to changes in global or regional climate patterns attributed largely to human-caused increased levels of atmospheric greenhouse gases.

Resilience can be generally defined as the capacity of a system to maintain function in the face of stresses imposed by climate change and to adapt the system to be better prepared for future climate impacts.

Vulnerability means the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes; it is a function of the character, magnitude, and rate of climate variation to which a system is exposed; its sensitivity; and its adaptive capacity.

ADDITIONAL RESOURCES

1. The U.S. Climate Resilience Toolkit: A Platform Designed to Help People Find and Use Tools, Information, and Subject Matter Expertise to Build Climate Resilience. (https://toolkit.climate.gov/#steps).
2. EPA's Adaptation Actions for Protecting Waste Facilities. (https://www.epa.gov/arc-x/adaptation-actions-protecting-waste-facilities#tab-1).
3. EPA Superfund Climate Resilience Technical Fact Sheet: Groundwater Remediation Systems (https://semspub.epa.gov/work/11/175851.pdf).
4. EPA Superfund Climate Resilience Technical Fact Sheet: Contaminated Sediment Sites. (https://semspub.epa.gov/work/11/177110.pdf).
5. EPA Superfund Climate Resilience Technical Fact Sheet: Contaminated Waste Containment Systems. (https://www.epa.gov/sites/default/files/2019-12/documents/cr_containment_fact_sheet_2019_update.pdf).

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[9]Vocabulary Catalog; Topic: Climate Change; Publisher: EPA Office of Air and Radiation/Office of Atmospheric Programs/Climate Change Division.
https://sor.epa.gov/sor_internet/registry/termreg/searchandretrieve/glossariesandkeywordlists/search.do?details=&vocabName=Glossary%20Climate%20Change%20Terms#formTop

[10]Climate Adaptation and EPA's Role: https://www.epa.gov/climate-adaptation/climate-adaptation-and-epas-role

6. Superfund Climate Resilience: EPA's Superfund program approach addressing climate vulnerabilities as a standard operating practice in cleanup projects. (https://www.epa.gov/superfund/superfund-climate-resilience).
7. Fed Center Climate Adaptation Program Area: Federal government resource that supports federal agency climate adaptation planning. (https://www.fedcenter.gov/programs/climate/).