BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
	)	
	)	
STANDARDS FOR THE DISPOSAL OF	)	**R20-19**
COAL COMBUSTION RESIDUALS	)	**(Rulemaking – Land)**
IN SURFACE IMPOUNDMENTS:	)	
PROPOSED NEW 35 ILL. ADM. CODE 845	)	

NOTICE OF FILING

To: ALL PARTIES ON THE ATTACHED SERVICE LIST

PLEASE TAKE NOTICE that I have today filed with the Office of the Clerk of the Pollution Control Board **Dynegy's Prefiled Questions for the Environmental Law & Policy Center, Prairie Rivers Network and Sierra Club**, copies of which are herewith served upon you.

Respectfully submitted,

/s/ Ryan C. Granholm
Ryan C. Granholm

Dated: September 10, 2020

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Dynegy's Prefiled Questions for the Environmental Law & Policy Center, Prairie Rivers Network and Sierra Club

NOW COMES Dynegy Midwest Generation, LLC; Electric Energy Inc., Illinois Power Generating Company; Illinois Power Resources Generating, LLC; and Kincaid Generation, LLC (collectively, "Dynegy") by their attorneys, Schiff Hardin LLP, pursuant to the Hearing Officer's July 14, 2020 Order and 35 Ill. Adm. Code 102.430, and hereby submit prefiled questions for the Environmental Law & Policy Center's, Prairie Rivers Network's and Sierra Club's Witnesses. Dynegy respectfully request that the Hearing Officer allow follow-up questioning to be asked at hearing based on the answers provided.

Questions for Mr. Andrew Rehn

1. During your time working at Prairie Rivers Network ("PRN"), has it promoted the regulation of CCR surface impoundments to members of the Illinois General Assembly?

    a. If not, are you aware of other environmental groups, nonprofit organizations, or representatives thereof promoting the regulation of CCR surface impoundments to members of the Illinois General Assembly?

2. During your time working at PRN, has it advocated for an amendment to the Illinois Environmental Protection Act to regulate CCR surface impoundments?

    a. If not, are you aware of other environmental groups, nonprofit organizations, or representatives thereof advocating for an amendment to the Illinois Environmental Protection Act to regulate CCR surface impoundments?

    b. Are you aware of Earthjustice advocating for such an amendment?

3. Did PRN recommend that the General Assembly mandate closure by removal when a CCR surface impoundment fails a location restriction or is located within a floodplain?

    a. If not, are you aware of other environmental groups, nonprofit organizations, or representatives thereof recommending that the General Assembly mandate closure by removal when a CCR surface impoundment fails a location restriction or is located within a floodplain?

    b. Are you aware of Earthjustice recommending such an amendment?

4. During your time working at PRN, are you aware whether any bills or amendments were considered by the Illinois Legislature, or any of its members, that would have explicitly required closure by removal when a CCR surface impoundment fails a location restriction or is located within a floodplain?

    a. For example, are you aware that Sen. Bennett filed such an amendment on or about March 15, 2019? *Available at* https://www.ilga.gov/legislation/101/SB/10100SB0009sam001.htm? (attached as Appendix A).

    b. Section 15(a) (Appendix A, p. 5-6) of that amendment would have required closure by removal for all CCR surface impoundments that did not meet the "location standards" described in that amendment, correct?

    c. Section 5 (Appendix A, p. 2-3) defined "location standards" to include "a prohibition on being located, in whole or in part, in the 100-year floodplain," correct?

5. As you understand it, does the legislation ultimately passed by the Illinois General Assembly and signed by the Governor—P.A. 101-0171—explicitly require closure by removal when a CCR surface impoundment fails a location restriction or is located within a floodplain?

6. Have you determined what it would cost to perform closure by removal for all CCR surface impoundments located within a floodplain, failing the aquifer separation location restriction, or where in intermittent, reoccurring or constant contact with groundwater?

    a. If so, what are the costs?

7. Have you determined whether there is sufficient existing operating landfill capacity to accommodate all of the CCR that would have to be excavated if removal is required for every CCR surface impoundment is located within a floodplain, failing the aquifer separation location restriction, or in intermittent, reoccurring or constant contact with groundwater?

    a. If so, please describe your methodology?

8. Have you determined how many trucks, trains, barges, etc. would be required to transport all of the ash removed if removal is required in every situation where a CCR surface impoundment is located within a floodplain, fails the aquifer separation location restriction, or where there is intermittent, reoccurring or constant contact with groundwater?

Questions for Joint Testimony of Dr. Scott Payne and Mr. Ian Magruder

1. Did IEPA review each of the hydrogeologic characterization reports and groundwater models you discussed in the "Problem Statement" of your testimony?

2. Did IEPA approve the CCR surface impoundment closures associated with the hydrogeologic characterization reports and groundwater models you discussed in the "Problem Statement" of your testimony?

3. Were the groundwater models submitted to the Agency for Hennepin East Ash Pond No. 2, Meredosia, and Wood River sufficient for IEPA to properly evaluate the proposed closures of the CCR surface impoundments?

4. Is the groundwater modeling required by proposed Part 845, as currently drafted, sufficient to evaluate how long it will take each proposed closure to achieve the groundwater protection standards?

5. Is the groundwater modeling required by proposed Part 845, as currently drafted, sufficient to evaluate whether a groundwater corrective action will achieve compliance with the proposed groundwater protection standards?

6. Does IEPA have experience reviewing groundwater models?

7. Is it common for groundwater models to be revised in response to comments from regulatory agencies, such as IEPA?

8. Is it possible to construct a groundwater model without making any assumptions?

    a. Have you ever constructed a groundwater model that contained no assumptions?

    b. Have you ever reviewed a groundwater model used for a site cleanup, remediation, or closure that contained no assumptions?

    c. If a groundwater model contains assumptions, how should one determine which assumptions are acceptable and which are not?

    d. Does IEPA have sufficient experience to make such a determination?

9. Is a groundwater model ever 100% accurate?

10. Will a comparison of post-closure sampling data with pre-closure modeling predictions provide useful information regarding the accuracy of a groundwater model?

11. According to page 11 of Mr. Rehn's pre-filed testimony, Attachment 21 to his testimony was presented by Mr. Rick Cobb of the Illinois Environmental Protection Agency, right?

12. Do you have any reason to question the validity of the information contained in Attachment 21 of Mr. Rehn's pre-filed testimony?

13. According to slide 2 of Attachment 21 of Mr. Rehen's pre-filed testimony, an impoundment at the Havana power station was closed in 1993, correct?

14. According to slide 2 of Attachment 21 of Mr. Rehen's pre-filed testimony (Havana), the blue line is the modeled boron concentration after closure, and the green line is the observed concentration after closure, correct?

    a. Do you understand observed concentration to refer to actual groundwater sampling data?

    b. Do you agree that the sampling concentrations observed after closure were consistent with or lower than the concentrations predicted by the model?

    c. This model was sufficient to evaluate how long it would take the proposed closure to achieve the groundwater standard for boron, right?

    d. This model was sufficient to evaluate whether the groundwater corrective action would achieve compliance with the groundwater standard for boron, right?

15. According to slide 3 of Attachment 21 of Mr. Rehen's pre-filed testimony the impoundment at the Venice Power Station was closed in place with a geosynthetic cap, correct?

    a. According to IEPA the groundwater was intermittently intersecting with the CCR in the impoundment at Venice, right?

    b. What do you understand the phrase "intermittent intersecting groundwater" as used in the slide to mean?

    c. According to this slide, the yellow line represents the modeled concentration of boron and the blue line represents the observed concentration of boron, correct?

    d. Do you agree that the sampling concentrations post closure were consistent with or lower than the modeled concentration?

    e. This model was sufficient to evaluate how long it would take the proposed closure to achieve the groundwater standard for boron, right?

    f. This model was sufficient to evaluate whether the groundwater corrective action would achieve compliance with the groundwater standard for boron, right?

16. When performing your critique of the groundwater models in the "Problem Statement" of your testimony, did you review any post-closure groundwater sampling data to evaluate whether the models accurately predicted groundwater concentrations?

17. For Hennepin East you only reviewed the 2017 groundwater model, right?

18. Are you aware that additional modeling for Hennepin East was performed in 2018, 2019, and 2020?

19. Did you consider whether any of the concerns raised in your pre-filed testimony were addressed in the October 25, 2018 Closure Plan Addendum for Hennepin East?

20. Did you consider whether any of the concerns raised in your pre-filed testimony were addressed in the July 22, 2019 Response to IEPA Comments for Hennepin East?

21. Did you consider whether any of the concerns raised in your pre-filed testimony were addressed in the January 15, 2020 River Flood Evaluation Report for Hennepin East?

22. Did you consider the cost implications of having to collect the additional data you are advocating for in your pre-filed testimony?

23. Did you consider the cost implications of performing groundwater modeling consistent with the positions taken in your pre-filed testimony?

24. Did you perform any analyses to determine whether the additional data and modeling inputs you are advocating for are necessary to evaluate how long it will take each proposed closure alternative to achieve the groundwater protection standards?

25. Did you perform any analyses to determine whether the additional data and modeling inputs you are advocating for are necessary to evaluate whether a groundwater corrective action will achieve compliance with the groundwater protection standards?

26. Did you perform any analyses to determine whether the additional data or modeling inputs you advocate for would have changed the predictive ability of the models you critiqued in your "Problem Statement"?

27. Did you perform any analyses to determine whether the additional data or modeling inputs you advocate for would have changed the ability of the models you critiqued in your "Problem Statement" to predict how long it will take to achieve the groundwater standards after closure has been implemented?

    a. If yes, please provide a comparison of your results to the original models.

28. Did you perform any analyses to determine whether the additional data or modeling inputs you advocate for would have changed the ability of the models you critiqued in your "Problem Statement" to predict whether a closure will achieve the groundwater standards?

    a. If yes, please provide a comparison of your results to the original models.

29. Are model properties and boundaries usually adjusted during model calibration?

30. Do the constituent concentrations in CCR in a surface impoundment deplete over time?

31. Does the source concentration in a CCR surface impoundment deplete over time when CCR is in intermittent, reoccurring, or constant contact with groundwater?

32. Do you agree that groundwater sampled today was impacted by CCR constituents that leached from an impoundment sometime in the past?

33. Using the present day leachate concentration in a groundwater model could potentially underestimate the impact of higher initial concentrations that have declined as the leachate concentrations of the CCR was depleted over time, right?

34. Using a constant constituent concentration from a CCR source in a groundwater model could potentially overestimate the future impact to groundwater, right?

35. On page 19 of your testimony, you refer to CCR in some situations as a "perpetual source" for leachate constituents such as boron.

    a. Is a "perpetual source" one that supplies leachate constituents to groundwater at a constant concentration for an unlimited amount of time?

    b. Have you performed an analysis demonstrating that CCR could contain a sufficient mass of leachate constituents to behave as a perpetual source?

Questions for Mr. Mark Hutson

1. Groundwater corrective action under the federal CCR Rule is required only when there is an exceedance of a groundwater protection standard, right?

2. Groundwater corrective action under IEPA's proposed Part 845 is required only when there is an exceedance of a groundwater protection standard, right?

3. The groundwater protection standards proposed in Part 845 provide a threshold to determine when degradation of groundwater from CCR surface impoundments is unacceptable, right?

4. The groundwater protection standards proposed in Part 845 are intended to assure protection of human health and the environment, right?

5. Is it your opinion that Part 845 should preclude any release to groundwater of CCR constituents, even if that release does not result in an exceedance of a groundwater protection standard?

6. In general, are consideration of future risk and the assessment of risk important factors when selecting and designing remedial actions?

7. Do site-specific conditions and characteristics typically inform which remedial actions will be effective at a site?

8. Is it important to evaluate current and potential future risks when evaluating and selecting closure alternatives at CCR surface impoundments?

9. Is it your opinion that closure by removal is the only closure alternative that is protective of human health and the environment at CCR surface impoundments that are not "isolated from water"?

10. Are there risks to workers and the community associated with closure by removal?

11. Do you believe there are scenarios where an unlined CCR surface impoundment that is not "isolated from water" can be capped in a way that is protective of human health and the environment?

12. Are all floodplains "unstable" areas?

13. If a CCR surface impoundment is located within a floodplain, existing Illinois regulations require that it must be, at a minimum, kept "in good repair," correct? *See* 17 Ill. Adm. Code § 3702.30.

14. If a CCR surface impoundment is located within a floodplain, is the owner/operator required to demonstrate that a release of material will not occur if the unit becomes inundated? *See* Section 845.110(b)(1)(A); 17 Ill. Adm. Code § 3706.630 ("Storage of materials likely to cause water pollution, in the event of flooding, is prohibited unless

adequate safeguards approved by the Illinois Environmental Protection Agency are provided.").

15. Do you believe there are scenarios where an unlined CCR surface impoundment located within a floodplain can be capped in a way that is protective of human health and the environment?

16. Do you believe there are scenarios where an unlined CCR surface impoundment that has failed a location restriction can be capped in a way that is protective of human health and the environment?

17. Do you believe there are scenarios where an unlined CCR surface impoundment that has a bottom located within 5 feet of the uppermost aquifer can be capped in a way that is protective of human health and the environment?

18. Do you believe there are scenarios where a CCR surface impoundment located in an "unstable area" can be capped in a way that is protective of human health and the environment?

19. Does proposed Section 845.710 present a structure for evaluating risks to human health and the environment when selecting a closure method for CCR surface impoundments?

20. Do proposed Section 845.710(b)(1)(B) and 845.710(b)(2) require owners/operators to assess the risk of future releases of CCR and constituents from CCR surface impoundments, including at sites with intersecting groundwater?

21. Do proposed Section 845.710(b)(1)(B) and 845.710(b)(2) require owners/operators to assess the risk of future releases of CCR, including at sites located within a floodplain?

22. Does proposed Section 845.710(b)(1)(E) require owners/operators to assess the time each proposed closure will take to achieve the groundwater protection standards, including at sites with intersecting groundwater?

23. Does proposed Section 845.710(b)(1)(F) require owners/operators to assess whether long-term contact of CCRs with groundwater is of concern?

24. Does proposed Section 845.710(b)(1)(G) require owners/operators to assess structural hazards posed by floodwaters when a CCR surface impoundment is located within a floodplain?

25. Do proposed Section 845.710(b)(1)(G) and 845.710(b)(3)(B) require an owner/operator to assess whether overtopping floodwaters present a reliability risk to a particular site?

26. Were IEPA's prior approvals of closure plans for CCR surface impoundments in Illinois sufficient to protect the quality of groundwater and surface water?

27. Do you agree that techniques such as groundwater modeling, site characterization, and risk assessment are widely accepted tools to evaluate closure alternatives for CCR surface impoundments?

    a. Do you agree that these techniques are employed by a variety of companies and engineering consultants across the country?

    b. Do you agree that these techniques are regularly requested and reviewed by state regulators?

28. Do municipal solid waste landfills store materials containing metals that are also found in coal combustion residuals?

29. Do the metals found in materials stored in municipal solid waste landfills biodegrade?

    a. If not, are those metals capable of leaching from solid waste landfills into Illinois' groundwater?

30. Do special and hazardous waste landfills store materials containing metals that are also found in coal combustion residuals?

31. Do the metals found in materials stored in special and hazardous waste landfills biodegrade?

    b. If not, are those metals capable of leaching from solid waste landfills into Illinois' groundwater?

32. Is it your belief that coal ash in an unlined impoundment will <u>always</u> come in intermittent, recurring, or sustained contact with groundwater when the impoundment is located within a floodplain?

    a. If not, what are some of the factors that determine whether coal ash within an unlined impoundment located within a floodplain will come in intermittent, recurring, or sustained contact with groundwater during a flood event?

33. Is it your belief that coal ash in an unlined impoundment will <u>always</u> come in intermittent, recurring, or sustained contact with groundwater when the bottom of the unlined impoundment is located within five feet of the uppermost aquifer?

    a. If not, what are some of the factors that determine whether the coal ash is expected to come in intermittent, recurring, or sustained contact with groundwater?

34. If the bottom of an unlined CCR surface impoundment is located within 5 feet of the seasonal high groundwater elevation, including any perched water zones, irrespective of whether the water-bearing unit is classified as an aquifer, will groundwater <u>always</u> come in intermittent, reoccurring or constant contact with ash?

a. If not, what are some of the factors that determine whether the coal ash is expected to come in intermittent, recurring, or sustained contact with groundwater?

35. Is it your belief that coal ash in an unlined impoundment that is located within a floodplain will always result in an exceedance of the groundwater protection standards?

36. Is it your belief that coal ash in an unlined impoundment that is in intermittent contact with groundwater will always result in an exceedance of the groundwater protection standards?

37. Is it your belief that coal ash in an unlined impoundment that is in reoccurring contact with groundwater will always result in an exceedance of the groundwater protection standards?

38. Is it your belief that coal ash in an unlined impoundment that is in constant contact with groundwater will always result in an exceedance of the groundwater protection standards?

39. What are some of the factors that determine the rate of groundwater flowing through an unlined impoundment where the bottom of the impoundment is located below the water table?

40. What are some of the factors that determine the rate of groundwater flowing through an unlined impoundment during flood events?

41. What are some of the factors that determine the contaminant loading to groundwater from coal ash when a CCR surface impoundment is unlined and coal is in intermittent contact with groundwater?

42. What are some of the factors that determine the contaminant loading to groundwater from coal ash when a CCR surface impoundment is unlined and coal is in reoccurring contact with groundwater?

43. What are some of the factors that determine the contaminant loading to groundwater from coal ash when a CCR surface impoundment is unlined and coal is in constant contact with groundwater?

44. On page 7 of your pre-filed testimony you state that "without a clear and specific prohibition on leaving CCR in contact with groundwater, owners/operators are free to propose CCR unit closures that fail to contain CCR constituents. . . ."

a. Does proposed Section 845.710 require owners/operators to evaluate the "effectiveness of the closure method in controlling future releases?"

b. Does proposed Section 845.710 require owners/operators to propose a closure method that will "achieve compliance with the groundwater protection standards in Section 845.600?"

c. Does proposed Part 845 require IEPA to review and approve all closure plans?

d. Under proposed Part 845, is an owner/operator free to implement any closure plan it chooses?

45. On page 10 of your pre-filed testimony you raise concerns with CCR surface impoundments located in floodplains along river channels. Do those same concerns exist when a CCR surface impoundment is not located along a river channel, but instead in a floodplain along a lake or pond?

46. On page 10 of your pre-filed testimony you discuss rising floodwaters in Wilmington, North Carolina and allege they inundated coal ash storage and disposal units.

a. Are you aware of any such examples in Illinois of rising floodwaters inundating CCR surface impoundments?

b. The rising floodwaters that you allege inundated coal ash storage and disposal units in Wilmington, North Carolina in 2018 were associated with a hurricane, correct?

47. Was the photo included on page 11 of your pre-filed testimony obtained from a Washington Post article available at the following link: www.washingtonpost.com/energy-environment/2018/09/21/dam-breach-reported-former-nc-coal-plant-raising-fears-that-toxic-coal-ash-may-pollute-cape-fear-river ?

48. The article states that the photo "shows flooding . . . overtopping an earthen dike . . . ." Do you have any information demonstrating that the photo included in your testimony depicts an ash pond breach or water flowing in/out of an ash pond?

a. If so, identify the source and provide a description of the information.

49. On page 12 of your testimony you state that certain elements of groundwater monitoring systems are "often ignored . . . by regulators." Is it your opinion that IEPA has ignored certain elements of groundwater monitoring systems associated with CCR surface impoundments?

a. If so, please provide examples.

50. Is it your opinion that current IEPA approved groundwater monitoring systems associated with CCR surface impoundments are "inadequate to identify impacts to water quality from CCR surface impoundments"?

51. Does the collection of porewater sampling inform the design and construction of a final cover system for CCR surface impoundments?

52. Does the collection of porewater sampling support the development of an accurate approximation of the direction of groundwater flow?

53. Does the chemical composition of CCR influence how a CCR surface impoundment is closed?

    a. If so, please describe.

54. You propose adding iron, manganese, and vanadium to the list of groundwater protection standards. Are you aware that these three constituents were included in U.S. EPA's 2014 Risk Assessment?

    a. Are you aware that U.S. EPA did not identify any risks to either human or ecological receptors for any of these constituents?

55. Is it your opinion that IEPA's current proposal is insufficient to allow IEPA to effectively review and evaluate the groundwater data collected?

56. In forming your opinion, did you review any groundwater data collected from any sites in Illinois?

    a. If so, were you able to understand and interpret the data?

    b. If so, were you able to gain an understanding of the impacts to groundwater associated with CCR surface impoundments in Illinois?

57. Typically, in what portion of a sediment column does biological activity occur?

    a. What biological activity occurs in these sediments?

58. Are you aware that US EPA's 2014 Risk Assessment did not identify any unacceptable risks to surface waters or sediments associated with groundwater contamination from CCR surface impoundments?

59. Are sediment systems complex and dynamic?

60. Generally speaking, are sediments in rivers constantly moving down stream?

61. Does the Clean Water Act's point source discharge program allow dilution and dispersion to occur within "mixing zones" in receiving water bodies?

62. Is it appropriate to apply groundwater standards to surface waters?

63. On page 18 of your testimony you suggest that closure by removal should be required when there is less than 5-feet of vertical separation between the bottom of an impoundment and "the elevation of the seasonal high groundwater elevation, including any perched water zones, irrespective of whether the water-bearing unit is classified as an aquifer," correct?

    a. What is a "perched water zone"?

b. Generally speaking how close to the ground surface are perched water zones located along rivers in Illinois?

c. Have you identified the number of CCR surface impoundments in Illinois that would have to close by removal if the Board were to follow your recommendation regarding closure by removal for CCR surface impoundments located within 5 vertical feet of a perched water zone?

64. If the bottom of an unlined CCR surface impoundment is located within 5 feet of the seasonal high groundwater elevation, including any perched water zones, irrespective of whether the water-bearing unit is classified as an aquifer, will groundwater always come in intermittent, reoccurring or constant contact with ash?

65. Is 30 years the standard post-closure care period for hazardous and solid waste management units under the Resource Conservation and Recovery Act ("RCRA")?

66. Dilution and dispersion can reduce concentrations of dissolved compounds to levels below applicable groundwater standards, correct?

67. U.S. EPA guidance has established the below definition for the term "monitored natural attenuation," as used at CERLCA, RCRA Corrective Action, and Underground Storage Tank Sites, correct?

"...[t]he reliance on natural attenuation processes (within the context of a carefully controlled and monitored site cleanup approach) to achieve site-specific remediation objectives within a time frame that is reasonable compared to that offered by other more active methods. The 'natural attenuation processes' that are at work in such a remediation approach include a variety of physical, chemical, or biological processes that, under favorable conditions, act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in soil or groundwater. These in-situ processes include biodegradation; **dispersion; dilution**; sorption; volatilization; radioactive decay; and chemical or biological stabilization, transformation, or destruction of contaminants." U.S. EPA, Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites at 3 (Apr. 21, 1999) (emphasis added) (attached as Appendix B).

68. When placing additional coal ash for purposes of grading and contouring, does proposed Section 845.750(d) allow an owner/operator to place the additional coal ash in a manner that would allow the coal ash to be in contact with groundwater?

69. Do you agree that the placement of CCR above the water table during closure in accordance with Section 845.750(d) will not increase the magnitude/size of groundwater impacts?

70. Would consolidating coal ash from two impoundments into one reduce the coal ash footprint at a site?

a. Are there any potential benefits associated with this?

71. Have you determined what it would cost if removal is required for all CCR surface impoundments located within a floodplain, failing the aquifer separation location restriction, or in intermittent, reoccurring, or constant contact with groundwater?

    a. If so, what are the costs?

72. Have you determined whether there is sufficient existing operating landfill capacity to accommodate all of the ash that would have to be excavated if removal if required for all CCR surface impoundments located within a floodplain, failing the aquifer separation location restriction, or in is intermittent, reoccurring or constant contact with groundwater?

    a. If so, please describe your methodology?

73. Have you determined the environmental and community impacts if removal is required when all CCR surface impoundments located within a floodplain, failing the aquifer separation location restriction, or in intermittent, reoccurring or constant contact with groundwater?

    a. If so, please describe your methodology?

Respectfully submitted,

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CERTIFICATE OF SERVICE

I, the undersigned, certify that on this 10th day of September, 2020, I have served electronically the attached **Dynegy's Prefiled Questions for the Environmental Law & Policy Center, Prairie Rivers Network and Sierra Club**, upon the individuals on the attached service list. I further certify that my email address is rgranholm@schiffhardin.com; the number of pages in the email transmission is 101; and the email transmission took place today before 5:00 p.m.

Respectfully submitted,

/s/ Ryan C. Granholm
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Appendix A

Sen. Scott M. Bennett

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AMENDMENT TO SENATE BILL 9

AMENDMENT NO. _____. Amend Senate Bill 9 by replacing everything after the enacting clause with the following:

"Section 1. Short title. This Act may be cited as the Coal Ash Pollution Prevention Act.

Section 2. Findings and construction. The General Assembly finds that a clean environment is essential to the continuing growth and well-being of Illinois' economy and its people. This Act shall be interpreted broadly to prevent pollution from the many coal ash dumps threatening the public health and environment throughout Illinois. It is intended to be more stringent than federal requirements, which, at the time of this Act's enactment, continue to leave Illinoisans and our environment at risk.

Section 5. Definitions. In this Act:

"Agency" means the Illinois Environmental Protection Agency.

"CCR landfill" means an area of land or an excavation that receives, or has received, CCR and is not a CCR surface impoundment, underground injection well, salt dome formation, salt bed formation, underground or surface coal mine, or cave. "CCR landfill" includes CCR piles.

"CCR surface impoundment" means a natural topographic depression, man-made excavation, quarry, or diked area that (i) is designed, or has been used, to hold an accumulation of CCR and liquids, and (ii) treats, stores, or disposes of CCR, regardless of whether CCR continues to be added to the impoundment.

"CCR unit" means any CCR landfill, CCR surface impoundment, lateral expansion of a CCR unit, or combination of 2 or more of those units. "CCR unit" includes any CCR below the unit boundary of the CCR landfill or CCR surface impoundment.

"Coal combustion residuals" or "CCR" means fly ash, bottom ash, boiler slag, or flue gas desulfurization materials generated from burning coal for the purpose of generating electricity for sale by an electric utility or for use by a private corporation.

"CCR pile" means any non-containerized accumulation of solid, non-flowing CCR that is placed on the land, but does not include any CCR stored for beneficial use under subsection (c) of Section 40.

"CCR pollutants" means antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, fluoride, lead, lithium, mercury, molybdenum, selenium, thallium, and radium 226 and 228 combined.

"Director" means the Director of the Illinois Environmental Protection Agency.

"Encapsulated beneficial use" means a beneficial use of CCR that binds the CCR into a solid matrix and minimizes its mobilization into the surrounding environment.

"Lined CCR unit" means any CCR unit with a liner meeting the specifications of 40 C.F.R. 257.71(a)(1)(ii) or 257.71(a)(1)(iii).

"LEAF leach test" means the U.S. Environmental Protection Agency's Leaching Environmental Assessment Framework ("LEAF"), EPA Methods 1313 and 1314.

"Location standards" means:

For CCR surface impoundments, the location restrictions set out at 40 C.F.R. 257.60 through 257.64 as promulgated by the U.S. Environmental Protection Agency on April 17, 2015, in

"Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities," 80 Fed. Reg. 21,302, 21,471-21,473, as well as a prohibition on being located, in whole or in part, in the 100-year floodplain.

For CCR landfills, the location restriction for unstable areas set out at 40 C.F.R. 257.64 as promulgated by the U.S. Environmental Protection Agency on April 17, 2015, in

"Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities," 80 Fed. Reg. 21,302, 21,473, as well as a prohibition on being located, in whole or in part, in the 100-year floodplain.

"Operator" or "owner or operator" means any person that owns or operates, solely or with other persons, any CCR unit.

"Person" means any individual, partnership, co-partnership, firm, company, limited liability company, corporation, association, joint stock company, trust, estate, political subdivision, State agency, or any other legal entity, or their legal representative, agent, or assigns.

"Potential environmental justice community" means a community where the low-income or minority population percentage is greater than the statewide average.

"Prevailing wage" has the meaning given for "prevailing rate of wage" in Section 2 of the Prevailing Wage Act.

"Safety factors" means the factors of safety set out at 40 C.F.R 257.74(e)(i) through (v).

"Sole Source Aquifer" means an aquifer determined by the U.S. Environmental Protection Agency to be a Sole Source Aquifer under 1424(e) of the Safe Drinking Water Act of 1974. "Sole Source Aquifer" includes, but is not limited to, the Mahomet Aquifer.

"Statistically significant increase" means:

For CCR Pollutants for which a groundwater protection standard has been set by the U.S. Environmental Protection

Agency under 40 C.F.R. 257.95(h), any statistically

significant increase over that groundwater protection standard as determined under 40 C.F.R. 257.95(h).

For CCR Pollutants for which no groundwater protection standard has been set by the U.S. Environmental Protection Agency under 40 C.F.R. 257.95(h), a statistically significant increase, as determined under 40 C.F.R. 257.93(f),(g),and (h)(1), in that CCR pollutant above the Class I groundwater standard for that pollutant set out in Section 620.410 of Title 35 of the Illinois Administrative Code.

"Unlined CCR unit" means any CCR unit that is not a lined CCR unit.

Section 10. Powers and duties.

(a) Except as otherwise provided, the Agency shall enforce this Act and any rules, regulations, or orders adopted in accordance with this Act.

(b) Except as otherwise provided, the Agency shall have jurisdiction and authority over all persons and property necessary to effectively enforce the provisions of this Act. In aid of this jurisdiction, the Director, or anyone designated in writing by the Director, shall have the authority to administer oaths and to issue subpoenas for the production of records or other documents and for the attendance of witnesses at any proceedings of the Agency.

(c) The Agency may authorize any employee of the Agency

qualified by training and experience to perform the powers and duties set forth in this Act.

(d) For the purpose of determining compliance with the provisions of this Act and any orders or rules entered or adopted under this Act, the Agency shall have the right at all times to go upon and inspect properties where CCR is or has been generated, stored, disposed of, transported, or beneficially used.

(e) The Agency shall have the authority and it shall be the Agency's duty to make such inquiries as the Director may think proper to determine whether or not a violation of this Act or any orders or rules entered or adopted under this Act exists or is imminent. In the exercise of these powers, the Agency has the authority to:

(1) collect data;

(2) require testing and sampling;

(3) make investigation and inspection;

(4) examine properties, including records and logs;

(5) hold hearings;

(6) adopt administrative rules; and

(7) take any action reasonably necessary to enforce this Act.

(f) The Agency may specify the manner in which all information required under this Act is to be submitted.

(g) The Agency shall specify the fees to be submitted with all proposals required by this Act, including closure plans,

corrective action plans, applications for CCR transport permits, applications for beneficial use permits, and evaluation of alternatives analyses for landfill disposal of CCR. The fee to accompany those proposals shall be non-refundable and in an amount adequate to cover the costs the Agency incurs in reviewing and issuing or denying the proposal, including, but not limited to, the costs of:

(1) reviewing the proposal and accompanying materials, as well as any public comments or testimony offered on the proposal;

(2) holding a public hearing on the proposal in accordance with Section 65; and

(3) drafting the permit or the denial of the proposal.

The Agency shall review and, if necessary, revise the fees for proposals under this Act on an annual basis.

Section 15. CCR units; closure by removal.

(a) An owner or operator of an unlined CCR unit, as determined under subsection (d), a CCR unit that does not meet the location standards as determined under subsection (e), a CCR surface impoundment that does not meet the safety factors as determined under subsection (f), and a CCR unit at which a statistically significant increase in any CCR pollutant has been identified, shall close the CCR unit by:

(1) halting the placement of CCR in the CCR unit;

(2) removing all CCR from the CCR unit; and

(3) either:

(A) using the CCR in encapsulated beneficial use; or

(B) disposing of the CCR in a permitted landfill on the property upon which the CCR unit is located, adjacent to the property upon which the CCR unit is located, or off of the property on which the CCR unit is located, that:

(i) meets all location standards for CCR surface impoundments;

(ii) is not located over a sole source aquifer;

(iii) has a leachate collection system that meets or exceeds the federal criteria for a municipal solid waste landfills under 40 C.F.R. Part 258; and

(iv) meets all requirements for lined CCR landfills set forth at 40 C.F.R. Part 257 except as otherwise specified herein.

(b) An owner or operator of a CCR unit required to close by removal under subsection (a) shall, within 6 months of the effective date of this Act, halt the placement of CCR in those CCR units and begin removal of the CCR in those CCR units.

An owner or operator shall complete the removal of CCR from the CCR unit no later than 15 years after initiating the closure process at that CCR unit.

(c) The Agency shall issue a confirmation of completion of

closure before financial assurance under Section 75 may be released.

(d) Within 60 days after the effective date of this Act, the operator of a CCR unit shall submit to the Agency the following:

(1) a determination, prepared and certified by a professional engineer licensed in Illinois, specifying

whether the CCR unit meets the definition in this Act of a lined CCR unit; and

(2) documentation supporting that determination.

The determination and supporting documentation shall be posted on the Agency's website as well as a publicly accessible website that does not require registration and is operated by the operator of the CCR unit.

(e) Within 60 days after the effective date of this Act, an operator of a CCR unit must submit to the Agency the following:

(1) a determination, prepared and certified by a professional engineer licensed in Illinois, specifying whether the CCR unit meets the location standards, which of the location standards the CCR unit meets, and which it does not meet; and

(2) documentation supporting that determination.

The determination and supporting documentation shall be posted on the Agency's website as well as a publicly accessible website that does not require registration and is operated by the operator of the CCR unit.

(f) To determine whether a CCR surface impoundment meets the safety factors, a professional engineer licensed in Illinois shall assess whether the critical cross section of the embankment of the CCR surface impoundment achieves the safety factors. The safety factor assessments must be supported by appropriate engineering calculations. All safety factor assessments and supporting calculations and documentation shall be submitted to the Agency within 60 days after the effective date of this Act. The safety factor assessment and supporting documentation shall be posted on the Agency's website as well as a publicly accessible website operated by the operator of the CCR unit that does not require registration.

In this subsection, "critical cross section" means the cross section anticipated to be the most susceptible of all cross sections to structural failure based on appropriate engineering considerations, including loading conditions.

(g) If a person has information indicating that any liner status determination, location standards determination, or

safety factor assessment submitted by an operator under this Section inaccurately concludes that the CCR unit is a lined CCR unit, meets location standards, or meets the applicable safety factors, that person may submit that information to the Agency.

The Agency shall review the information submitted, provide it to the operator of the CCR unit at issue, and make a determination of whether the documentation submitted by the

operator is inaccurate. If the Agency so concludes, it shall inform the operator and the person who provided the information under this Section of that decision, post the decision on its website, and direct the operator of the CCR unit at issue to comply with applicable requirements of this Act.

Section 20. Closure plan.

(a) An operator of a CCR unit required to close by removal under Section 15 must submit a closure plan to the Agency within 3 months after the effective date of this Act.

(b) The closure plan must specify measures that the operator will take to limit water pollution and air pollution from the CCR unit while removal of the CCR is ongoing. Those measures shall include, but are not limited to, the following:

(1) Measures to control CCR dust at the site during removal, including, but not limited to: covering CCR transport trucks; limiting the distance that CCR is dropped from any storage facility or equipment into trucks or other storage facilities; using water sprays or chemical suppressants to limit dust during removal; loading, unloading, or transfer operations; and suspending loading, unloading, or transfer operations during high winds.

(2) Measures to minimize risk to workers while removal is taking place, including, but not limited to: properly located, calibrated, and operated dust monitors, checked at determined intervals; provision of dust masks and suits

for use during removal; enclosed areas set back from the

CCR unit where workers can store and change into regular clothing; protected areas for workers to take breaks or eat meals; and training for workers before they begin removal activities about the contents and dangers of CCR dust, how to protect against those dangers, and who to contact if dust controls are not working.

(3) Measures to minimize the release of any CCR into surface waters while removal is ongoing, which may include, but are not limited to, silt dams, silt curtains, or temporary barriers between the CCR unit and the surface water.

(c) Together with any supporting materials, the closure plan shall be posted by the Agency on its website and made available for public review, comment, and public hearing, if requested, consistent with Sections 55, 60, and 65. The owner or operator that submits the closure plan shall also post the closure plan and any supporting materials on a publicly accessible website, that has no registration requirements, until the Agency has issued an approved closure plan.

(d) The Agency shall only approve a closure plan if it complies with the requirements of this Act. The Agency shall review the closure plan and make any changes it deems necessary to ensure compliance with this Act. In evaluating whether any changes to the closure plan are needed, the Agency shall consider the following:

(1) The closure plan and all supporting documentation.

(2) All written comments received during the public comment period on the closure plan.

(3) If applicable, testimony from any public hearing held under Section 65.

Within 90 days after receiving the closure plan, the Agency shall approve the plan or approve it with any modifications the Agency deems necessary to ensure compliance with this Act. The Agency shall post the approved closure plan on its website, and the owner or operator who submits the closure plan shall post the approved closure plan on a publicly accessible website that has no registration requirements.

The Agency's approval of the approved closure plan under

this Section shall be considered a final administrative decision subject to judicial review under the Administrative Review Law and the rules adopted under that Law.

Section 25. Local workers.

(a) An entity conducting closure activities, including removal of CCR, transport of CCR, or corrective action to remediate CCR pollution as set forth in Sections 15, 30, and 50, shall, to the maximum extent practicable, utilize local labor and ensure that the work is performed by responsible contractors and subcontractors that pay workers, as evidenced by payroll and employee records, the prevailing wage and fair benefits, including employee health care coverage, pension or

401(k) benefits, and certified apprenticeship programs.

(b) A contractor or subcontractor shall keep a record of observing all local, State, and federal laws, including laws pertaining to withholding taxes, minimum and overtime wages, workers' compensation insurance, and occupational health and safety. A contractor working on the project shall keep an up-to-date list of its subcontractors.

Section 30. CCR transport.

(a) A CCR transport truck must carry manifests specifying, for each load of CCR transported, the following:

(1) The volume of the CCR.

(2) The location from which the CCR was loaded onto the truck and the date the loading took place.

(3) The location where the CCR is being taken and the date it will be delivered.

(4) A warning of the hazards of inhalation or ingestion of CCR, instructions on how to prevent inhalation or ingestion of CCR, and what to do if CCR is inhaled or ingested.

(b) The operator of a CCR unit from which CCR is removed and transported off-site under Section 15 shall develop a CCR transportation plan in consultation with the unit of local government in which the CCR unit is located and any unit of local government within 2 miles of the CCR units in order to

minimize the impact of any transport of CCR on adjacent

property owners and surrounding communities.

(c) The CCR transportation plan specified in subsection (b) shall do all of the following:

(1) Identify transportation options available in order to transport removed CCR from the CCR unit. This may include a combination of different transportation methods as necessary to meet the closure time frame established in Section 15.

(2) Specify plans for any transportation by truck, including the frequency, time of day, and route of truck travel, and measures to minimize noise, traffic, and safety concerns caused by the truck travel.

(3) Specify measures to limit fugitive dust from any transportation of CCR by truck. Measures to control fugitive dust from truck travel include, but are not limited to:

(A) regular maintenance of roads used for transport of CCR;

(B) restricting the speed of CCR transport trucks;

(C) covering CCR transport trucks;

(D) limiting the distance that CCR is dropped from any storage facilities or excavating equipment into trucks; and

(E) suspending the loading, unloading, or transfer of CCR during high winds.

(4) Specify measures to be used by CCR transport trucks

to limit air pollution from trucks, which include, but are not limited to:

(A) restrictions on fuel type;

(B) minimum fuel efficiency requirements;

(C) air pollution control equipment requirements; and

(D) limits on idling.

If transportation of CCR is not by truck, the owner or operator shall specify similar measures to control fugitive CCR dust pollution when it is transported using other modes of transportation.

(d) No CCR that is removed from a CCR unit may be transported without a CCR transport permit approved by the Agency.

(1) An operator of any CCR unit from which CCR is removed that seeks to transport that CCR off-site for disposal in an off-site landfill or through beneficial use shall, within 60 days after the effective date of this Act, submit an application for a CCR transport permit to the Agency. The permit application shall be accompanied by the fee required under subsection (g) of Section 10 and shall consist of the following additional materials:

(A) the CCR transportation plan developed under subsections (b) and (c); and

(B) a certification that the operator shall only transport CCR, or contract for transport with an entity

that will transport CCR, in accordance with the manifest requirements of subsection (a) as well as the CCR transportation plan.

(2) If the Agency determines that an application for a CCR transport permit satisfies the requirements of this Act, the Agency shall prepare a draft CCR transport permit within 60 days after receipt of the application for the CCR transport permit. The draft CCR transport permit shall:

(A) approve, disapprove, or approve with any conditions the Agency deems necessary the CCR transportation plan, which shall be incorporated as a condition of the CCR transport permit; and

(B) require compliance with the manifest requirements set out in subsection (a) as a condition of the CCR transport permit.

(3) Together with the permit application and any supporting materials, the draft CCR transport permit shall

be posted by the Agency on its website and made available for public review, comment, and, if requested, public hearing, consistent with Sections 55, 60, and 65. The applicant shall post the permit application, supporting materials, and draft CCR transport permit on a publicly accessible website that has no registration requirements and shall keep those documents posted until the Agency has issued a final CCR transport permit or denied the permit application.

(e) Within 120 days after receipt of an application for a CCR transport permit, the Agency shall determine whether to issue a final CCR transport permit. In determining whether to issue the permit, the Agency shall consider the following:

(1) The CCR transport permit application and all supporting documentation.

(2) All written comments received during the public comment period on the draft CCR transport permit.

(3) If applicable, testimony from any public hearing held under Section 65.

(f) The Agency shall only issue a final CCR transport permit if:

(1) the applicant has submitted a complete application for a CCR transport permit under paragraph (1) of subsection (d); and

(2) the CCR transportation plan meets the requirements under subsections (b) and (c).

(g) The final CCR transport permit shall, at minimum, comply with the following:

(1) incorporate the CCR transportation plan, with any modifications the Agency deems necessary, as a permit condition or conditions;

(2) require compliance with the manifest system set out in subsection (a) as a permit condition; and

(3) any other terms or conditions the Agency deems necessary.

The Agency shall post the final CCR transport permit or notice of denial of the CCR transport permit application on its website. The applicant shall post the final CCR transport permit or notice of denial on a publicly accessible website that has no registration requirements.

The Agency's decision to issue a final CCR transport permit or deny an application for a permit under this Section shall be considered a final administrative decision subject to judicial review under the Administrative Review Law and the rules adopted under that Law.

Section 35. Off-site landfill disposal.

(a) No CCR removed from a CCR unit under this Act may be disposed of in a landfill off of the property on which the CCR unit is located without approval from the Agency.

(b) If CCR removed from a CCR unit is to be disposed of in a landfill off of the property on which the CCR unit is located, the operator of the CCR unit must, within 90 days after the effective date of this Act, submit to the Agency an evaluation of alternatives accompanied by the fee required under subsection (g) of Section 10. The evaluation must conform with all of the following:

(1) Identify any landfills meeting the requirements of subparagraph (B) of paragraph (3) of subsection (a) of Section 15 that are within 100 miles of the CCR unit from which the CCR will be removed.

(2) Include documentation demonstrating that the landfill meets the requirements of subparagraph (B) of paragraph (3) of subsection (a) of Section 15.

(3) Set forth the demographics of the municipality, if applicable, where each landfill is located, including whether the municipality is a potential environmental justice community.

(4) State the volume of CCR that could be deposited in each landfill identified in paragraph (1).

(5) Identify the landfill in which the operator

proposes to dispose of CCR.

If the landfill proposed by the operator for CCR disposal is located in a potential environmental justice community, the operator must show that it is not technically feasible to dispose of the CCR in any other landfill within 100 miles of the CCR unit that meets the requirements of subparagraph (B) of paragraph (3) of subsection (a) of Section 15.

The Agency shall post the evaluation of alternatives and any supporting documentation on its website and make them available for public review, comment, and, if requested, public hearing in accordance with Sections 55, 60, and 65. The applicant shall post the evaluation of alternatives and supporting materials on a publicly accessible website that has no registration requirements.

(c) The Agency shall review the evaluation of alternatives. For the purpose of determining whether to approve the disposal

site proposed in the evaluation of alternatives, the Agency shall consider the following:

(1) The evaluation of alternatives and all supporting documentation.

(2) All written comments received during the public comment period.

(3) If applicable, testimony from any public hearing held under Section 65.

Within 90 days of receipt of the evaluation of alternatives, the Agency shall approve, deny, or approve with conditions the disposal of CCR in the landfill proposed by the operator in paragraph (5) of subsection (b).

(d) The Agency may only approve the disposal site proposed in the evaluation of alternatives if:

(1) The applicant has submitted a complete evaluation of alternatives with all required supporting documentation.

(2) The applicant demonstrates that the landfill proposed for CCR disposal meets the requirements of subparagraph (B) of paragraph (3) of subsection (a) of Section 15.

(3) If the landfill proposed for CCR disposal is

located in a potential environmental justice community, the operator demonstrates that it is not technically feasible to dispose of the CCR in any other landfill within 100 miles of the CCR unit that meets the requirements of

subparagraph (B) of paragraph (3) of subsection (a) of Section 15.

If the Agency denies disposal in the landfill proposed by the operator of the CCR unit, the Agency shall, in the notice of denial, specify any acceptable landfills for CCR disposal that meet the requirements of subparagraph (B) of paragraph (3) of subsection (a) of Section 15. The operator may dispose of the CCR in any landfill specified by the Agency that is not within a potential environmental justice community.

The Agency shall post its notice of approval, denial, or approval with conditions, under this subsection, on its website. The applicant shall post the notice of approval, notice of denial, and notice of approval with conditions, as well as the evaluation of benefits and supporting materials on a publicly accessible website that has no registration requirements.

The Agency's decision to approve, deny, or approve with conditions the landfill proposed for disposal of CCR under this Section shall be considered a final administrative decision subject to judicial review under the Administrative Review Law as now or hereafter amended, and the rules adopted under that Law.

Section 40. Beneficial use permit.

(a) Notwithstanding any other provision of law, no CCR removed from any CCR unit under Section 15 may be beneficially

used in this State unless the Agency has issued a beneficial use permit for that CCR under this Act.

(b) Every operator that seeks to dispose of CCR removed under Section 15 by means of beneficial use must submit to the

Agency an application for a beneficial use permit. The application shall be accompanied by the fee required by subsection (g) of Section 10 and shall contain the following:

(1) The name and address of the operator, and any parent or subsidiary entity thereof, of the CCR unit from which the CCR will be removed.

(2) The name and address of any person proposing to beneficially use the CCR.

(3) The proposed encapsulated beneficial use for which the CCR will be used.

(4) The volume of CCR to be beneficially used.

(5) The location at which the beneficially used CCR will be used, if available.

(6) An explanation, with supporting documentation, of how the CCR proposed to be beneficially used will be stored in accordance with the requirements of subsection (c).

(7) The results of a LEAF leach test of the CCR performed in accordance with subsection (d), if applicable.

(c) CCR removed from a CCR unit that will be, but has not yet been, beneficially used in accordance with this Act must be stored and handled in the following manner:

(1) The CCR must be stored in an enclosed vessel or space, including, but not limited to, a building or a covered silo, bin, or tank, that is located at least 40 feet from any waterway and has an impermeable floor or is set on an impermeable surface.

(2) Measures must be taken to limit CCR dust pollution during the loading, unloading, and transferring of the CCR, including:

(A) using water sprays or chemical dust suppressants to limit dust during loading, unloading, and transferring of the CCR;

(B) limiting the distance that the CCR is dropped during the loading, unloading, and transferring of the CCR to no more than 5 feet; and

(C) suspending the loading, unloading, and

transferring of the CCR during high winds.

(d) Prior to submitting an application for a beneficial use permit, an operator of a CCR unit that seeks to dispose of CCR through beneficial use must conduct an independent LEAF leach test on that CCR. An independent LEAF leach test shall be performed on CCR taken from each CCR unit.

(e) If the Agency determines that the application satisfies the requirements of this Act, the Agency shall, within 60 days after receiving the application for a beneficial use permit, issue a draft beneficial use permit. The draft beneficial use permit shall propose to approve, disapprove, or approve with

conditions the beneficial use permit.

(f) Together with the beneficial use permit application and any supporting materials, the draft beneficial use permit shall be posted by the Agency on its website and made available for public review, comment, and, if requested, public hearing, consistent with Sections 55, 60, and 65. The applicant shall post the draft permit, application, and supporting materials on a publicly accessible website that has no registration requirements until the Agency has issued a final beneficial use permit or denied the permit application.

(g) The Agency shall determine whether to issue a final beneficial use permit. For the purpose of determining whether to issue such permit, the Agency shall consider the following:

(1) The beneficial use permit application and all supporting documentation.

(2) All written comments received during the public comment period on the draft beneficial use permit.

(3) If applicable, testimony from any public hearing held under Section 65.

(h) The Agency shall only issue a final beneficial use permit if:

(1) The applicant submits a complete application for a beneficial use permit consistent with this Section.

(2) The applicant demonstrates that the applicant will comply with the storage requirements set forth in subsection (c).

(3) The results of the LEAF leach tests of the CCR proposed to be beneficially used, performed in accordance with subsection (d), do not show concentrations of CCR pollutants in excess of Class I groundwater standards set forth in Section 620.410 of Title 35 of the Illinois Administrative Code for any CCR pollutants. If no Class I standard has been set for a CCR pollutant, the LEAF leach tests must not show concentrations exceeding the groundwater protection standard set by the U.S. Environmental Protection Agency for that pollutant under 40 C.F.R. 257.95(h).

(4) The application satisfies all relevant requirements of this Act.

(i) The final beneficial use permit shall, at minimum, (i) incorporate proposals and representations in the application, as appropriate, as conditions in order to ensure compliance with this Act; and (ii) require compliance with CCR storage provisions set forth in subsection (c). The Agency may include other terms and conditions that it deems necessary.

(1) The Agency shall post the final beneficial use permit or notice of denial of the beneficial use permit application on its website. The applicant shall post the final beneficial use permit or notice of denial on a publicly accessible website that has no registration requirements.

(2) The Agency's decision to issue or deny a final

beneficial use permit under this Section shall be considered a final administrative decision subject to judicial review under the Administrative Review Law, and the rules adopted under that Law.

Section 45. Closure progress reports.

(a) On or before October 1, 2022, and on October 1st of each even-numbered year thereafter, until closure of all of a

facility's CCR units is complete, the operator of a CCR unit subject to Sections 15 and 20 shall compile the following 2 reports:

(1) A report regarding the closure plan containing the following:

(A) A description of the owner's or operator's closure plan for all CCR units.

(B) The closure progress as of the date of the report, both per unit and in total.

(C) A detailed accounting of the amounts of CCR that have been and are expected to be beneficially used from CCR units, both per unit and in total.

(D) A detailed accounting of the amounts of CCR that have been and are expected to be landfilled from units, both per unit and in total.

(E) A detailed accounting of the CCR transportation plan as required under Section 30.

(F) The results of groundwater and surface water

monitoring conducted under the closure plan and any measures taken to address the results as closure is being or has been completed.

(2) A report on any beneficial use permits or beneficial use permit applications under Section 40 summarizing the types of encapsulated beneficial use for which removed CCR has been or is being used and any obstacles to increased encapsulated beneficial use that the owner or operator encountered over the reporting period.

(b) The owner or operator shall post each report on a publicly accessible website that has no registration requirements, and shall submit each such report to the Agency, the Governor, and the General Assembly.

Section 50. Corrective action and clean drinking water.

(a) An owner or operator of a CCR unit from which CCR is required to be removed under Section 15 shall, within one year after the effective date of this Act, conduct a comprehensive evaluation of the extent of CCR pollution of groundwater,

surface water, and soils at any property surrounding the property on which a CCR unit is located.

(b) As part of the evaluation of pollution required under subsection (a) and continuing through completion of corrective action under subsection (e), an owner or operator must conduct the following:

(1) Groundwater monitoring in accordance with 40 C.F.R. 257.90 through 257.95, except that:

(A) Wells designated as "background" or "upgradient wells" under 40 C.F.R. 257.91 must not be affected by leakage from any CCR, regardless of whether the CCR is in a CCR unit or not.

(B) Wells designated as "downgradient" under 40 C.F.R. 257.91 must be sufficient in number and adequate in location to detect leakage from any CCR on the property, regardless of whether the CCR is in a CCR unit or not.

(C) Pollutants monitored during assessment monitoring under 40 C.F.R. 257.95 shall be CCR pollutants.

(2) Semi-annual monitoring of discharges of CCR pollutants into any adjacent surface waters from the CCR unit, including seeps where groundwater is discharging into surface water.

(c) Within 18 months after the effective date of this Act, an owner or operator must develop and submit to the Agency a draft corrective action plan discussing how to decontaminate any groundwater, surface water, or soils affected by leakage or leachate from the CCR unit. The draft corrective action plan must:

(1) Describe the findings of the comprehensive evaluation of CCR pollution required under subsection (a).

(2) Provide for groundwater and surface water

monitoring in accordance with subsection (b).

(3) Include a discussion of measures that could be used to decontaminate the site in order to complete corrective action, as specified in subsection (h).

(4) Set forth a proposal specifying which corrective action measures the owner or operator proposes to implement in order to complete corrective action as quickly as possible.

(d) Within 60 days after receiving a draft corrective action plan, the Agency shall review the draft corrective plan for completeness and to determine if it satisfies compliance with the requirements of subsection (c).

If the Agency determines that the draft corrective action plan is complete and satisfies the requirements of subsection (c), the Agency shall, within 90 days after making that determination, issue a proposed corrective action plan.

If the Agency determines that the draft corrective action plan is incomplete or does not satisfy the requirements of subsection (c), the applicant shall have no more than 90 days after the Agency's determination to correct any deficiencies identified by the Agency. If the applicant fails to correct those deficiencies within 90 days, the Agency shall have 90 additional days to issue a proposed corrective action plan.

(e) Together with the draft corrective action plan and any supporting materials, the proposed corrective action plan

shall be posted by the Agency on its website and made available for public review, comment, and, if requested, public hearing, consistent with Sections 55, 60, and 65. The applicant shall post the draft corrective action plan, proposed corrective action plan, and supporting materials on a publicly accessible website that has no registration requirements until the Agency has issued a final corrective action plan.

(f) Within 120 days after issuing the proposed corrective action plan, the Agency shall issue a final corrective action plan. In determining whether the final corrective action plan requires any changes from the proposed corrective action plan, the Agency shall consider:

(1) The draft corrective action plan and all supporting

documentation.

(2) All written comments received during the public comment period on the proposed corrective action plan.

(3) If applicable, testimony from any public hearing held under Section 65.

(f-5) No final corrective action plan shall be issued unless it satisfies all applicable requirements of this Act. At minimum, the final corrective action plan must comply with the following:

(1) Describe the findings of the comprehensive evaluation of CCR pollution required under subsection (a).

(2) Provide for groundwater and surface water monitoring in accordance with subsection (b).

(3) Set forth the measures that will be used to decontaminate the site in order to complete corrective action, as specified in subsection (h).

(4) Set forth a timeline for completing corrective action, as specified in subsection (h).

The Agency shall post the final corrective action plan on its website, and the owner or operator who submitted the draft corrective action plan shall post the final corrective action plan on a publicly accessible website that has no registration requirements.

The Agency's approval of the final corrective action plan under this Section shall be considered a final administrative decision subject to judicial review under the Administrative Review Law, and the rules adopted under that Law.

(g) Once approved by the Agency following the procedures set forth in this Section, the final corrective action plan shall remain in effect until the corrective action is completed and decontamination is achieved in accordance with subsection (h). The Agency must issue a confirmation of completion of corrective action before financial assurance under Section 75 is released.

(h) Corrective action is not complete at a CCR unit until each of the following has occurred:

(1) All soils contaminated with CCR have been removed and disposed of in a landfill that is safe, modern, and

lined.

(2) The concentrations of all CCR pollutants in downgradient groundwater monitoring wells at the site that form part of the groundwater monitoring system required under paragraph (1) of subsection (b) comply with the Class 1 groundwater standards set forth under Section 620.410 of Title 35 of the Illinois Administrative Code. If no Class I standard has been set for a CCR pollutant, concentrations of all CCR pollutants must comply with the groundwater protection standard set forth by the U.S. Environmental Protection Agency for that pollutant under 40 C.F.R. 257.95(h). Compliance occurs when concentrations of CCR pollutants have not exceeded the Class I standards set forth under Section 620.410 of Title 35 of the Illinois Administrative Code or, if applicable, the groundwater protection standard under 40 C.F.R. 257.95(h), for a period of 3 consecutive years using the statistical procedures and performance standards set forth under 40 C.F.R. 257.93(f) and 40 C.F.R. 257.93(g).

(i) During the closure process, an owner or operator shall, at the owner or operator's expense if accepted, offer to provide a connection to a municipal water supply. Where a connection to a municipal water supply is not feasible, an owner or operator shall, at the owner or operator's expense if accepted, offer to provide water testing for any residence within 1/2 mile of the CCR unit.

If the testing conducted under paragraph (1) of subsection

(h) reveals CCR pollutants in excess of Class I groundwater standards set forth under Section 620.410 of Title 35 of the Illinois Administrative Code, the operator shall replace the affected water supply with an alternative source of clean drinking water. Where Class I standards have not been set for a CCR pollutant, the groundwater protection standard shall be

that set forth by the U.S. Environmental Protection Agency under 40 C.F.R. 257.95(h).

Section 55. Public notice.

(a) Within one week of receiving a closure plan, CCR transport permit application, evaluation of alternatives, beneficial use permit application, or draft corrective action plan, the Agency shall post notice of its receipt of that document as well as a copy of the document and supporting materials on its website. The Agency shall also send, via email, notice of receipt of those documents to the State Senator, State Representative, county board chair, mayor, and township supervisor of the location of the CCR unit at issue, as well as to a mailing list of persons seeking to be notified of such documents and subsequent permitting proceedings. An owner or operator that submits a closure plan, CCR transport permit application, evaluation of alternatives, beneficial use permit application, or draft corrective action plan shall publish notice of the submission of that document in a newspaper circulating in the unit of local government where the

CCR unit is located.

(b) If the Agency issues a draft permit or proposed corrective action plan under this Act, within one week of issuing the draft permit or proposed corrective action plan the Agency shall post notice of issuance of that document on its website, together with a copy of the draft permit or proposed correction action plan, permit application, and all supporting materials. The Agency shall also send, via email, notice of issuance of the draft permit to the State Senator, State Representative, county board chair, mayor, and township supervisor of the location of the CCR unit at issue, as well as to the mailing list referenced in subsection (a). An owner or operator that submits a plan or permit application shall publish notice of any such draft permit or proposed corrective action plan within one week of issuance of the document in a newspaper circulating in the unit of local government where the CCR unit is located.

(c) A notice of application, draft permit, or proposed corrective action plan shall include the following:

(1) The name of the applicant.

(2) The type of document available for review.

(3) The name of a person at the Agency available to contact for questions.

(4) The dates of the public comment period, where applicable.

(5) Directions for interested parties to submit

comments and request a public hearing on the document in accordance with Section 65.

(6) The Agency's website and, where applicable, the operator's website at which the draft permit or proposed corrective action plan, permit application, and supporting materials shall be made available for review.

(7) Directions on how to sign up for the mailing list referenced in subsection (a).

(d) If the Agency issues a final permit or plan approval, it shall post notice of issuance of the final permit or plan approval on its website, together with a copy of the permit application and all supporting materials. The Agency shall also send, via email, notice of issuance of the final permit or plan approval to the mailing list referenced in subsection (a).

Section 60. Public comment.

(a) Public comment periods under this Act shall be 40 days. The Agency may grant extensions of the comment period of no more than 15 days if it receives an extension request and the requester demonstrates a need for the extension.

(b) The public comment period on a closure plan, evaluation of benefits, draft CCR transport permit, draft beneficial use permit, or proposed corrective action plan shall begin within 7 calendar days after the referenced document is posted on the Agency's website.

(c) During a public comment period, any person may submit

written comments to the Agency concerning any portion of the

draft CCR transport permit, draft beneficial use permit, evaluation of benefits, closure plan, proposed corrective action plan, or associated permit applications or supporting materials, as well as comments concerning any issue relating to the applicant's compliance with the requirements of this Act or any other applicable laws. A person who submits a public comment to the Agency concerning any of the documents referenced in this subsection is a party to the proceeding concerning that document for purposes of the Administrative Review Law.

(d) The Agency may ask the applicant to respond to any substantive public comments received during the comment period.

Section 65. Public hearing.

(a) A person having an interest which is or may be adversely affected by approval of a closure plan, CCR transport permit, beneficial use permit, evaluation of alternatives, or proposed corrective action plan may request a public hearing on that permit, plan, or proposal during the public comment period established under Section 60. The Agency shall hold a public hearing upon request by any such requester.

(b) At least 10 calendar days before the date of the public hearing, the Agency shall publish notice of the public hearing on its website and in a newspaper of general circulation

published in the unit of local government where the CCR unit at issue is located. The Agency shall also notify, via email, persons on the mailing list referenced in subsection (a) of Section 55 of the hearing. The notice shall contain the location, date, and time the public hearing is to take place, as well as information on whom to contact with questions and instructions on how to sign up to testify at the hearing.

(c) The Agency shall hold the public hearing in an easily accessible location as close to the CCR unit as feasible. The hearing shall be held during evening or weekend hours to facilitate attendance. The hearing shall be scheduled for no fewer than 2 hours, although the Agency may end the hearing after one hour if all persons who signed up to testify have

already testified.

(d) A person who signs up to testify at the public hearing shall be allowed to testify, provided the person attends the hearing. The Agency shall post a sign-up form on its website in which a person seeking to testify shall note his or her name, address, and email address. The Agency shall also have a sign-up form available at the hearing that requests the same information.

(e) The public hearing shall serve as an opportunity for the public to voice concerns about a document at issue, as well as an opportunity to ask questions of the Agency or the owner or operator of the CCR unit for which the document was submitted. At least one representative of the Agency and the

applicant shall attend the public hearing, and at least 20 minutes shall be set aside for the public to ask those representatives questions relevant to the permit or plan at issue. Any person who testifies at a public hearing concerning a permit or plan under this Section is a party to the proceeding concerning that document for purposes of the Administrative Review Law.

(f) A complete electronic record or transcript of the hearing and all testimony shall be made by the Agency. The complete record shall be posted on the Agency's website until closure and decontamination of the CCR unit at issue are complete.

Section 70. Permit and plan conditions and modifications.

(a) Each closure plan, CCR transport permit, beneficial use permit, evaluation of alternatives, and final corrective action plan approved or issued by the Agency under this Act shall require the permittee to comply with all provisions of this Act and all other applicable local, State, and federal laws, rules, and regulations in effect at the time the permit is issued.

(b) An approved closure plan issued under this Act shall continue in effect until closure is complete under Section 15. A CCR transport permit issued under this Act shall continue in effect until all CCR has been transported to a landfill or for beneficial reuse. A beneficial use permit issued under Section

40 shall continue in effect until all the CCR governed by that permit has been beneficially used in encapsulated beneficial use. A final corrective action plan issued under this Act shall continue in effect until the plan has been achieved and corrective action is complete as specified in Section 50.

(c) No closure plan, CCR transport permit, beneficial use permit, or final corrective action plan issued under this Act may be modified without approval of the Agency. If the Agency determines that a proposed modification constitutes a significant deviation from the terms of the original application and permit or plan approval, or presents a serious risk to public health, life, property, aquatic life, or wildlife, the Agency shall provide the public notice required under Section 55 and the opportunities for comment and hearing required under Sections 60 and 65. Any owner or operator seeking a permit modification shall pay a fee in the amount specified in subsection (g) of Section 10 for processing of that modification.

Section 75. Financial assurance.

(a) The owner or operator of a CCR unit located in Illinois is required to provide and maintain financial assurance for closure and corrective action in accordance with this Act.

(b) Financial assurance for closure must be provided and maintained in amounts sufficient to cover all costs associated with closure, including, but not limited to, the following:

(1) removal of all CCR from the CCR unit under Section 15; and

(2) transport of the removed CCR to an approved landfill or for beneficial use, in accordance with Sections 30, 35, and 40.

Financial assurance for closure must be maintained, and will not be released, until the Agency has confirmed that closure is complete under Section 15.

(c) Financial assurance for corrective action must be provided and maintained in amounts sufficient to cover all costs associated with complying with Section 50, including undertaking the comprehensive evaluation of pollution, conducting groundwater and surface water monitoring, and developing and implementing the final corrective action plan. Financial assurance for corrective action must be maintained, and will not be released, until the Agency has confirmed the completion of correction action under Section 50.

(d) To ensure financial assurance is provided in adequate amounts, an owner or operator of a CCR unit shall submit to the Agency the following:

(1) An initial cost estimate for closure, consistent with subsection (b), within 6 months after the effective date of this Act.

(2) Annual revised cost estimates for closure based on any changed circumstances or information available to the owner or operator, taking into account inflation.

(3) An initial cost estimate for corrective action within 3 months after the Agency approves any final corrective action plan required under Section 50.

(4) Annual revised cost estimates for corrective action based on any changed circumstances or information available to the owner or operator, taking into account inflation.

(e) Acceptable financial assurance mechanisms for use under this Section include, but are not limited to, the following:

(1) cash, certified check, or money order payable to a bank account set up by the Agency for the sole purpose of holding financial assurance funds under this Act;

(2) certificate of deposit;

(3) surety bond;

(4) irrevocable letter of credit; or

(5) escrow account.

Neither a corporate guarantee nor a corporate financial test may be used to satisfy the requirements of this Section.

(f) The Agency shall adopt rules to further clarify and

specify requirements for financial assurance consistent with this Act.

(g) If, after notice and hearing, the Agency determines that an owner or operator of a CCR unit is not removing CCR from a CCR unit as required under Section 15, the permittee's financial assurance for closure shall then be forfeited.

Forfeiture under this subsection shall not limit any duty of the permittee to mitigate or remediate harms or foreclose enforcement by the Agency. Forfeiture of financial assurance for closure does not count toward any penalty imposed on the owner or operator of the CCR unit.

If, after notice and hearing, the Agency determines that an owner or operator of a CCR unit is not implementing a final corrective action plan as required under Section 50, the permittee's financial assurance for corrective action shall then be forfeited. Forfeiture under this subsection shall not limit any duty of the permittee to mitigate or remediate harms or foreclose enforcement by the Agency. Forfeiture of financial assurance for corrective action does not count toward any penalty imposed on the owner or operator of the CCR unit.

When any financial assurance is forfeited under the provisions of this Act or rules adopted under this Act, the Agency shall collect the forfeiture without delay. All forfeitures shall be deposited in a fund set up by the Agency to be used, as necessary, to mitigate or remediate violations of this Act or rules adopted under this Act.

Section 80. Elimination of wet or unlined CCR disposal. Beginning 18 months after the effective date of this Act, no CCR generated in Illinois may be treated, stored, or disposed of in a CCR surface impoundment or unlined CCR landfill.

Section 85. Violations; penalties.

(a) Any person who violates this Act or a permit, plan, or

rule issued, approved, or adopted under this Act commits open dumping as defined in the Illinois Environmental Protection Act and is subject to administrative penalties, civil liability, or, where appropriate, criminal prosecution.

(b) The Agency shall issue rules specifying the administrative or civil penalties or criminal fines to which a person in violation of this Act may be subject, which shall be consistent with penalties, fines, and liability for open dumping violations under the Illinois Environmental Protection Act.

(c) Any person who knowingly makes a false, fictitious, or fraudulent material statement, orally or in writing, to the Agency that is related to or required by this Act, a rule adopted under this Act, or any permit, term, or condition thereof, commits a Class 4 felony, and each such statement or writing shall be considered a separate violation.

(d) The State's Attorney of the county in which the violation occurred, or the Attorney General, may, at the request of the Agency or on his or her own motion, institute a civil action for an injunction, prohibitory or mandatory, to restrain violations of this Act, a rule or regulation adopted under this Act, a permit or term or condition of the permit, or to require other civil or criminal actions as may be necessary to address violations of this Act, any rule adopted under this

Act, or a permit or term or condition of a permit issued under this Act.

(e) Any criminal action provided for under this Section shall be brought by the State's Attorney of the county in which the violation occurred or by the Attorney General and shall be conducted in accordance with the applicable provision of the Code of Criminal Procedure of 1963. The limitations period for violations of this Section shall not begin to run until the offense is discovered by or reported to a State or local agency having authority to investigate violations of this Act.

(f) The State's Attorney of the county in which the violation occurred or the Attorney General shall bring actions under this Section in the name of the People of the State of Illinois. Without limiting any other authority that may exist

for the awarding of attorney's fees and costs, a court of competent jurisdiction may award costs and reasonable attorney's fees, including the reasonable costs of expert witnesses and consultants, to the State's Attorney or the Attorney General in a case where he or she has prevailed against a person who has committed a knowing or repeated violation of this Act, any rule adopted under this Act, or a permit or term or condition of a permit issued under this Act.

(g) Any person with an interest that is or may be adversely affected by a violation of this Act may institute a civil action for an injunction to restrain a violation of this Act, any rule or regulation adopted under this Act, a permit issued

or plan approved under this Act, or term or condition of a permit issued under this Act, or for civil penalties for violations of this Act, any rule adopted under this Act, a permit issued under this Act or term or condition of a permit issued under this Act. Any civil action shall be brought before the circuit court of the county in which the violation occurred or in the circuit court of Sangamon County. Venue shall be considered proper in either court. Except as otherwise provided in this Act, all civil penalties collected shall be deposited in an account set up by the Agency within the Environmental Protection Trust Fund for addressing violations of this Act.

(h) All final orders imposing civil penalties under this Section shall prescribe the time for payment of those penalties. If any penalty is not paid within the time prescribed, interest on the penalty at the rate set forth in subsection (a) of Section 1003 of the Illinois Income Tax Act shall be paid for the period from the date the payment is due until the date the payment is received. However, if the time for payment is stayed during the pendency of an appeal, interest shall not accrue during the stay.

Section 90. Applicable federal, State, and local laws.

(a) Compliance with this Act does not relieve responsibility for compliance with the Illinois Environmental Protection Act and other applicable federal, State, and local laws. This Act is intended to be more protective than federal

regulations and should be construed accordingly.

(b) Nothing in this Act shall be construed to preempt any local laws that may otherwise operate to affect, govern, limit, or prohibit disposal of CCR otherwise allowed under this Act.

Section 900. The Environmental Protection Act is amended by changing Section 3.135 as follows:

(415 ILCS 5/3.135) (was 415 ILCS 5/3.94)

Sec. 3.135. Coal combustion by-product; CCB.

(a) "Coal combustion by-product" (CCB) means coal combustion waste when used beneficially in any of the following ways:

(1) The extraction or recovery of material compounds contained within CCB.

(2) The use of CCB as a raw ingredient or mineral filler in the manufacture of the following commercial products: cement; ~~concrete and concrete mortars;~~ cementious products including block, pipe and precast/prestressed components; asphalt or cementious roofing products; ~~plastic products including pipes and fittings; paints and metal alloys;~~ kiln fired products including bricks, blocks, and tiles; ~~abrasive media;~~ gypsum wallboard; asphaltic concrete, or asphalt based paving material.

(3) (Blank). ~~CCB used (A) in accordance with the~~

~~Illinois Department of Transportation ("IDOT") standard specifications and subsection (a-5) of this Section or (B) under the approval of the Department of Transportation for IDOT projects.~~

(4) (Blank). ~~Bottom ash used as antiskid material, athletic tracks, or foot paths.~~

(5) (Blank). ~~Use in the stabilization or modification of soils providing the CCB meets the IDOT specifications for soil modifiers.~~

(6) (Blank). ~~CCB used as a functionally equivalent substitute for agricultural lime as a soil conditioner.~~

(6.5) CCB that is a synthetic gypsum that:

(A) has a calcium sulfate dihydrate content greater than 90%, by dry weight, and is generated by the lime or limestone forced oxidation process;

(B) is registered with the Illinois Department of Agriculture as a fertilizer or soil amendment and is used as a fertilizer or soil amendment;

(C) is a functionally equivalent substitute for mined gypsum (calcium sulfate dihydrate) used as a fertilizer or soil amendment;

(D) is used in accordance with, and applied at a rate consistent with, documented recommendations of a qualified agricultural professional or institution, including, but not limited to any of the following: certified crop adviser, agronomist, university researcher,

federal Natural Resources Conservation Service Conservation Practice Standard regarding the amendment of soil properties with gypsum, or State-approved nutrient management plan; but in no case is applied at a rate greater than 5 dry tons per acre per year; and

(E) has not been mixed with any waste.

(7) (Blank). ~~Bottom ash used in non-IDOT pavement sub-base or base, pipe bedding, or foundation backfill.~~

(8) (Blank). ~~Structural fill, designed and constructed according to ASTM standard E2277-03 or Illinois Department of Transportation specifications, when used in an engineered application or combined with cement, sand, or water to produce a controlled strength fill material and covered with 12 inches of soil unless infiltration is prevented by the material itself or other cover material.~~

(9) (Blank). ~~Mine subsidence, mine fire control, mine sealing, and mine reclamation.~~

(a-5) (Blank). ~~Except to the extent that the uses are otherwise authorized by law without such restrictions, the uses specified in items (a)(3)(A) and (a)(7) through (9) shall be~~

~~subject to the following conditions:~~

~~(A) CCB shall not have been mixed with hazardous waste prior to use.~~

~~(B) CCB shall not exceed Class I Groundwater Standards for metals when tested utilizing test method ASTM D3987-85. The sample or samples tested shall be representative of the~~

~~CCB being considered for use.~~

~~(C) Unless otherwise exempted, users of CCB for the purposes described in items (a)(3)(A) and (a)(7) through (9) of this Section shall provide notification to the Agency for each project utilizing CCB documenting the quantity of CCB utilized and certification of compliance with conditions (A) and (B) of this subsection. Notification shall not be required for users of CCB for purposes described in items (a)(1), (a)(2), (a)(3)(B), (a)(4), (a)(5) and (a)(6) of this Section, or as required specifically under a beneficial use determination as provided under this Section, or pavement base, parking lot base, or building base projects utilizing less than 10,000 tons, flowable fill/grout projects utilizing less than 1,000 cubic yards or other applications utilizing less than 100 tons.~~

~~(D) Fly ash shall be managed in a manner that minimizes the generation of airborne particles and dust using techniques such as moisture conditioning, granulating, inground application, or other demonstrated method.~~

~~(E) CCB is not to be accumulated speculatively. CCB is not accumulated speculatively if during the calendar year, the CCB used is equal to 75% of the CCB by weight or volume accumulated at the beginning of the period.~~

~~(F) CCB shall include any prescribed mixture of fly ash, bottom ash, boiler slag, flue gas desulfurization~~

~~scrubber sludge, fluidized bed combustion ash, and stoker~~

~~boiler ash and shall be tested as intended for use.~~

(b) (Blank).

(c) Users of CCB for the purposes described in this Section shall provide notification to the Agency for each project utilizing CCB documenting the quantity of CCB utilized.

(d) Fly ash shall be managed in a manner that minimizes the generation of airborne particles and dust using techniques such as moisture conditioning, granulating, inground application, or other demonstrated method.

(e) CCB is not to be accumulated speculatively. CCB is not accumulated speculatively if during the calendar year, the CCB used is equal to 75% of the CCB by weight or volume accumulated at the beginning of the period.

(f) CCB shall include any prescribed mixture of fly ash, bottom ash, boiler slag, flue gas desulfurization scrubber sludge, fluidized bed combustion ash, and stoker boiler ash and shall be tested as intended for use.

~~To encourage and promote the utilization of CCB in productive and beneficial applications, upon request by the applicant, the Agency shall make a written beneficial use determination that coal-combustion waste is CCB when used in a manner other than those uses specified in subsection (a) of this Section if the applicant demonstrates that use of the coal-combustion waste satisfies all of the following criteria: the use will not cause, threaten, or allow the discharge of any~~

~~contaminant into the environment; the use will otherwise protect human health and safety and the environment; and the use constitutes a legitimate use of the coal-combustion waste as an ingredient or raw material that is an effective substitute for an analogous ingredient or raw material.~~

~~The Agency's beneficial use determinations may allow the uses set forth in items (a)(3)(A) and (a)(7) through (9) of this Section without the CCB being subject to the restrictions set forth in subdivisions (a-5)(B) and (a-5)(E) of this Section.~~

~~Within 90 days after the receipt of an application for a beneficial use determination under this subsection (b), the Agency shall, in writing, approve, disapprove, or approve with~~

~~conditions the beneficial use. Any disapproval or approval with conditions shall include the Agency's reasons for the disapproval or conditions. Failure of the Agency to issue a decision within 90 days shall constitute disapproval of the beneficial use request. These beneficial use determinations are subject to review under Section 40 of this Act.~~

~~Any approval of a beneficial use under this subsection (b) shall become effective upon the date of the Agency's written decision and remain in effect for a period of 5 years. If an applicant desires to continue a beneficial use after the expiration of the 5-year period, the applicant must submit an application for renewal no later than 90 days prior to the expiration. The beneficial use approval shall be automatically~~

~~extended unless denied by the Agency in writing with the Agency's reasons for disapproval, or unless the Agency has requested an extension for review, in which case the use will continue to be allowed until an Agency determination is made.~~

~~Coal-combustion waste for which a beneficial use is approved pursuant to this subsection (b) shall be considered CCB during the effective period of the approval, as long as it is used in accordance with the approval and any conditions.~~

~~Notwithstanding the other provisions of this subsection (b), written beneficial use determination applications for the use of CCB at sites governed by the federal Surface Mining Control and Reclamation Act of 1977 (P.L. 95-87) or the rules and regulations thereunder, or by any law or rule or regulation adopted by the State of Illinois pursuant thereto, shall be reviewed and approved by the Office of Mines and Minerals within the Department of Natural Resources pursuant to 62 Ill. Adm. Code §§ 1700-1850. Further, appeals of those determinations shall be made pursuant to the Illinois Administrative Review Law.~~

~~The Board shall adopt rules establishing standards and procedures for the Agency's issuance of beneficial use determinations under this subsection (b). The Board rules may also, but are not required to, include standards and procedures for the revocation of the beneficial use determinations. Prior to the effective date of Board rules adopted under this~~

~~subsection (b), the Agency is authorized to make beneficial use~~

~~determinations in accordance with this subsection (b).~~

(g) The Agency is authorized to prepare and distribute guidance documents relating to its administration of this Section. ~~Guidance documents prepared under this subsection are not rules for the purposes of the Illinois Administrative Procedure Act.~~

(Source: P.A. 99-20, eff. 7-10-15.)

Section 997. Severability. The provisions of this Act are severable under Section 1.31 of the Statute on Statutes.

Section 999. Effective date. This Act takes effect upon becoming law.".

Appendix B

United States
Environmental Protection
Agency

Office of
Solid Waste and
Emergency Response

EPA

DIRECTIVE NUMBER: 9200.4-17P

TITLE: Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites

APPROVAL DATE: April 21, 1999

EFFECTIVE DATE: April 21, 1999

ORIGINATING OFFICE: OSWER

[X] **FINAL**

[ ] **DRAFT**

STATUS:

REFERENCE (other documents):

OSWER OSWER OSWER DIRECTIVE DIRECTIVE DIRECTIVE

EPA

United States Environmental Protection Agency
Washington, DC 20460

OSWER Directive Initiation Request

1. Directive Number: 9200.4-17P

2. Originator Information

Name of Contact Person	Mail Code	Office	Telephone Code
Hal White	5403G	OUST	(703)-603-7177

3. Title
Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites

4. Summary of Directive (include brief statement of purpose)
The purpose of this Directive is to clarify EPA's policy regarding the use of monitored natural attenuation (MNA) for the remediation of contaminated soil and groundwater at sites administered by EPA's Office of Solid Waste and Emergency Response (OSWER).

5. Keywords
natural attenuation, remediation, soil, groundwater, contamination

6a. Does This Directive Supersede Previous Directive(s)?
☒ No ☐ Yes What Directive (number, title)

b. Does It Supplement Previous Directive(s)?
☒ No ☐ Yes What Directive (number, title)

7. Draft Level
☒ A - Signed by AA/DAA ☐ B - Signed by Office Director ☐ C -For Review and Comment ☐ D - In Development

8. Document to be distributed to States by Headquarters? ☒ Yes ☐ No

This Requests Meets OSWER Directives System Format Standards

9. Signature of Lead Office Directives Coordinator: Shushona Clark — Date: 3/29/99

10. Name and Title of Approving Official: Timothy Fields, Jr., Acting AA/OSWER — Date: 4/21/99

EPA Form 1315-17 (Rev 5-87) Previous editions are obsolete

OSWER DIRECTIVE **OSWER DIRECTIVE** **OSWER DIRECTIVE**

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

APR 21 1999

OFFICE OF
SOLID WASTE AND EMERGENCY
RESPONSE

MEMORANDUM

SUBJECT: Final OSWER Directive "Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites" (OSWER Directive Number 9200.4-17P)

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TO: Addressees

Purpose

This memorandum accompanies a copy of the Final OSWER Directive regarding the use of monitored natural attenuation for the remediation of contaminated soil and groundwater at sites regulated under all Office of Solid Waste and Emergency Response (OSWER) programs. A draft Interim Final version of this Directive was released on December 1, 1997 for use, and for general public review and comment. In response to comments received on that draft, EPA has incorporated several changes in this final version dealing with topics such as contaminants of concern, cross-media transfer, plume migration, and remediation time frame.

Implementation

This Directive is being issued in Final form and should be used immediately as guidance for proposing, evaluating, and approving Monitored Natural Attenuation remedies. This Final Directive will be available from the Superfund, RCRA, and OUST dockets and through the RCRA, Superfund & EPCRA Hotline (800-424-9346 or 703-412-9810). The directive will also be available in electronic format from EPA's home page on the Internet (the address is http://www.epa.gov/swerust1/directiv/d9200417.htm).

Questions/Comments

If you need more information about the Directive please feel free to contact any of the appropriate EPA staff listed on the attachment.

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attachment

Attachment
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January 1999

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USE OF MONITORED NATURAL ATTENUATION AT SUPERFUND, RCRA CORRECTIVE ACTION, AND UNDERGROUND STORAGE TANK SITES

U.S. Environmental Protection Agency
Office of Solid Waste and Emergency Response
Directive 9200.4-17P

April 1999

USE OF MONITORED NATURAL ATTENUATION AT SUPERFUND, RCRA CORRECTIVE ACTION, AND UNDERGROUND STORAGE TANK SITES

Contents

NOTICE: This document provides guidance to EPA and state staff. It also provides guidance to the public and to the regulated community on how EPA intends to exercise its discretion in implementing its regulations. The guidance is designed to implement national policy on these issues. The document does not, however, substitute for EPA's statutes or regulations, nor is it a regulation itself. Thus, it does not impose legally-binding requirements on EPA, States, or the regulated community, and may not apply to a particular situation based upon the circumstances. EPA may change this guidance in the future, as appropriate.

PURPOSE AND OVERVIEW

The purpose of this Directive is to clarify EPA's policy regarding the use of monitored natural attenuation (MNA) for the cleanup of contaminated soil and groundwater[1] in the Superfund, RCRA Corrective Action, and Underground Storage Tank programs. These programs are administered by EPA's Office of Solid Waste and Emergency Response (OSWER) which include the Office of Emergency and Remedial Response (OERR), Office of Solid Waste (OSW), Office of Underground Storage Tanks (OUST), and the Federal Facilities Restoration and Reuse Office (FFRRO). Statutory authority for these remediation programs is provided under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the Resource Conservation and Recovery Act (RCRA).

EPA remains fully committed to its goals of protecting human health and the environment by remediating contaminated soils, restoring contaminated groundwaters to their beneficial uses, preventing migration of contaminant plumes[2], and protecting groundwaters and other environmental resources[3]. EPA advocates using the most appropriate technology for a given site. EPA does not consider MNA to be a "presumptive" or "default" remedy—it is merely one option that should be evaluated with other applicable remedies. EPA does not view MNA to be a "no action[4]" or "walk-away" approach, but rather

[1] Although this Directive does not address remediation of contaminated sediments, many of the same principles would be applicable. Fundamental issues such as having source control, developing lines of evidence, monitoring and contingency plans are also appropriate for sediments. However, the Agency is developing the policy and technical aspects for sediments, specifically.

[2] The outer limits of contaminant plumes are typically defined for each contaminant of concern based on chemical concentrations above which the overseeing regulatory authority has determined represent an actual or potential threat to human health or the environment.

[3] Environmental resources to be protected include groundwater, drinking water supplies, surface waters, ecosystems and other media (air, soil and sediments) that could be impacted by site contamination.

[4] For the Superfund program, Section 300.430(e)(6) of the National Contingency Plan (NCP) directs that a "no action alternative" (or no further action) "shall be developed" for all feasibility studies (USEPA, 1990a, p. 8849). The "no action" alternative can include monitoring but generally not other remedial actions, where such actions are defined in Section 300.5 of the NCP. In general, the "no action" alternative is selected when there is no current or potential threat to human health or the environment or when CERCLA exclusions preclude taking an action (USEPA, 1991a). As explained in this Directive, a remedial alternative that relies on monitored natural attenuation to attain site-specific remediation objectives is **not** the same as the "no action" alternative.

considers it to be an alternative means of achieving remediation objectives[5] that may be appropriate for specific, well-documented site circumstances where its use meets the applicable statutory and regulatory requirements. As there is often a variety of methods available for achieving remediation objectives at any given site, MNA may be evaluated and compared to other viable remediation methods (including innovative technologies) during the study phases leading to the selection of a remedy. As with any other remedial alternative, MNA should be selected only where it meets all relevant remedy selection criteria, and where it will meet site remediation objectives within a timeframe that is reasonable compared to that offered by other methods. In the majority of cases where MNA is proposed as a remedy, its use may be appropriate as one component of the total remedy, that is, either in conjunction with active remediation or as a follow-up measure. MNA should be used very cautiously as the sole remedy at contaminated sites. Furthermore, the availability of MNA as a potential remediation tool does not imply any lessening of EPA's longstanding commitment to pollution prevention. Waste minimization, pollution prevention programs, and minimal technical requirements to prevent and detect releases remain fundamental parts of EPA waste management and remediation programs.

Use of MNA does not signify a change in OSWER's remediation objectives. These objectives (discussed in greater detail under the heading "Implementation") include control of source materials[6], prevention of plume migration, and restoration of contaminated groundwaters, where appropriate. Thus, EPA expects that source control measures (see section on "Remediation of Sources") will be evaluated for all sites under consideration for any proposed remedy. As with other remediation methods, selection of MNA as a remediation method should be supported by detailed site-specific information that demonstrates the efficacy of this remediation approach. In addition, the progress of MNA toward a site's remediation objectives should be carefully monitored and compared with expectations. Where MNA's ability to meet these expectations is uncertain and based predominantly on predictive analyses, decision makers should incorporate contingency measures into the remedy.

The scientific understanding of natural attenuation processes continues to evolve. EPA recognizes that significant advances have been made in recent years, but there is still a great deal to be learned regarding the mechanisms governing natural attenuation processes and their ability to address different types of contamination problems. Therefore, while EPA believes MNA may

[5] In this Directive, remediation objectives are the overall objectives that remedial actions are intended to accomplish and are not the same as chemical-specific cleanup levels. Remediation objectives could include preventing exposure to contaminants, preventing further migration of contaminants from source areas, preventing further migration of the groundwater contaminant plume, reducing contamination in soil or groundwater to specified cleanup levels appropriate for current or potential future uses, or other objectives. The term "remediation" as used in this Directive is not limited to "remedial actions" defined in CERCLA §101(24), and includes CERCLA "removal actions", for example.

[6] **"Source material** is defined as material that includes or contains hazardous substances, pollutants or contaminants that act as a reservoir [either stationary or mobile] for migration of contamination to the ground water, to surface water, to air, [or other environmental media,] or acts as a source for direct exposure. Contaminated ground water generally is not considered to be a source material although non-aqueous phase liquids (NAPLS [occurring either as residual- or free-phase]) may be viewed as source materials." (USEPA, 1991b).

be used where circumstances are appropriate, it should be used with caution commensurate with the uncertainties associated with the particular application. Furthermore, largely due to the uncertainty associated with the potential effectiveness of MNA to meet remediation objectives that are protective of human health and the environment, EPA expects that **source control and long-term performance monitoring will be fundamental components of any MNA remedy**.

This Directive is a policy document and as such is not intended to provide detailed technical guidance on evaluating MNA remedies. EPA recognizes that at present there are relatively few EPA guidance documents concerning appropriate implementation of MNA remedies. Chapter IX of OUST's alternative cleanup technologies manual (USEPA, 1995a) addresses the use of natural attenuation at leaking UST sites. The Office of Research and Development (ORD) has recently published a protocol for evaluating MNA at chlorinated solvent sites (USEPA, 1998a). Additional technical resource documents for evaluating MNA in groundwater, soils, and sediments are being developed by ORD. Supporting technical information regarding the evaluation of MNA as a remediation alternative is available from a variety of other sources, including those listed at the end of this Directive. "References Cited" lists those EPA documents that were specifically cited within this Directive. The list of "Additional References" includes documents produced by EPA as well as non-EPA entities. Finally, "Other Sources of Information" lists sites on the World Wide Web (Internet) where additional information can be obtained. Non-EPA documents may provide regional and state site managers, as well as the regulated community, with useful technical information. However, these non-EPA guidances are not officially endorsed by EPA, EPA does not necessarily agree with all their conclusions, and all parties involved should clearly understand that such guidances do not in any way replace current EPA or OSWER guidances or policies addressing the remedy selection process in the Superfund, RCRA, or UST programs.

BACKGROUND

The term "monitored natural attenuation", as used in this Directive, refers to the reliance on natural attenuation processes (within the context of a carefully controlled and monitored site cleanup approach) to achieve site-specific remediation objectives within a time frame that is reasonable compared to that offered by other more active methods. The "natural attenuation processes" that are at work in such a remediation approach include a variety of physical, chemical, or biological processes that, under favorable conditions, act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in soil or groundwater. These *in-situ* processes include biodegradation; dispersion; dilution; sorption; volatilization; radioactive decay; and chemical or biological stabilization, transformation, or destruction of contaminants. When relying on natural attenuation processes for site remediation, EPA prefers those processes that degrade or destroy contaminants. Also, EPA generally expects that MNA will only be appropriate for sites that have a low potential for contaminant migration. Additional discussion of criteria for "Sites Where Monitored Natural Attenuation May Be Appropriate" may be found later in this Directive. Other terms associated with natural attenuation in the literature include "intrinsic remediation", "intrinsic bioremediation", "passive bioremediation", "natural

recovery", and "natural assimilation". While some of these terms are synonymous with "natural attenuation," others refer strictly to biological processes, excluding chemical and physical processes. Therefore, it is recommended that for clarity and consistency, the term "monitored natural attenuation" be used throughout OSWER remediation programs unless a specific process (*e.g.*, reductive dehalogenation) is being referenced.

Natural attenuation processes are typically occurring at all sites, but to varying degrees of effectiveness depending on the types and concentrations of contaminants present and the physical, chemical, and biological characteristics of the soil and groundwater. Natural attenuation processes may reduce the potential risk posed by site contaminants in three ways:

(1) Transformation of contaminant(s) to a less toxic form through destructive processes such as biodegradation or abiotic transformations;

(2) Reduction of contaminant concentrations whereby potential exposure levels may be reduced; and

(3) Reduction of contaminant mobility and bioavailability through sorption onto the soil or rock matrix.

Where conditions are favorable, natural attenuation processes may reduce contaminant mass or concentration at sufficiently rapid rates to be integrated into a site's soil or groundwater remedy. Following source control measures, natural attenuation may be sufficiently effective to achieve remediation objectives at some sites without the aid of other (active) remedial measures. Typically, however, MNA will be used in conjunction with active remediation measures. For example, active remedial measures could be applied in areas with high concentrations of contaminants while MNA is used for low concentration areas; or MNA could be used as a follow-up to active remedial measures. EPA also encourages the consideration of innovative technologies for source control or "active" components of the remedy, which may offer greater confidence and reduced remediation time frames at modest additional cost.

While MNA is often dubbed "passive" remediation because natural attenuation processes occur without human intervention, its use at a site does **not** preclude the use of "active" remediation or the application of enhancers of biological activity (*e.g.*, electron acceptors, nutrients, and electron donors). However, by definition, a remedy that includes the introduction of an enhancer of any type is no longer considered to be "natural" attenuation. Use of MNA does not imply that activities (and costs) associated with investigating the site or selecting the remedy (*e.g.*, site characterization, risk assessment, comparison of remedial alternatives, performance monitoring, and contingency measures) have been eliminated. These elements of the

investigation and cleanup must still be addressed as required under the particular OSWER program, regardless of the remedial approach selected.

Contaminants of Concern

It is common practice in conducting remedial actions to focus on the most obvious contaminants of concern, but other contaminants may also be of significant concern in the context of MNA remedies. In general, since engineering controls are not used to control plume migration in an MNA remedy, decision makers need to ensure that MNA is appropriate to address **all contaminants** that represent an actual or potential threat to human health or the environment. Several examples are provided below to illustrate the need to assess both the obvious as well as the less obvious contaminants of concern when evaluating an MNA remedial option.

- Mixtures of contaminants released into the environment often include some which may be amenable to MNA, and others which are not addressed sufficiently by natural attenuation processes to achieve remediation objectives. For example, Benzene, Toluene, Ethylbenzene and Xylenes (BTEX) associated with gasoline have been shown in many circumstances to be effectively remediated by natural attenuation processes. However, a common additive to gasoline (*i.e.*, methyl tertiary-butyl ether [MTBE]) has been found to migrate large distances and threaten downgradient water supplies at the same sites where the BTEX component of a plume has either stabilized or diminished due to natural attenuation. In general, compounds that tend not to degrade readily in the subsurface (*e.g.*, MTBE and 1,4-dioxane) and that represent an actual or potential threat should be assessed when evaluating the appropriateness of MNA remedies.

- Analyses of contaminated media often report chemicals which are identified with a high degree of certainty, as well other chemicals labeled as "tentatively identified compounds" (TICs). It is often assumed that TICs will be addressed by a remedial action along with the primary contaminants of concern. This may be a reasonable assumption for an active remediation system (*e.g.*, pump and treat) which is capturing all contaminated groundwater, but might not be acceptable for an MNA remedy that is relying on natural processes to prevent contaminant migration. Where MNA is being proposed for sites with TICs, it may be prudent to identify the TICs and evaluate whether they too will be sufficiently mitigated by MNA.

- At some sites the same geochemical conditions and processes that lead to biodegradation of chlorinated solvents and petroleum hydrocarbons can chemically transform naturally occurring minerals (*e.g.*, arsenic and manganese compounds) in the aquifer matrix to forms that are more mobile and/or more toxic than the original materials (USEPA, 1998). A

> comprehensive assessment of an MNA remedial option should include evaluation of whether naturally occurring metals will become contaminants of concern.

Addressing the above concerns does not necessarily require sampling and analysis of extensive lists of parameters at every monitoring location in all situations. The location and number of samples collected and analyzed for this purpose should be determined on a site-specific basis to ensure adequate characterization and protection of human health and the environment.

Transformation Products

It also should be noted that some natural attenuation processes may result in the creation of transformation products[7] that are more toxic and/or mobile than the parent contaminant (*e.g.*, degradation of trichloroethylene to vinyl chloride). The potential for creation of toxic transformation products is more likely to occur at non-petroleum release sites (*e.g.*, chlorinated solvents or other volatile organic spill sites) and should be evaluated to determine if implementation of a MNA remedy is appropriate and protective in the long term.

Cross-Media Transfer

Natural attenuation processes may often result in transfer of some contaminants from one medium to another (*e.g.*, from soil to groundwater, from soil to air or surface water, and from groundwater to surface water). Processes that result in degradation of contaminants are preferable to those which rely predominantly on the transfer of contamination from one medium to another. MNA remedies involving cross-media transfer of contamination should include a site-specific evaluation of the potential risk posed by the contaminant(s) once transferred to a particular medium. Additionally, long-term monitoring should address the media to which contaminants are being transferred.

[7] The term "transformation products" in the Directive includes intermediate products resulting from biotic or abiotic processes (*e.g.*, TCE, DCE, vinyl chloride), decay chain daughter products from radioactive decay, and inorganic elements that become methylated compounds (*e.g.*, methyl mercury) in soil or sediment. Some transformation products are quickly transformed to other products while others are longer lived.

Petroleum-Related Contaminants

Natural attenuation processes, particularly biological degradation, are currently best documented at petroleum fuel spill sites. Under appropriate field conditions, the regulated compounds benzene, toluene, ethylbenzene, and xylene (BTEX) may naturally degrade through microbial activity and ultimately produce non-toxic end products (*e.g.*, carbon dioxide and water). Where microbial activity is sufficiently rapid, the dissolved BTEX contaminant plume may stabilize (*i.e.*, stop expanding), and contaminant concentrations in both groundwater and soil may eventually decrease to levels below regulatory standards. Following degradation of a dissolved BTEX plume, a residue consisting of heavier petroleum hydrocarbons of relatively low solubility and volatility will typically be left behind in the original source (spill) area. Although this residual contamination may have relatively low potential for further migration, it still may pose a threat to human health or the environment either from direct contact with soils in the source area or by continuing to slowly leach contaminants to groundwater. For these reasons, MNA alone is generally not sufficient to remediate petroleum release sites. Implementation of source control measures in conjunction with MNA is almost always necessary. Other controls (*e.g.*, institutional controls[8]), in accordance with applicable state and federal requirements, may also be necessary to ensure protection of human health and the environment.

Chlorinated Solvents

Chlorinated solvents[9], such as trichloroethylene, represent another class of common contaminants. These compounds are more dense than water and are referred to as DNAPLs (dense non-aqueous phase liquids). Recent research has identified some of the mechanisms potentially responsible for degrading these solvents, furthering the development of methods for estimating biodegradation rates of these chlorinated compounds. However, the hydrologic and geochemical conditions favoring significant biodegradation of chlorinated solvents sufficient to achieve remediation objectives within a reasonable timeframe are anticipated to occur only in limited circumstances. DNAPLs tend to sink through the groundwater column toward the bottom of the aquifer. However, they can also occur as mixtures with other less dense contaminants. Because of the varied nature and distribution of chlorinated compounds, they are typically difficult to locate, delineate, and remediate even with active measures. In the subsurface, chlorinated solvents represent source materials that can continue to contaminate groundwater for decades or longer. Cleanup of solvent spills is also complicated by the fact that a typical spill includes

[8] The term "institutional controls" refers to non-engineering measures—usually, but not always, legal controls—intended to affect human activities in such a way as to prevent or reduce exposure to hazardous substances. Examples of institutional controls cited in the National Contingency Plan (USEPA, 1990a, p.8706) include land and resource (*e.g.*, water) use and deed restrictions, well-drilling prohibitions, building permits, well use advisories, and deed notices.

[9] Chlorinated solvents are only one type of halogenated compound. Chlorinated solvents are specifically referenced in this Directive because they are commonly found at contaminated sites. The discussion in this Directive regarding chlorinated solvents may also apply to other halogenated compounds to be remediated.

multiple contaminants, including some that tend not to degrade readily in the subsurface.[10] Extremely long dissolved solvent plumes have been documented that may be due to the existence of subsurface conditions that are not conducive to natural attenuation.

Inorganics

MNA may, under certain conditions (*e.g.*, through sorption or oxidation-reduction reactions), effectively reduce the dissolved concentrations and/or toxic forms of inorganic contaminants in groundwater and soil. Both metals and non-metals (including radionuclides) may be attenuated by sorption[11] reactions such as precipitation, adsorption on the surfaces of soil minerals, absorption into the matrix of soil minerals, or partitioning into organic matter. Oxidation-reduction (redox) reactions can transform the valence states of some inorganic contaminants to less soluble and thus less mobile forms (*e.g.*, hexavalent uranium to tetravalent uranium) and/or to less toxic forms (*e.g.*, hexavalent chromium to trivalent chromium). Sorption and redox reactions are the dominant mechanisms responsible for the reduction of mobility, toxicity, or bioavailability of inorganic contaminants. It is necessary to know what specific mechanism (type of sorption or redox reaction) is responsible for the attenuation of inorganics so that the stability of the mechanism can be evaluated. For example, precipitation reactions and absorption into a soil's solid structure (*e.g.*, cesium into specific clay minerals) are generally stable, whereas surface adsorption (*e.g.*, uranium on iron-oxide minerals) and organic partitioning (complexation reactions) are more reversible. Complexation of metals or radionuclides with carrier (chelating) agents (*e.g.*, trivalent chromium with EDTA) may increase their concentrations in water and thus enhance their mobility. Changes in a contaminant's concentration, pH, redox potential, and chemical speciation may reduce a contaminant's stability at a site and release it into the environment. Determining the existence, and demonstrating the irreversibility, of these mechanisms is important to show that a MNA remedy is sufficiently protective.

In addition to sorption and redox reactions, radionuclides exhibit radioactive decay and, for some, a parent-daughter radioactive decay series. For example, the dominant attenuating mechanism of tritium (a radioactive isotopic form of hydrogen with a short half-life) is radioactive decay rather than sorption. Although tritium does not generate radioactive daughter products, those generated by some radionulides (*e.g.*, Am-241 and Np-237 from Pu-241) may be more toxic, have longer half-lives, and/or be more mobile than the parent in the decay series. Also, it is

[10] For example, 1,4-dioxane, which is used as a stabilizer for some chlorinated solvents, is more highly toxic, less likely to sorb to aquifer solids, and less biodegradable than some other solvent constituents under the same environmental conditions.

[11] When a contaminant is associated with a solid phase, it is usually not known if the contaminant is precipitated as a three-dimensional molecular coating on the surface of the solid, adsorbed onto the surface of the solid, absorbed into the structure of the solid, or partitioned into organic matter. "Sorption" will be used in this Directive to describe, in a generic sense (*i.e.*, without regard to the precise mechanism) the partitioning of aqueous phase constituents to a solid phase.

important that the near surface or surface soil pathways be carefully evaluated and eliminated as potential sources of external direct radiation exposure[12].

Inorganic contaminants persist in the subsurface because, except for radioactive decay, they are not degraded by the other natural attenuation processes. Often, however, they may exist in forms that have low mobility, toxicity, or bioavailability such that they pose a relatively low level of risk. Therefore, natural attenuation of inorganic contaminants is most applicable to sites where immobilization or radioactive decay is demonstrated to be in effect and the process/mechanism is irreversible.

Advantages and Disadvantages of Monitored Natural Attenuation

MNA has several potential advantages and disadvantages, and the factors listed below should be carefully considered during site characterization and evaluation of remediation alternatives before selecting MNA as the remedial alternative. **Potential advantages** of MNA include:

- As with any *in situ* process, generation of lesser volume of remediation wastes, reduced potential for cross-media transfer of contaminants commonly associated with *ex situ* treatment, and reduced risk of human exposure to contaminants, contaminated media, and other hazards, and reduced disturbances to ecological receptors;

- Some natural attenuation processes may result in *in-situ* destruction of contaminants;

- Less intrusion as few surface structures are required;

- Potential for application to all or part of a given site, depending on site conditions and remediation objectives;

- Use in conjunction with, or as a follow-up to, other (active) remedial measures; and

- Potentially lower overall remediation costs than those associated with active remediation.

[12] External direct radiation exposure refers to the penetrating radiation (*i.e.,* primarily gamma radiation and x-rays) that may be an important exposure pathway for certain radionuclides in near surface soils. Unlike chemicals, radionuclides can have deleterious effects on humans without being taken into or brought in contact with the body due to high energy particles emitted from near surface soils. Even though the radionuclides that emit penetrating radiation may be immobilized due to sorption or redox reactions, the resulting contaminated near surface soil may not be a candidate for a MNA remedy as a result of this exposure risk.

The **potential disadvantages** of MNA include:

- Longer time frames may be required to achieve remediation objectives, compared to active remediation measures at a given site;
- Site characterization is expected to be more complex and costly;
- Toxicity and/or mobility of transformation products may exceed that of the parent compound;
- Long-term performance monitoring will generally be more extensive and for a longer time;
- Institutional controls may be necessary to ensure long term protectiveness;
- Potential exists for continued contamination migration, and/or cross-media transfer of contaminants;
- Hydrologic and geochemical conditions amenable to natural attenuation may change over time and could result in renewed mobility of previously stabilized contaminants (or naturally occurring metals), adversely impacting remedial effectiveness; and
- More extensive education and outreach efforts may be required in order to gain public acceptance of MNA.

IMPLEMENTATION

The use of MNA is not new in OSWER programs. For example, in the Superfund program, use of natural attenuation as an element in a site's groundwater remedy is discussed in "Guidance on Remedial Actions for Contaminated Groundwater at Superfund Sites" (USEPA, 1988a). Use of MNA in OSWER programs has slowly increased over time with greater program experience and scientific understanding of the processes involved. Recent advances in the scientific understanding of the processes contributing to natural attenuation have resulted in a heightened interest in this approach as a potential means of achieving remediation objectives for soil and groundwater. However, EPA expects that reliance on MNA as the sole remedy will only be appropriate at relatively few contaminated sites. This Directive is intended to clarify OSWER program policies regarding the use of MNA and ensure that MNA remedies are selected and implemented appropriately. Topics addressed include the role of MNA in OSWER remediation programs, site characterization, the types of sites where MNA may be appropriate, reasonable remediation timeframes, source control, performance monitoring, and contingency remedies where MNA will be employed.

Role of Monitored Natural Attenuation in OSWER Remediation Programs

Under OSWER programs, remedies selected for contaminated media (such as contaminated soil and groundwater) must protect human health and the environment. Remedies may achieve this level of protection using a variety of methods, including treatment, containment, engineering controls, and other means identified during the remedy selection process.

The regulatory and policy frameworks for corrective actions under the UST, RCRA, and Superfund programs have been established to implement their respective statutory mandates and to promote the selection of technically defensible, nationally consistent, and cost effective solutions for the cleanup of contaminated media. EPA recognizes that MNA may be an appropriate remediation option for contaminated soil and groundwater under certain circumstances. However, determining the appropriate mix of remediation methods at a given site, including when and how to use MNA, can be a complex process. Therefore, MNA should be carefully evaluated along with other viable remedial approaches or technologies (including innovative technologies) within the applicable remedy selection framework. **MNA should not be considered a default or presumptive remedy at any contaminated site.**

Each OSWER program has developed regulations and policies to address the particular types of contaminants and facilities within its purview[13]. Although there are differences among

[13] Existing program guidance and policy regarding MNA can be obtained from the following sources: For Superfund, see "Guidance on Remedial Actions for Contaminated Groundwater at Superfund Sites," (USEPA, 1988a; pp. 5-7 and 5-8); the Preamble to the 1990 National Contingency Plan (USEPA, 1990a, pp.8733-34); and "Presumptive Response Strategy and Ex-Situ Treatment Technologies for Contaminated Ground Water at CERCLA Sites, Final Guidance" (USEPA, 1996a; p. 18). For the RCRA program, see the Subpart S Proposed Rule (USEPA, 1990b, pp.30825 and 30829), and the Advance Notice of Proposed Rulemaking (USEPA, 1996b, pp.19451-52). For the UST program, refer to Chapter IX in "How to Evaluate Alternative Cleanup Technologies for Underground Storage Tank Sites: A Guide for Corrective Action Plan Reviewers;" (USEPA, 1995a).

these programs, they share several key principles that should generally be considered during selection of remedial measures, including:

- Source control measures should use treatment to address "principal threat" wastes (or products) wherever practicable, and engineering controls such as containment for waste (or products) that pose a relatively low long-term threat, or where treatment is impracticable.[14]

- Contaminated groundwaters should be returned to "their beneficial uses[15] wherever practicable, within a timeframe that is reasonable given the particular circumstances of the site." When restoration of groundwater is not practicable, EPA "expects to prevent further migration of the plume, prevent exposure to the contaminated groundwater, and evaluate further risk reduction."[16]

- Contaminated soil should be remediated to achieve an acceptable level of risk to human and environmental receptors, and to prevent any transfer of contaminants to other media (*e.g.*, surface or groundwater, air, sediments) that would result in an unacceptable risk or exceed required cleanup levels.

- Remedial actions in general should include opportunity(ies) for public involvement that serve to both educate interested parties and to solicit feedback concerning the decision making process.

Consideration or selection of MNA as a remedy or remedy component does not in any way change or displace these (or other) remedy selection principles. Nor does use of MNA

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[14] Principal threat wastes are those **source materials** that are "highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur. They include liquids and other highly mobile materials (*e.g.*, solvents) or materials having high concentrations of toxic compounds." (USEPA, 1991b). Low level threat wastes are "source materials that generally can be reliably contained and that would present only a low risk in the event of release." (USEPA, 1991b). Since contaminated groundwater is not source material, it is neither a principal nor a low-level threat waste.

[15] **Beneficial uses** of groundwater could include uses for which water quality standards have been promulgated, (*e.g.*, drinking water supply, discharge to surface water), or where groundwater serves as a source of recharge to either surface water or adjacent aquifers, or other uses. These or other types of beneficial uses may be identified as part of a Comprehensive State Groundwater Protection Program (CSGWPP). For more information on CSGWPPs, see USEPA, 1992a and USEPA, 1997b, or contact your state implementing agency.

[16] This is a general expectation for remedy selection in the Superfund program, as stated in §300.430 (a)(1)(iii)(F) of the National Contingency Plan (USEPA, 1990a, p.8846). The NCP Preamble also specifies that cleanup levels appropriate for the expected beneficial use (*e.g.*, MCLs for drinking water) "should generally be attained throughout the contaminated plume, or at and beyond the edge of the waste management area when waste is left in place" (USEPA, 1990a, p.8713). The RCRA Corrective Action program has similar expectations (see USEPA, 1996b, pp.19448-19450).

diminish EPA's or the regulated party's responsibility to achieve protectiveness or to satisfy long-term site remediation objectives. EPA expects that **MNA will be an appropriate remediation method only where its use will be protective of human health and the environment and it will be capable of achieving site-specific remediation objectives within a timeframe that is reasonable compared to other alternatives.** The effectiveness of MNA in both near-term and long-term timeframes should be demonstrated to EPA (or other overseeing regulatory authority) through: 1) sound technical analyses which provide confidence in natural attenuation's ability to achieve remediation objectives; 2) performance monitoring; and 3) contingency (or backup) remedies where appropriate. **In summary, use of MNA does not imply that EPA or the responsible parties are "walking away" from the cleanup or financial responsibility at a site.**

It also should be emphasized that the selection of MNA as a remedy does **not** imply that active remediation measures are infeasible, or are "technically impracticable" from an engineering perspective. Technical impracticability (TI) determinations are used to justify a departure from cleanup levels that would otherwise be required at a Superfund site or RCRA facility based on the inability to achieve such cleanup levels using available remedial technologies (USEPA, 1993a). Such a TI determination does not imply that there will be no active remediation at the site, nor that MNA will be used at the site. Rather, such a TI determination simply indicates that the cleanup levels and objectives which would otherwise be required cannot practicably be attained using available remediation technologies. In such cases, an alternative cleanup strategy that is fully protective of human health and the environment must be identified. Such an alternative strategy may still include engineered remediation components, such as recovery of free phase NAPLs and containment of residual contaminants, in addition to approaches intended to restore some portion of the contaminated groundwater to beneficial uses. Several remedial approaches could be appropriate to address the dissolved plume, one of which could be MNA under suitable conditions. However, the evaluation of natural attenuation processes and the decision to rely upon MNA for the dissolved plume should be distinct from the recognition that restoration of a portion of the plume is technically impracticable (*i.e.*, MNA should **not** be viewed as a direct or presumptive outcome of a technical impracticability determination.)

Demonstrating the Efficacy of Natural Attenuation Through Site Characterization

Decisions to employ MNA as a remedy or remedy component should be thoroughly and adequately supported with site-specific characterization data and analysis. In general, the level of site characterization necessary to support a comprehensive evaluation of MNA is more detailed than that needed to support active remediation. Site characterizations for natural attenuation generally warrant a quantitative understanding of source mass; groundwater flow (including preferential pathways); contaminant phase distribution and partitioning between soil, groundwater, and soil gas; rates of biological and non-biological transformation; and an understanding of how all of these factors are likely to vary with time. This information is generally necessary since contaminant behavior is governed by dynamic processes which must be well understood before MNA can be appropriately applied at a site. Demonstrating the efficacy of

MNA may require analytical or numerical simulation of complex attenuation processes. Such analyses, which are critical to demonstrate natural attenuation's ability to meet remediation objectives, generally require a detailed conceptual site model[17] as a foundation.

EPA recommends the use of conceptual site models to integrate data and guide both investigative and remedial actions. However, program implementors should be cautious and collect sufficient field data to test conceptual hypotheses and not "force-fit" site data into a pre-conceived, and possibly inaccurate, conceptual representation. For example, a common mechanism for transport of contaminants is advection-dispersion, by which contaminants dissolved in groundwater migrate away from a source area. An alternative mechanism of contaminant transport (*i.e.*, NAPL migration) could be associated with a relatively large release of NAPL into the subsurface such that the NAPL itself has the potential to migrate significant distances along preferential pathways. Since NAPL migration pathways are often difficult to locate in the subsurface, one may incorrectly conclude that only the dissolved transport model applies to a site, when a combined NAPL and dissolved phase migration model would be more accurate. Applying a wrong conceptual model, in the context of evaluating an MNA (or any other) remedy, could result in a deficient site characterization (*e.g.*, did not use tools and approaches designed to find NAPLs or NAPL migration pathways), and inappropriate selection of an MNA remedy where long-term sources were not identified nor considered during remedy selection. NAPL present as either free- or residual phase represents a significant mass of contamination that will serve as a long-term source. Sources of contamination are more appropriately addressed by engineered removal, treatment or containment technologies, as discussed later in this Directive. Where the sources of contamination have been controlled, dissolved plumes may be amenable to MNA because of the relatively small mass of contaminants present in the plume.

Site characterization should include collecting data to define (in three spatial dimensions over time) the nature and distribution of contaminants of concern and contaminant sources as well as potential impacts on receptors (see "Background" section for further discussion pertaining to "Contaminants of Concern"). However, where MNA will be considered as a remedial approach, certain aspects of site characterization may require more detail or additional elements. For

[17] A conceptual site model (CSM) is a three-dimensional representation that conveys what is known or suspected about contamination sources, release mechanisms, and the transport and fate of those contaminants. The conceptual model provides the basis for assessing potential remedial technologies at the site. "Conceptual site model" is **not** synonymous with "computer model"; however, a computer model may be helpful for understanding and visualizing current site conditions or for predictive simulations of potential future conditions. Computer models, which simulate site processes mathematically, should in turn be based upon sound conceptual site models to provide meaningful information. Computer models typically require a lot of data, and the quality of the output from computer models is directly related to the quality of the input data. Because of the complexity of natural systems, models necessarily rely on simplifying assumptions that may or may not accurately represent the dynamics of the natural system. Calibration and sensitivity analyses are important steps in appropriate use of models. Even so, the results of computer models should be carefully interpreted and continuously verified with adequate field data. Numerous EPA references on models are listed in the "Additional References" section at the end of this Directive.

example, to assess the contributions of sorption, dilution, and dispersion to natural attenuation of contaminated groundwater, a very detailed understanding of aquifer hydraulics, recharge and discharge areas and volumes, and chemical properties is necessary. Where biodegradation will be assessed, characterization also should include evaluation of the nutrients and electron donors and acceptors present in the groundwater, the concentrations of co-metabolites and metabolic by-products, and perhaps specific analyses to identify the microbial populations present. The findings of these, and any other analyses pertinent to characterizing natural attenuation processes, should be incorporated into the conceptual model of contaminant fate and transport developed for the site.

MNA may not be appropriate as a remedial option at many sites for technological or economic reasons. For example, in some complex geologic systems, technological limitations may preclude adequate monitoring of a natural attenuation remedy to ensure with a high degree of confidence that potential receptors will not be impacted. This situation typically occurs in many karstic, structured, and/or fractured rock aquifers where groundwater moves preferentially through discrete pathways (*e.g.*, solution channels, fractures, joints, foliations). The direction of groundwater flow through such heterogeneous (and often anisotropic) materials can not be predicted directly from the hydraulic gradient, and existing techniques may not be capable of identifying the pathway along which contaminated groundwater moves through the subsurface. MNA will not generally be appropriate where site complexities preclude adequate monitoring. In some other situations where it may be technically feasible to monitor the progress of natural attenuation, the cost of site characterization and long-term monitoring required for the implementation of MNA may be higher than the cost of other remedial alternatives. Under such circumstances, MNA may not be less costly than other alternatives.

A related consideration for site characterization is how other remedial activities at the site could affect natural attenuation. For example, the capping of contaminated soil could alter both the type of contaminants leached to groundwater, as well as their rate of transport and degradation. Another example could be where there is co-mingled petroleum and chlorinated solvent contamination. In such cases, degradation of the chlorinated solvents is achieved, in part, through the action of microbes that derive their energy from the carbon in the petroleum. Recovery of the petroleum removes some of the source of food for these microbes and the rate of degradation of the chlorinated solvents is decreased. Therefore, the impacts of any ongoing or proposed remedial actions should be factored into the analysis of the effectiveness of MNA.

Once site characterization data have been collected and a conceptual model developed, the next step is to evaluate the potential efficacy of MNA as a remedial alternative. This involves collection of site-specific data sufficient to estimate with an acceptable level of confidence both the rate of attenuation processes and the anticipated time required to achieve remediation objectives. A three-tiered approach to such an evaluation is becoming more widely practiced and accepted. In this approach, successively more detailed information is collected as necessary to provide a specified level of confidence on the estimates of attenuation rates and remediation timeframe. These three tiers of site-specific information, or “lines of evidence”, are:

(1) Historical groundwater and/or soil chemistry data that demonstrate a clear and meaningful trend[18] of decreasing contaminant mass and/or concentration over time at appropriate monitoring or sampling points. (In the case of a groundwater plume, decreasing concentrations should not be solely the result of plume migration. In the case of inorganic contaminants, the primary attenuating mechanism should also be understood.)

(2) Hydrogeologic and geochemical data that can be used to demonstrate **indirectly** the type(s) of natural attenuation processes active at the site, and the rate at which such processes will reduce contaminant concentrations to required levels. For example, characterization data may be used to quantify the rates of contaminant sorption, dilution, or volatilization, or to demonstrate and quantify the rates of biological degradation processes occurring at the site.

(3) Data from field or microcosm studies (conducted in or with actual contaminated site media) which **directly** demonstrate the occurrence of a particular natural attenuation process at the site and its ability to degrade the contaminants of concern (typically used to demonstrate biological degradation processes only).

Unless EPA or the overseeing regulatory authority determines that historical data (Number 1 above) are of sufficient quality and duration to support a decision to use MNA, data characterizing the nature and rates of natural attenuation processes at the site (Number 2 above) should be provided. Where the latter are also inadequate or inconclusive, data from microcosm studies (Number 3 above) may also be necessary. In general, more supporting information may be required to demonstrate the efficacy of MNA at those sites with contaminants which do not readily degrade through biological processes (*e.g.*, most non-petroleum compounds, inorganics), or that transform into more toxic and/or mobile forms than the parent contaminant, or where monitoring has been performed for a relatively short period of time. The amount and type of information needed for such a demonstration will depend upon a number of site-specific factors, such as the size and nature of the contamination problem, the proximity of receptors and the potential risk to those receptors, and other characteristics of the environmental setting (*e.g.*, hydrogeology, ground cover, climatic conditions).

Note that those parties responsible for site characterization and remediation should ensure that all data and analyses needed to demonstrate the efficacy of MNA are collected and evaluated by capable technical specialists with expertise in the relevant sciences. Furthermore, EPA expects that documenting the level of confidence on attenuation rates will provide more technically defensible predictions of remedial timeframes and form the basis for more effective performance monitoring programs.

[18] For guidance on statistical analysis of environmental data, please see USEPA, 1989, USEPA, 1993b, USEPA, 1993d, and Gilbert, 1987, listed in the "References Cited" section at the end of this Directive.

Sites Where Monitored Natural Attenuation May Be Appropriate

MNA is appropriate as a remedial approach where it can be demonstrated capable of achieving a site's remediation objectives within a timeframe that is reasonable compared to that offered by other methods and where it meets the applicable remedy selection criteria (if any) for the particular OSWER program. **EPA expects that MNA will be most appropriate when used in conjunction with other remediation measures (*e.g.*, source control, groundwater extraction), or as a follow-up to active remediation measures that have already been implemented**.

In determining whether MNA is an appropriate remedy for soil or groundwater at a given site, EPA or other regulatory authorities should consider the following:

- Whether the contaminants present in soil or groundwater can be effectively remediated by natural attenuation processes;
- Whether or not the contaminant plume is stable and the potential for the environmental conditions that influence plume stability to change over time;
- Whether human health, drinking water supplies, other groundwaters, surface waters, ecosystems, sediments, air, or other environmental resources could be adversely impacted as a consequence of selecting MNA as the remediation option;
- Current and projected demand for the affected resource over the time period that the remedy will remain in effect;
- Whether the contamination, either by itself or as an accumulation with other nearby sources (on-site or off-site), will exert a long-term detrimental impact on available water supplies or other environmental resources;
- Whether the estimated timeframe of remediation is reasonable (see section on "Reasonable Timeframe for Remediation") compared to timeframes required for other more active methods (including the anticipated

effectiveness of various remedial approaches on different portions of the contaminated soil and/or groundwater);

- The nature and distribution of sources of contamination and whether these sources have been, or can be, adequately controlled;

- Whether the resulting transformation products present a greater risk, due to increased toxicity and/or mobility, than do the parent contaminants;

- The impact of existing and proposed active remediation measures upon the MNA component of the remedy, or the impact of remediation measures or other operations/activities (*e.g.*, pumping wells) in close proximity to the site; and

- Whether reliable site-specific mechanisms for implementing institutional controls (*e.g.*, zoning ordinances) are available, and if an institution responsible for their monitoring and enforcement can be identified.

Of the above factors, the most important considerations regarding the suitability of MNA as a remedy include: whether the contaminants are likely to be effectively addressed by natural attenuation processes, the stability of the groundwater contaminant plume and its potential for migration, and the potential for unacceptable risks to human health or environmental resources by the contamination. MNA should not be used where such an approach would result in either plume migration[19] or impacts to environmental resources that would be unacceptable to the overseeing regulatory authority. **Therefore, sites where the contaminant plumes are no longer increasing in extent, or are shrinking, would be the most appropriate candidates for MNA remedies.**

An example of a situation where MNA may be appropriate is a remedy that includes source control, a pump-and-treat system to mitigate the highly-contaminated plume areas, and MNA in the lower concentration portions of the plume. In combination, these methods would maximize groundwater restored to beneficial use in a timeframe consistent with future demand on the aquifer, while utilizing natural attenuation processes to reduce the reliance on active remediation methods and reduce remedy cost. If, at such a site, the plume was either expanding

[19] In determining whether a plume is stable or migrating, users of this Directive should consider the **uncertainty** associated with defining the limits of contaminant plumes. For example, a plume is typically delineated for each contaminant of concern as a 2- or 3-dimensional feature. Plumes are commonly drawn by computer contouring programs which estimate concentrations between actual data points. EPA recognizes that a plume boundary is more realistically defined by a zone rather than a line. Fluctuations within this zone are likely to occur due to a number of factors (*e.g.*, analytical, seasonal, spatial, etc.) which may or may not be indicative of a trend in plume migration. Therefore, site characterization activities and performance monitoring should focus on collection of data of sufficient quality to enable decisions to be made with a high level of confidence. See USEPA, 1993b, USEPA, 1993c, USEPA, 1994b, and USEPA, 1998b, for additional guidance.

or threatening downgradient wells or other environmental resources, then MNA would **not** be an appropriate remedy.

Reasonable Timeframe for Remediation

EPA recognizes that determination of what timeframe is "reasonable" for **attaining remediation objectives** is a site-specific determination. The NCP preamble suggests that a "reasonable" timeframe for a remedy relying on natural attenuation is generally a "...timeframe **comparable** to that which could be achieved through active restoration" (USEPA, 1990a, p.8734; emphasis added). The NCP preamble further states that "[t]he most appropriate timeframe must, however, be determined through an analysis of alternatives" (USEPA, 1990a, p.8732). To ensure that these estimates are comparable, assumptions should be consistently applied for each alternative considered. Thus, determination of the most appropriate timeframe is achieved through a comparison of estimates of remediation timeframe for **all** appropriate remedy alternatives.

If **restoring groundwaters to beneficial uses** is a remediation objective, a comparison of restoration alternatives from most aggressive to passive (*i.e.*, MNA) will provide information concerning the approximate range of time periods needed to attain groundwater cleanup levels. An excessively long restoration timeframe, using the most aggressive restoration method, **may** indicate that groundwater restoration is technically impracticable from an engineering perspective (USEPA, 1993a). Where restoration **is** technically **practicable** using either aggressive or passive methods, the longer restoration timeframe required by the passive alternative may be reasonable in comparison with the timeframe needed for more aggressive restoration alternatives (USEPA, 1996a).

The advantages and disadvantages of each remedy alternative, including the timeframe, should be evaluated in accordance with the remedy selection criteria used by each OSWER program. Whether a particular remediation timeframe is appropriate and reasonable for a given site is determined by balancing tradeoffs among many factors which include:

- Classification of the affected resource (*e.g.*, drinking water source, agricultural water source) and value of the resource[20];

[20] In determining whether an extended remediation timeframe may be appropriate for the site, EPA and other regulatory authorities should consider state groundwater resource classifications, priorities and/or valuations where available, in addition to relevant federal guidelines. Individual states may provide information and guidance relevant to groundwater classifications or use designations as part of a Comprehensive State Groundwater Protection Program (CSGWPP). (See USEPA, 1992a and USEPA, 1997b).

- Relative timeframe in which the affected portions of the aquifer might be needed for future water supply (including the availability of alternate supplies);

- Subsurface conditions and plume stability which can change over an extended timeframe;

- Whether the contamination, either by itself or as an accumulation with other nearby sources (on-site or off-site), will exert a long-term detrimental impact on available water supplies or other environmental resources;

- **Uncertainties** regarding the mass of contaminants in the subsurface and predictive analyses (*e.g.*, remediation timeframe, timing of future demand, and travel time for contaminants to reach points of exposure appropriate for the site);

- Reliability of monitoring and of institutional controls over long time periods;

- Public acceptance of the timeframe required to reach remediation objectives; and

- Provisions by the responsible party for adequate funding of monitoring and performance evaluation over the time period required for remediation.

It should be noted that the timeframe required for MNA remedies is often longer than that required for more active remedies. **As a consequence, the uncertainty associated with the above factors increases dramatically. Adequate performance monitoring and contingency remedies (both discussed in later sections of this Directive) should be utilized because of this higher level of uncertainty.** When determining reasonable timeframes, the uncertainty in estimated timeframes should be considered, as well as the ability to establish performance monitoring programs capable of verifying the performance expected from natural attenuation in a timely manner (*e.g.*, as would be required in a Superfund five-year remedy review).

A decision on whether or not MNA is an appropriate remedy for a given site is usually based on estimates of the rates of natural attenuation processes. Site characterization (and monitoring) data are typically used for estimating attenuation rates. These calculated rates may be expressed with respect to either time or distance from the source. Time-based estimates are

used to predict the time required for MNA to achieve remediation objectives and distance-based estimates provide an evaluation of whether a plume will expand, remain stable, or shrink. For environmental decision-making, EPA requires that the data used be of "adequate quality and usability for their intended purpose." (USEPA, 1998b). Therefore, where these rates are used to evaluate MNA, or predict the future behavior of contamination, they must also be of "adequate quality and usability." Statistical confidence intervals should be estimated for calculated attenuation rate constants (including those based on methods such as historical trend data analysis, analysis of attenuation along a flow path in groundwater, and microcosm studies). When predicting remedial timeframes, sensitivity analyses should also be performed to indicate the dependence of the calculated remedial timeframes on uncertainties in rate constants and other factors (McNab and Dooher, 1998). A statistical evaluation of the rate constants estimated from site characterization studies of natural attenuation of groundwater contamination often reveals that the estimated rate constants contain considerable uncertainty. For additional guidance on data quality, see USEPA, 1993c, 1994c, 1995b, and 1995c.

As an example, analysis of natural attenuation rates from many sites indicates that a measured decrease in contaminant concentrations of at least one order of magnitude is necessary to determine the appropriate rate law to describe the rate of attenuation, and to demonstrate that the estimated rate is statistically different from zero at a 95% level of confidence (Wilson, 1998). Due to variability resulting from sampling and analysis, as well as plume variability over time, smaller apparent reductions are often insufficient to demonstrate (with 95% level of confidence) that attenuation has in fact occurred at all.

Thus, EPA or other regulatory authorities should consider a number of factors when evaluating reasonable timeframes for MNA at a given site. These factors, on the whole, should allow the overseeing regulatory authority to determine whether a natural attenuation remedy (including institutional controls where applicable) will fully protect potential human and environmental receptors, and whether the site remediation objectives and the time needed to meet them are consistent with the regulatory expectation that contaminated groundwaters will be restored to beneficial uses within a reasonable timeframe. **When these conditions cannot be met using MNA, a remedial alternative that more likely would meet these expectations should be selected.**

Remediation of Sources

Source control measures should be evaluated as part of the remedy decision process at **all** sites, particularly where MNA is under consideration as the remedy or as a remedy component. Source control measures include removal, treatment, or containment, or a combination of these approaches. EPA prefers remedial options which remove free-phase NAPLs and treat those source materials determined to constitute "principal threat wastes" (see Footnote 13).

Contaminant sources that are not adequately addressed complicate the long-term cleanup effort. For example, following free product recovery, residual contamination from a petroleum

fuel release may continue to leach significant quantities of contaminants into the groundwater as well as itself posing unacceptable risks to humans or environmental resources. Such a lingering source often unacceptably extends the time necessary to reach remediation objectives. This leaching can occur even while contaminants are being naturally attenuated in other parts of the plume. If the rate of attenuation is lower than the rate of replenishment of contaminants to the groundwater, the plume can continue to expand thus contaminating additional groundwater and potentially posing a threat to downgradient receptors.

Control of source materials is the most effective means of ensuring the timely attainment of remediation objectives. **EPA, therefore, expects that source control measures will be evaluated for all contaminated sites and that source control measures will be taken at most sites where practicable.** At many sites it will be appropriate to implement source control measures during the initial stages of site remediation ("phased remedial approach"), while collecting additional data to determine the most appropriate groundwater remedy.

Performance Monitoring and Evaluation

Performance monitoring to evaluate remedy effectiveness and to ensure protection of human health and the environment is a critical element of all response actions. Performance monitoring is of even greater importance for MNA than for other types of remedies due to the potentially longer remediation timeframes, potential for ongoing contaminant migration, and other uncertainties associated with using MNA. This emphasis is underscored by EPA's reference to "monitored natural attenuation".

The monitoring program developed for each site should specify the location, frequency, and type of samples and measurements necessary to evaluate whether the remedy is performing as expected and is capable of attaining remediation objectives. In addition, all monitoring programs should be designed to accomplish the following:

- Demonstrate that natural attenuation is occurring according to expectations;
- Detect changes in environmental conditions (*e.g.*, hydrogeologic, geochemical, microbiological, or other changes) that may reduce the efficacy of any of the natural attenuation processes[21];
- Identify any potentially toxic and/or mobile transformation products;
- Verify that the plume(s) is not expanding (either downgradient, laterally or vertically);

[21] Detection of changes will depend on the proper siting and construction of monitoring wells/points. Although the siting of monitoring wells is a concern for any remediation technology, it is of even greater concern with MNA because of the lack of engineering controls to control contaminant migration.

- Verify no unacceptable impact to downgradient receptors;
- Detect new releases of contaminants to the environment that could impact the effectiveness of the natural attenuation remedy;
- Demonstrate the efficacy of institutional controls that were put in place to protect potential receptors; and
- Verify attainment of remediation objectives.

The frequency of monitoring should be adequate to detect, in a timely manner, the potential changes in site conditions listed above. At a minimum, the monitoring program should be sufficient to enable a determination of the rate(s) of attenuation and how that rate is changing with time. When determining attenuation rates, the uncertainty in these estimates and the associated implications should be evaluated (see McNab and Dooher, 1998). Flexibility for adjusting the monitoring frequency over the life of the remedy should also be included in the monitoring plan. For example, it may be appropriate to decrease the monitoring frequency at some point in time, once it has been determined that natural attenuation is progressing as expected and very little change is observed from one sampling round to the next. In contrast, the monitoring frequency may need to be increased if unexpected conditions (*e.g.*, plume migration) are observed.

Performance monitoring should continue until remediation objectives have been achieved, and longer if necessary to verify that the site no longer poses a threat to human health or the environment. Typically, monitoring is continued for a specified period (*e.g.*, one to three years) after remediation objectives have been achieved to ensure that concentration levels are stable and remain below target levels. The institutional and financial mechanisms for maintaining the monitoring program should be clearly established in the remedy decision or other site documents, as appropriate.

Details of the monitoring program should be provided to EPA or the overseeing regulatory authority as part of any proposed MNA remedy. Further information on the types of data useful for monitoring natural attenuation performance can be found in the ORD publications (*e.g.*, USEPA, 1997a, USEPA, 1994a) listed in the “References Cited” section of this Directive. Also, USEPA (1994b) published a detailed document on collection and evaluation of performance monitoring data for pump-and-treat remediation systems.

Contingency Remedies

A contingency remedy is a cleanup technology or approach specified in the site remedy decision document that functions as a "backup" remedy in the event that the "selected" remedy fails to perform as anticipated. A contingency remedy may specify a technology (or technologies) that is (are) different from the selected remedy, or it may simply call for modification of the selected technology, if needed. Contingency remedies should generally be flexible—allowing for the incorporation of new information about site risks and technologies.

Contingency remedies are not new to OSWER programs. Contingency remedies should be included in the decision document where the selected technology is not proven for the specific site application, where there is significant uncertainty regarding the nature and extent of contamination at the time the remedy is selected, or where there is uncertainty regarding whether a proven technology will perform as anticipated under the particular circumstances of the site (USEPA, 1990c).

It is also recommended that one or more criteria ("triggers") be established, as appropriate, in the remedy decision document that will signal unacceptable performance of the selected remedy and indicate when to implement contingency remedies. Such criteria should generally include, but not be limited to, the following:

- Contaminant concentrations in soil or groundwater at specified locations exhibit an increasing trend not originally predicted during remedy selection;
- Near-source wells exhibit large concentration increases indicative of a new or renewed release;
- Contaminants are identified in monitoring wells located outside of the original plume boundary;
- Contaminant concentrations are not decreasing at a sufficiently rapid rate to meet the remediation objectives; and
- Changes in land and/or groundwater use will adversely affect the protectiveness of the MNA remedy.

In establishing triggers or contingency remedies, however, care is needed to ensure that sampling variability or seasonal fluctuations do not unnecessarily trigger a contingency. For example, an anomalous spike in dissolved concentration(s) at a well(s) might not be a true indication of a change in trend.

EPA recommends that remedies employing MNA be evaluated to determine the need for including one or more contingency measures that would be capable of achieving remediation objectives. EPA believes that contingency remedies should generally be included as part of a MNA remedy which has been selected based primarily on predictive analyses rather than documented trends of decreasing contaminant concentrations.

SUMMARY

EPA remains fully committed to its goals of protecting human health and the environment by remediating contaminated soils, restoring contaminated groundwaters to their beneficial uses, preventing migration of contaminant plumes, and protecting groundwaters and other environmental resources. EPA does not view MNA to be a "no action" remedy, but rather considers it to be a means of addressing contamination under a limited set of site circumstances where its use meets the applicable statutory and regulatory requirements. MNA is not a "presumptive" or "default" remediation alternative, but rather should be evaluated and compared to other viable remediation methods (including innovative technologies) during the study phases leading to the selection of a remedy. The decision to implement MNA should include a comprehensive site characterization, risk assessment where appropriate, and measures to control sources. In addition, the progress of natural attenuation towards a site's remediation objectives should be carefully monitored and compared with expectations to ensure that it will meet site remediation objectives within a timeframe that is reasonable compared to timeframes associated with other methods. Where MNA's ability to meet these expectations is uncertain and based predominantly on predictive analyses, decision-makers should incorporate contingency measures into the remedy.

EPA is confident that MNA will be, at many sites, a reasonable and protective component of a broader remediation strategy. However, EPA believes that there will be many other sites where either the uncertainties are too great or there is a need for a more rapid remediation that will preclude the use of MNA as a stand-alone remedy. This Directive should help promote consistency in how MNA remedies are proposed, evaluated, and approved.

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