Document Type: EIS-Administrative Record
Index Field: Final Environmental Impact Statement
Project Name: Ash Impoundment Closure EIS
Project Number: 2015-31

FINAL
ASH IMPOUNDMENT CLOSURE
ENVIRONMENTAL IMPACT STATEMENT

PART I – PROGRAMMATIC NEPA REVIEW

Prepared by:
TENNESSEE VALLEY AUTHORITY
Chattanooga, Tennessee

June 2016

Ashley R. Farless, PE, AICP
NEPA Compliance
Tennessee Valley Authority
1101 Market Street
Chattanooga, TN 37402
Phone: 423.751.2361
Fax: 423.751.7011

Ash Impoundment Closure
Final Environmental Impact Statement
Tennessee Valley Authority
June 2016
Executive Summary

This Environmental Impact Statement (EIS) addresses the closure of coal combustion residual (CCR) impoundments at the Tennessee Valley Authority's coal plants. The purpose of this review is to support TVA's goal to eliminate all wet CCR storage at its coal plants by closing CCR impoundments across the TVA system, and to assist TVA in complying with EPA's CCR Rule. The EPA rule establishes national criteria and schedules for the management and closure of CCR facilities

CCRs are byproducts produced from burning coal and include fly ash, bottom ash, boiler slag and flue gas desulfurization materials. Historically, TVA has managed storage of CCR materials in ash impoundments or dry landfills. After the dike failure and ash spill at the Kingston Fossil Plant in 2008, TVA's Board of Directors directed TVA staff to review and address systems, controls and standards related to CCRs.

The outcome of that review was the goal to convert wet storage of CCRs to dry storage and close ash impoundments. This is being done on a project by project basis, subject to technical feasibility, availability of resources and environmental review. The ash impoundments within TVA's system vary in size from less than 10 acres (ac) to those that are nearly 400 ac. Many of the existing ash impoundments are decades old, and the larger impoundments contain millions of cubic yards (yd3) of CCR material.

Part I of the EIS considers all TVA ash impoundments and the environmental effects of two primary ash impoundment closure methods at a programmatic or generic level. These methods are: (1) Closure-in-Place and (2) Closure-by-Removal. Part II of the EIS consists of site-specific reviews of 10 CCR facilities that TVA proposes to close quickly.

From its analyses and available data, TVA concludes that CCR management activities at its plants do not pose any real risk to human health or the environment. Closure-in-Place or Closure-by-Removal would further lessen risks. At most locations, Closure-in-Place is more environmental beneficial than Closure-by-Removal, largely because Closure-by-Removal has significantly greater transportation-related impacts and takes longer than Closure-in-Place. Both reduce groundwater contamination. While Closure-by-Removal would reduce groundwater contamination more than Closure-in-Place over the long-term when CCR intersects groundwater (is in the groundwater), Closure-in-Place still reduces contamination in such situations. Closure-by-Removal always is more costly, and depending on the volume of CCR material to be moved significantly more costly, compared to Closure-in-Place.

EPA's CCR Rule, an administrative order issued by the Tennessee Department of Environment and Conservation, and other regulatory processes will help ensure that TVA CCR management activities, including the closure of its impoundments, will continue to be protective of human health and the environment. If TVA data and analyses indicated that its CCR activities were not protective of people's health and the environment, it would have acted to remedy this already. TVA is committed to doing so in the future.

Alternatives Considered

In addition to a No-Action Alternative which served as a baseline, TVA considered both Closure-in-Place and Closure-by-Removal Alternatives for CCR impoundments.

Based on its technical studies to support the CCR Rule, EPA determined that either Closure-in-Place or Closure-by-Removal would be equally protective of human health and the environment provided they are completed properly. EPA also observed that most facilities would be closed in place because of the difficulty of removing CCRs and notably higher costs and it assumed in its regulatory impact analysis that all facilities would be closed in place.

Closure-in-Place involves dewatering the impoundment, stabilizing the CCR, and installing a cover system. This keeps new sources of water from mixing with the CCR material which reduces risks of structural instability and groundwater contamination.

Closure-by-Removal involves dewatering and excavating the CCR material, transporting it to a lined landfill, reshaping the site and filling it with borrow material. Duration of Closure-by-Removal projects will depend on a number of factors including, primarily, the amount of CCR material to be removed from the impoundment, logistics associated with drying out the CCR and loading it into trucks or rail cars, and the amount of borrow material that must be transported to the site to fill in the excavated hole.

Public and Agency Involvement

On August 27, 2015, TVA published a Notice of Intent (NOI) in the Federal Register announcing that it planned to prepare an EIS to address the closure of CCR impoundments at its coal-fired power plants. The NOI initiated a 30-day public scoping period, which concluded on September 30, 2015. In addition to the NOI in the Federal Register, TVA published notices regarding this effort in regional and local newspapers; issued a news release to media; and posted the news release on the TVA Web site to solicit public input.

TVA developed a robust public involvement campaign for the release of the Draft EIS to ensure maximum awareness and opportunity to learn about and comment on the document. The notice of its availability was published in the Federal Register on January 8, 2016, with public notices running in major newspapers in the Tennessee Valley region. The formal public and agency comment period began January 11, 2016, and was scheduled to close 45 days later. (The Draft EIS actually was posted on the TVA Web site and available for public review on December 30, 2015.) The comment period was extended another 14 days until March 9, in response to several requests.

During the public comment period, TVA conducted 10 public meetings at fossil plant communities across the Valley. Notification of those townhall meetings entailed ads in each of the local newspapers and extensive media outreach. A 5-minute project and NEPA process overview video was created and played at each gathering and posted on the Web site. The public had the opportunity to submit comments at the meetings on response cards or by computer directly to our Web site.

TVA also provided information about the EIS to its Federal Advisory Committee Act (FACA) groups, the Regional Energy Resource Council (RERC) and the Regional Resource Stewardship Council (RRSC). Local, state and federal elected officials were briefed on the EIS too.

TVA received approximately 70 comment submissions which included letters, e-mails, petition-style submissions, comment forms, and submissions through the project website. The comment submissions were signed by more than 650 individuals. Comments and TVA's responses can be found in Appendix A of this document.

Part I Programmatic NEPA Review

The EIS describes the setting and existing conditions for natural and socioeconomic resource areas that could be affected by each alternative. From this baseline information, TVA analyzed potential impacts on 21 resource areas:

- Air Quality
- Climate Change
- Land Use
- Prime Farmland
- Geology and Seismology
- Groundwater
- Surface Water
- Floodplains
- Vegetation
- Wildlife
- Aquatic Ecology
- Solid Waste and Hazardous Waste and Hazardous Materials
- Threatened and Endangered Species
- Wetlands
- Socioeconomics and Environmental Justice
- Natural Areas, Parks, and Recreation
- Transportation
- Visual Resources
- Cultural and Historic Resources
- Noise
- Public Health and Safety

Both CCR impoundment closure alternatives have several common features that affect anticipated environmental impacts. These include temporary construction-related impacts (e.g., dewatering of impoundments) and those associated with the transport of borrow material needed to close the CCR impoundment.

For Closure-in-Place, TVA's analyses confirm EPA's determination that dewatering and capping impoundments would reduce groundwater contamination and structural stability risks because the hydraulic head (water pressure) would be reduced. Compared to Closure-by-Removal, this alternative would have significantly less risks to workforce health and safety and those related to off-site transportation of CCR (crashes, derailments, road damage and other transportation-related effects).

Closure-by-Removal would reduce groundwater contamination risks more than Closure-in-Place over the long term when CCR intersects with groundwater because CCR material would be excavated and moved to a permitted landfill. However, this alternative would result in notably greater impacts associated with other environmental factors and would increase the potential for impacts on worker-related and transportation related health and safety.

Mitigation Measures

The reduction of environmental impacts was an important goal in TVA's process for identifying CCR impoundment closure methods. EPA's CCR Rule and state regulatory programs require actions that will avoid, eliminate, or reduce potential CCR impacts and these overlay all of TVA's proposed and future CCR-related closure activities. Mitigation measures identified in the programmatic review were identified to minimize potential adverse impacts associated with CCR impoundment closure at all TVA fossil-fuel plants. These measures include:

- Implementation of fugitive dust control systems;
- Erosion and sediment control best management practices (BMPs) to ensure that surface waters are protected from construction impacts
- Other construction BMPs to minimize and restore areas disturbed during construction such as revegation with native species; and
- Other more specific mitigation measures are identified in Part II reviews as appropriate

A comparison of effects on various resources for each alternative is presented in Table ES-1.

Table ES-1. Summary and Comparison of Alternatives by Resource Area

Issue Area	Alternative A – No Action	Alternative B – Closure-in-Place	Alternative C – Closure-by-Removal
Closure Cost	$0	<$3.5 to $200 million	<$20 million to $2.3 billion (Truck) <$23 million to $2.1 billion (Train)
Air Quality	No impact	Temporary minor impacts from fugitive dust and emissions from equipment and vehicles during construction and transport of borrow material.	Notably greater emissions (relative to Alternative B) from fugitive dust and emissions from equipment and vehicles during construction and transport of borrow and CCR material. For sites with large volumes of CCR magnitude of impact would be greater due to increased operation of on-site equipment and increased duration and frequency of off-site trucking. No exceedances of NAAQS expected for sites in attainment areas. No further deterioration of air quality is anticipated in the non-attainment areas for particulates and ozone.
Climate Change and Greenhouse Gases (GHG)	No impact	Construction and trucking operations of borrow material contributes to emissions of GHG.	Construction and trucking operations of CCR removal and borrow material contributes to emissions of GHG. For sites with large volumes of CCR, magnitude of impact would be greater due to increased operation of on-site equipment and increased duration and frequency of off-site trucking.
Land Use	No impact as no change in industrial land use	No impact as no change in industrial land use. Temporary impacts associated with the conversion of some vacant areas to laydown areas.	No impact as no change in industrial land use. Impacts associated with the conversion of some vacant areas to laydown areas. Minor beneficial impact as land could be reused for an alternative use following closure.
Prime Farmland	No impact	No impact	No impact
Geology and Seismology	Marginal improvement to static and seismic factor of safety of the impoundment.	Stable under static conditions. Stability increased by removal of hydraulic head. Seismic stability under evaluation and mitigable.	No impacts or risks of failure.
Groundwater	Risk to groundwater is not reduced.	Eliminating rain access reduces risk of migration of constituents to groundwater.	Reduces risk to groundwater by removing CCR from impoundment. Less short-term benefit for sites having high volume of CCR materials.
Surface Water	Risk to surface water is not reduced.	Risk to surface water would be reduced. Construction-related impacts would be negligible.	Risks to surface water would be reduced. Construction-related impacts would be negligible.

Table ES-1. Summary and Comparison of Alternatives by Resource Area

Issue Area	Alternative A – No Action	Alternative B – Closure-in-Place	Alternative C – Closure-by-Removal
Floodplains	Impacts to floodplains unchanged.	Reduces risk and extent of CCR migration into surface water during potential flooding event.	Removes risk of CCR migration into surface water during potential flooding event. Potential to incrementally increase floodplain storage.
Vegetation	No impact	Limited to construction-phase disturbance of largely industrialized settings that lack notable plant communities. Minor and adverse in the short term, but minor and positive in the long term.	Limited to construction-phase disturbance of largely industrialized settings that lack notable plant communities. Minor and adverse in the short term, but minor and positive in the long term.
Wildlife	No impact	Minor impact to predominantly previously disturbed low quality habitats during the construction phase.	Minor impact to predominantly previously disturbed low quality habitats during the construction phase.
Aquatic Ecology	No impact	No adverse impact	No adverse impact
Threatened and Endangered Species	No impact to threatened or endangered species.	No impact to threatened or endangered species. For sites that require limited tree removal potential impacts to threatened and endangered species would be minor.	No impact to threatened or endangered species. For sites that require limited tree removal potential impacts to threatened and endangered species would be minor.
Wetlands	No impact	No direct impact. Potential minor indirect impact may occur during construction. These would be minimized through BMPs.	No direct impact. Potential minor indirect impact may occur during construction. These would be minimized through BMPs.
Socioeconomic Resources	No impact	Short-term beneficial increases in employment and income during construction.	Short-term beneficial increases in employment and income. The larger the CCR volume the longer the benefits would last due to increased construction periods. Potential impacts to community services due to increased demand on workforce and equipment.
Environmental Justice	No impacts to EJ communities.	Impacts associated with the transport of borrow material (construction related noise, exposure to fugitive dust and exhaust emissions) to identified EJ communities. These impacts would be short term and generally minor.	Impacts associated with the transport of borrow and CCR material (construction related noise, exposure to fugitive dust and exhaust emissions) to identified EJ communities. For sites with large volumes of CCR, magnitude of impact would be greater due to increased duration and frequency of off-site truck or rail transport.

Table ES-1. Summary and Comparison of Alternatives by Resource Area

Issue Area	Alternative A – No Action	Alternative B – Closure-in-Place	Alternative C – Closure-by-Removal
Natural Areas, Parks and Recreation	No impacts	Potential long-term impact if recreational sites are closed as a result of impoundment closure activities.	Potential long-term impact if recreational sites are closed as a result of impoundment closure activities.
Transportation	No impacts	Temporary minor impacts from transport of borrow material.	Impact magnitude dependent upon CCR volume and removal duration. For sites with large volumes of CCR, magnitude of impact would be greater due to increased duration and frequency of off-site trucking resulting in additional impacts to local traffic and increase need for roadway maintenance. Impacts on level of service of roadway network notably greater for sites having large CCR volumes and short removal durations, resulting in increased risk of injuries and deaths.
Visual Resources	No impacts	Minor impacts during construction. Beneficial in long term.	Minor impacts during construction. Beneficial in long term.
Cultural Resources	No impacts	No impacts due to use of previously disturbed lands.	No impacts due to use of previously disturbed lands.
Noise	No impacts	Temporary minor construction noise impacts from equipment and vehicles.	Minor construction noise impacts from equipment and vehicles. For sites with large volumes of CCR, magnitude of impact would be greater due to increased duration and frequency of off-site truck and rail transport.
Solid and Hazardous Waste	No impacts	Minimal amounts generated during construction activities and managed in permitted facilities.	Minimal amounts generated during construction activities and managed in permitted facilities.
Public Health and Safety	No reduction in public health and safety risks to groundwater and surface water.	Temporary potential for impacts during construction activities and transportation of borrow material.	Potential for impacts during construction activities and transportation of borrow material and CCR. Increased risk associated with deep excavation of CCR impoundments. Notably greater risk to worker safety and traffic related safety associated with sites having high CCR volumes

Table ES-1. Summary and Comparison of Alternatives by Resource Area

Issue Area	Alternative A – No Action	Alternative B – Closure-in-Place	Alternative C – Closure-by-Removal
Cumulative Effects	No impacts	Beneficial cumulative impact to groundwater quality associated with TVA plant sites from closure of CCR impoundments.	Beneficial cumulative impact to groundwater quality associated with TVA plant sites from removal of CCR from impoundments. Adverse cumulative impact to traffic operations within the TVA region. Cumulative impacts to air quality, noise, land use, natural resources socioeconomics, EJ communities and public health and safety would be expected and greater than Alternative B due to greater trucking and secondary effects on regional landfill capacity.

Part II Site-Specific NEPA Review

In the CCR Rule, EPA encouraged utilities to close and cap impoundments quickly because this would significantly reduce groundwater contamination and structural stability risks. TVA identified 10 CCR facilities at six of its plants that it could close quickly. These are facilities at Allen, Bull Run, Kingston and John Sevier plants in Tennessee and at Widows Creek and Colbert plants in Alabama. TVA conducted a site-specific NEPA review for each of these facilities that tiers from the programmatic level review in Part I of this PEIS.

Recognizing the potential pathways for exposure and risk related to existing CCR impoundments, TVA developed a series of factors important in the screening and evaluation of closure alternatives. TVA used these factors to determine which closure alternatives should be considered in greater detail in its site-specific analyses.

Key factors that TVA considered included: volume of CCR materials, schedule/duration of closure activities, stability, risk to people's health and safety relating to closure activities, mode and duration of transport activities, potential human health risk associated with CCR constituents in the existing impoundments, effects to wetlands, risk to adjacent environmental resources, and cost. Based on these factors, Closure-in-Place was analyzed in detail at all sites. Closure-by-Removal also was analyzed in detail at Allen Fossil Plant and John Sevier Fossil Plant TVA explains in each site-specific review the reasons for including or excluding closure alternatives from more detailed review.

Based on the programmatic and site-specific analyses, TVA has identified Closure-in-Place as its preferred alternative for all 10 facilities. This alternative would achieve the purpose and need for TVA's proposed actions and compared to Closure-by-Removal with less environmental impact, shorter schedules, and less cost.

Table of Contents

CHAPTER 1 – PURPOSE AND NEED FOR ACTION **1**

1.1 Introduction 1
1.2 Purpose and Need 7
1.3 Related Environmental Reviews and Consultation Requirements 7
1.4 Decision to be Made 8
1.5 Identification of the Project Scope 8
1.6 Summary of Public and Agency Coordination Process 9
1.6.1 Notice of Intent 10
1.6.2 TVA's Project Web Site 10
1.7 Required Permits and Licenses 11

CHAPTER 2 – ALTERNATIVES **13**

2.1 Summary of Alternatives 13
2.2 Project Alternatives 13
2.2.1 Alternative A – No Action 13
2.2.2 Alternative B – Closure-in-Place 14
2.2.3 Alternative C – Closure-by-Removal 21
2.2.4 Modes of Material Transport 24
2.2.4.1 Transport of Borrow Material 25
2.2.4.2 Transport of CCR Material 25
2.2.5 Screening Factors to Evaluate Alternatives 28
2.3 EPRI Relative Impact Framework 32
2.3 Summary of Public and Agency Scoping Process 34
2.4 Comparison of Alternatives 35
2.5 Alternatives to be Carried Forward for Detailed Analysis 39
2.6 Summary of Mitigation Measures 39

CHAPTER 3 – AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES **41**

3.1 Air Quality 41
3.1.1 Affected Environment 41
3.1.1.1 Criteria Air Pollutants 41
3.1.1.2 Other Air Pollutants and Air Quality Concerns 44
3.1.2 Environmental Consequences 44
3.1.2.1 Alternative A – No Action 44
3.1.2.2 Alternative B – Closure-in-Place 44
3.1.2.3 Alternative C – Closure-by-Removal 46
3.2 Climate Change and Greenhouse Gases 46
3.2.1 Affected Environment 46
3.2.1.1 Natural Greenhouse Gas Emissions 47
3.2.1.2 Greenhouse Effect 47
3.2.1.3 Greenhouse Gas Emissions 48
3.2.1.4 Climate Adaptation 48
3.2.2 Environmental Consequences 49
3.2.2.1 Alternative A – No Action 49
3.2.2.2 Alternative B – Closure-in-Place 49
3.2.2.3 Alternative C – Closure-by-Removal 49
3.3 Land Use 50
3.3.1 Affected Environment 50

3.3.2 Environmental Consequences 50
3.3.2.1 Alternative A – No Action 50
3.3.2.2 Alternative B – Closure-in-Place 50
3.3.2.3 Alternative C – Closure-by-Removal 51
3.4 Prime Farmland 51
3.4.1 Affected Environment 51
3.4.2 Environmental Consequences 52
3.4.2.1 Alternative A – No Action 52
3.4.2.2 Alternative B – Closure-in-Place 52
3.4.2.3 Alternative C – Closure-by-Removal 52
3.5 Geology and Seismology 53
3.5.1 Affected Environment 53
3.5.1.1 Regional Geology 53
3.5.1.2 Regional Seismic Setting 55
3.5.1.3 Static Stability of Ash Impoundment Berms 57
3.5.2 Environmental Consequences 58
3.5.2.1 Alternative A – No Action Alternative 58
3.5.2.2 Alternative B – Closure-in-Place 58
3.5.2.3 Alternative C – Closure-by-Removal 59
3.6 Groundwater 59
3.6.1 Affected Environment 59
3.6.1.1 Regulatory Framework for Groundwater 59
3.6.1.2 Regional Aquifers 60
3.6.1.3 Groundwater Use 61
3.6.1.4 Conceptual Site Model 63
3.6.2 Environmental Consequences 63
3.6.2.1 Alternative A – No Action 63
3.6.2.2 Alternative B – Closure-in-Place 64
3.6.2.3 Alternative C – Closure-By-Removal 66
3.7 Surface Water 66
3.7.1 Affected Environment 66
3.7.1.1 Affected Watersheds 66
3.7.1.2 Characteristics of Ash Impoundment Discharges 71
3.7.2 Environmental Consequences 73
3.7.2.1 Alternative A – No Action Alternative 73
3.7.2.2 Alternative B – Closure-in-Place 73
3.7.2.3 Alternative C – Closure-by-Removal 75
3.8 Floodplains 76
3.8.1 Affected Environment 76
3.8.2 Environmental Consequences 78
3.8.2.1 Alternative A – No Action 78
3.8.2.2 Alternative B – Closure-in-Place 78
3.8.2.3 Alternative C – Closure-by-Removal 78
3.9 Vegetation 79
3.9.1 Affected Environment 79
3.9.2 Environmental Consequences 81
3.9.2.1 Alternative A – No Action 81
3.9.2.2 Alternative B – Closure-in-Place 81
3.9.2.3 Alternative C – Closure-by-Removal 81
3.10 Wildlife 82
3.10.1 Affected Environment 82

3.10.1.1 TVA Lands ... 83
3.10.1.2 TVA Coal-Fired Plant Sites ... 84
3.10.2 Environmental Consequences ... 84
3.10.2.1 Alternative A – No Action ... 84
3.10.2.2 Alternative B – Closure-in-Place ... 84
3.10.2.3 Alternative C – Closure-by-Removal ... 85
3.11 Aquatic Ecology ... 86
3.11.1 Affected Environment ... 86
3.11.1.1 The Tennessee River Basin ... 87
3.11.1.2 Other Drainages in the TVA Region ... 88
3.11.1.3 Site-Specific Information ... 88
3.11.2 Environmental Consequences ... 88
3.11.2.1 Alternative A – No Action ... 88
3.11.2.2 Alternative B – Closure-in-Place ... 88
3.11.2.3 Alternative C – Closure-by-Removal ... 89
3.12 Threatened and Endangered Species ... 89
3.12.1 Affected Environment ... 89
3.12.2 Environmental Consequences ... 91
3.12.2.1 Alternative A – No Action ... 91
3.12.2.2 Alternative B – Closure-in-Place ... 91
3.12.2.3 Alternative C – Closure-by-Removal ... 91
3.13 Wetlands ... 91
3.13.1 Affected Environment ... 91
3.13.2 Environmental Consequences ... 92
3.13.2.1 Alternative A – No Action ... 92
3.13.2.2 Alternative B – Closure-in-Place ... 92
3.13.2.3 Alternative C – Closure-by-Removal ... 93
3.14 Socioeconomics and Environmental Justice ... 94
3.14.1 Affected Environment ... 94
3.14.1.1 Demographics ... 99
3.14.1.2 Economic Conditions ... 100
3.14.1.3 Environmental Justice ... 104
3.14.2 Environmental Consequences ... 106
3.14.2.1 Alternative A – No Action ... 106
3.14.2.2 Alternative B – Closure-in-Place ... 106
3.14.2.3 Alternative C – Closure-by-Removal ... 107
3.15 Natural Areas, Parks and Recreation ... 108
3.15.1 Affected Environment ... 108
3.15.2 Environmental Consequences ... 109
3.15.2.1 Alternative A – No Action ... 109
3.15.2.2 Alternative B – Closure-in-Place ... 109
3.15.2.3 Alternative C – Closure-by-Removal ... 109
3.16 Transportation ... 110
3.16.1 Affected Environment ... 110
3.16.2 Environmental Consequences ... 110
3.16.2.1 Alternative A – No Action ... 110
3.16.2.2 Alternative B – Closure-in-Place ... 110
3.16.2.3 Alternative C – Closure-by-Removal ... 113
3.17 Visual Resources ... 117
3.17.1 Affected Environment ... 117
3.17.2 Environmental Consequences ... 118

3.17.2.1 Alternative A – No Action 118
3.17.2.2 Alternative B – Closure-in-Place 118
3.17.2.3 Alternative C – Closure-by-Removal 119
3.18 Cultural and Historic Resources 119
3.18.1 Affected Environment 119
3.18.1.1 Regulatory Framework for Cultural Resources 119
3.18.1.2 Archaeological Resources 120
3.18.1.3 Historic Resources 122
3.18.2 Environmental Consequences 122
3.18.2.1 Alternative A – No Action Alternative 122
3.18.2.2 Alternative B – Closure-in-Place 122
3.18.2.3 Alternative C – Closure-by-Removal 123
3.19 Noise 123
3.19.1 Affected Environment 123
3.19.1.1 Noise Regulations 124
3.19.1.2 Background Noise Levels 125
3.19.1.3 Sources of Noise 126
3.19.2 Environmental Consequences 126
3.19.2.1 Alternative A – No Action 126
3.19.2.2 Alternative B – Closure-in-Place 127
3.19.2.3 Alternative C – Closure-by-Removal 128
3.20 Solid Waste and Hazardous Waste and Hazardous Materials 129
3.20.1 Affected Environment 129
3.20.2 Environmental Consequences 130
3.20.2.1 Alternative A – No Action 130
3.20.2.2 Alternative B – Closure-in-Place 130
3.20.2.3 Alternative C – Closure-by-Removal 132
3.21 Public Health and Safety 133
3.21.1 Affected Environment 133
3.21.2 Environmental Consequences 134
3.21.2.1 Alternative A - No Action Alternative 134
3.21.2.2 Alternative B – Closure-in-Place 134
3.21.2.3 Alternative C – Closure-by-Removal 135
3.22 Unavoidable Adverse Environmental Impacts 136
3.23 Relationship of Short-Term Uses and Long-Term Productivity 136
3.24 Irreversible and Irretrievable Commitments of Resources 137
3.25 Cumulative Effects 138
3.25.1 Geographic Area of Analysis 138
3.25.2 Identification of “Other Actions” 138
3.25.2.1 Energy 139
3.25.2.2 Environmental Stewardship 139
3.25.3 Analysis of Cumulative Effects 139
3.25.3.1 Alterative B – Closure-in-Place 140
3.25.3.2 Alternative C – Closure-by-Removal 140

CHAPTER 4 – LITERATURE CITED 143

CHAPTER 5 – LIST OF PREPARERS 151

5.1 NEPA Core Team 151
5.2 Other Contributors 151

CHAPTER 6 – ENVIRONMENTAL IMPACT STATEMENT RECIPIENTS 157

6.1 Federal Agencies 157
6.2 Federally Recognized Tribes 157
6.3 State Agencies 157
6.4 Individuals and Organizations 158

List of Appendices

Appendix A – Responses to Comments 159
Appendix B – Regional Energy Resource Council Presentation 161
Appendix C – Agency Correspondence 163

List of Tables

Table 1-1. CCR Rule Regulatory Timeframe 4
Table 1-2. TVA Fleet-wide Coal-Fired Power Plants 6
Table 1-3. CCRs Generated by TVA from 2010-2015 7
Table 1-4. Summary of CCR Impoundments Evaluated in Part II 8
Table 2-1. Summary of Relevant Fleet-wide Construction Data for Alternative B 14
Table 2-2. Summary of Proposed Activities for Closure-in-Place Alternative 16
Table 2-3. Summary of Relevant Fleet-wide Construction Data for Alternative C 22
Table 2-4. Summary of Proposed Activities for Closure-by-Removal Alternative 22
Table 2-5. Advantages and Disadvantages of Transport Methods 25
Table 2-6. Site Features and Pathways Considered in the EPRI Relative Impact Framework 33
Table 2-7. Summary and Comparison of Alternatives by Resource Area 36
Table 3-1. Major Man-Made Greenhouse Gases and Their Global Warming Potentials 48
Table 3-2. Summary of Geologic Characteristics at TVA Coal-Fired Power Plants 54
Table 3-3. PGA Values at TVA Coal-Fired Facilities 56
Table 3-4. Aquifer, Well and Water Quality Characteristics in the TVA Region 62
Table 3-5. Principal Water Quality Concerns in TVA Reservoirs 68
Table 3-6. CCR Impoundment Flow Estimates 72
Table 3-7. CCR Impoundments at TVA Coal-Fired Plants 77
Table 3-8. Summary of Demographic Data for Counties in Alabama and Kentucky Near TVA Coal-Fired Plants 96
Table 3-9. Summary of Demographic Data for Counties in Tennessee Near TVA Coal-Fired Plants 97
Table 3-10. Demographic Characteristics of Cities with TVA Coal-Fired Plants (Alabama, Kentucky, Tennessee) 98
Table 3-11. Occupational Characteristics 101
Table 3-12. Summary of Employment and Unemployment Data for Counties with TVA Fossil Fuel Plants 103
Table 3-13. Borrow Material Transport Capacity for Closure-In-Place Alternative 112
Table 3-14. CCR Material Transport Capacity for Closure-By-Removal Alternative 114
Table 3-15. Summary of Previously Identified Cultural Resources at TVA Coal-Fired Plants 122
Table 3-16. Common Indoor and Outdoor Noise Levels 125
Table 3-17. Typical Construction Equipment Noise Levels 127
Table 3-18. Representative Hazardous and Solid Wastes Generated During Construction 131

List of Figures

Figure 1-1. TVA Coal-Fired Power Plants 1
Figure 1-2. Tiered NEPA Process for TVA Ash Impoundment Closure 5
Figure 2-1. Illustration of No Action Alternative 14
Figure 2-2. Illustration of Post-construction Condition for Closure-in-Place Options 15
Figure 2-3. Examples of Cover System Sub-alternatives 19
Figure 2-4. Illustration of Post-Construction Condition for Closure-by-Removal Alternative 21
Figure 2-5. Framework Pathways for CCR-Related Risk (Source: EPRI 2016c) 29
Figure 2-6. Duration of Trucking vs. CCR Removal Volume 31
Figure 3-1. TVA Service Area and Class I Air Quality Areas 42
Figure 3-2. Physiographic Sections of the TVA Region (Adapted from Fenneman, 1938) 53
Figure 3-3. Seismic Peak Ground Acceleration Factors in the Vicinity of TVA Coal-Fired Plants 56
Figure 3-4. Ecoregions within the TVA Valley 79
Figure 3-5. TVA Region Estimated 2009 Population by County, TVA 2015 95
Figure 3-6. Minority Populations within Counties in the TVA Region (TVA 2015) 105
Figure 3-7. Low Income Populations within Counties in the TVA Region (TVA 2015) 106
Figure 3-8. Trucking Intensity vs. CCR Removal Volume 116

Symbols, Acronyms, and Abbreviations

~	Approximately
>	Greater Than
<	Less Than
µm	Micrometers
ADEM	Alabama Department of Environmental Management
ALF	Allen Fossil Plant
APE	Area of Potential Effect
BMP	Best Management Practices
BRF	Bull Run Fossil Plant
CAA	Clean Air Act
CCR	Coal Combustion Residuals
CCW	Condenser Cooling Water
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CH_4	Methane
cm/sec	Centimeters per Second
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_3	Carbonate
COC	Constituents of Concern
COF	Colbert Fossil Plant
CUF	Cumberland Fossil Plant
CWA	Clean Water Act
dB	Decibel
dBA	A-weighted decibel
DDT	Dichlorodiphenyltrichloroethane
EF	Engineered Fill
EIS	Environmental Impact Statement
EF	Engineered Fill
EJ	Environmental Justice
EO	Executive Order
EPA	U.S. Environmental Protection Agency
EPRI	Electric Power Research Institute
ESA	Endangered Species Act of 1973
ETSZ	East Tennessee Seismic Zone
FGD	Flue Gas Desulfurization
FHWA	Federal Highway Administration
G	Gravitational Pull
GAF	Gallatin Fossil Plant
GHG	Green House Gas
GRM	Green River Mile
HAP	Hazardous Air Pollutants
HFC	Hydrofluorocarbons
HUD	U.S. Department of Housing and Urban Development
Hz	Hertz
JOF	Johnsonville Fossil Plant
JSF	John Sevier Fossil Plant
KDEP	Kentucky Department of Environmental Protection
KIF	Kingston Fossil Plant
Ldn	Day-Night Sound Level
Leq	Equivalent Sound Level
MCL	Maximum Contaminant Limit

MGD	Million Gallons Per Day
mg/l	Milligrams Per Liter
mi^2	Square Miles
MVM	Million Vehicle Miles
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMSZ	New Madrid Seismic Zone
N_2O	Nitrous Oxide
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
OSHA	Occupational Safety and Health Act
PAF	Paradise Fossil Plant
PCB	Polychlorinated Biphenyl
PEIS	Programmatic Environmental Impact Statement
PFC	Perfluorocarbon
PGA	Peak Ground Acceleration
PPK	Projectile Points/Knives
ppb	Parts Per Billion
PM	Particulate Matter
$PM_{2.5}$	Particulate Matter less than 2.5 µm
PM_{10}	Particulate Matter less than 10 µm
ppb	Parts Per Billion
PSA	Power Service Area
RIF	Relative Impact Framework
RCRA	Resource Conservation and Recovery Act
RERC	Regional Energy Resource Council
RRSC	Revised Regional Stewardship Council
SHF	Shawnee Fossil Plant
SHPO	State Historic Preservation Officer
SO_2	Sulfur Dioxide
TDEC	Tennessee Department of Environment and Conservation
TSDF	Treatment, Storage and Disposal
TSS	Total Suspended Solids
TVA	Tennessee Valley Authority
USACE	U.S. Army Corps of Engineers
USC	United States Code
USCB	U.S. Census Bureau
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VOC	Volatile Organic Compound
VSMP	Vital Signs Monitoring Program
WCF	Widows Creek Fossil Plant
yd^3	Cubic Yards

CHAPTER 1 – PURPOSE AND NEED FOR ACTION

1.1 Introduction

The Tennessee Valley Authority (TVA) has prepared this Programmatic Environmental Impact Statement (PEIS) to address the closure of coal combustion residual (CCR) impoundments at its coal-fired power plants (Figure 1-1). The purpose of the PEIS is to assist TVA in complying with the CCR Rule issued by the United States Environmental Protection Agency (EPA) on April 17, 2015 (80 Federal Register [FR] 21302). Additional information regarding EPA's CCR Rule can be found at: https://www.epa.gov/coalash. CCRs are byproducts produced from burning coal and include fly ash, bottom ash, boiler slag, and flue gas desulfurization materials. In 2009, TVA also outlined a plan to eliminate wet storage of CCRs at its plants and convert all wet fly ash, bottom ash, and gypsum operations to dry storage. This PEIS evaluates those impoundment closure actions that are consistent with TVA's overall plan to eliminate wet storage of CCRs at its facilities.

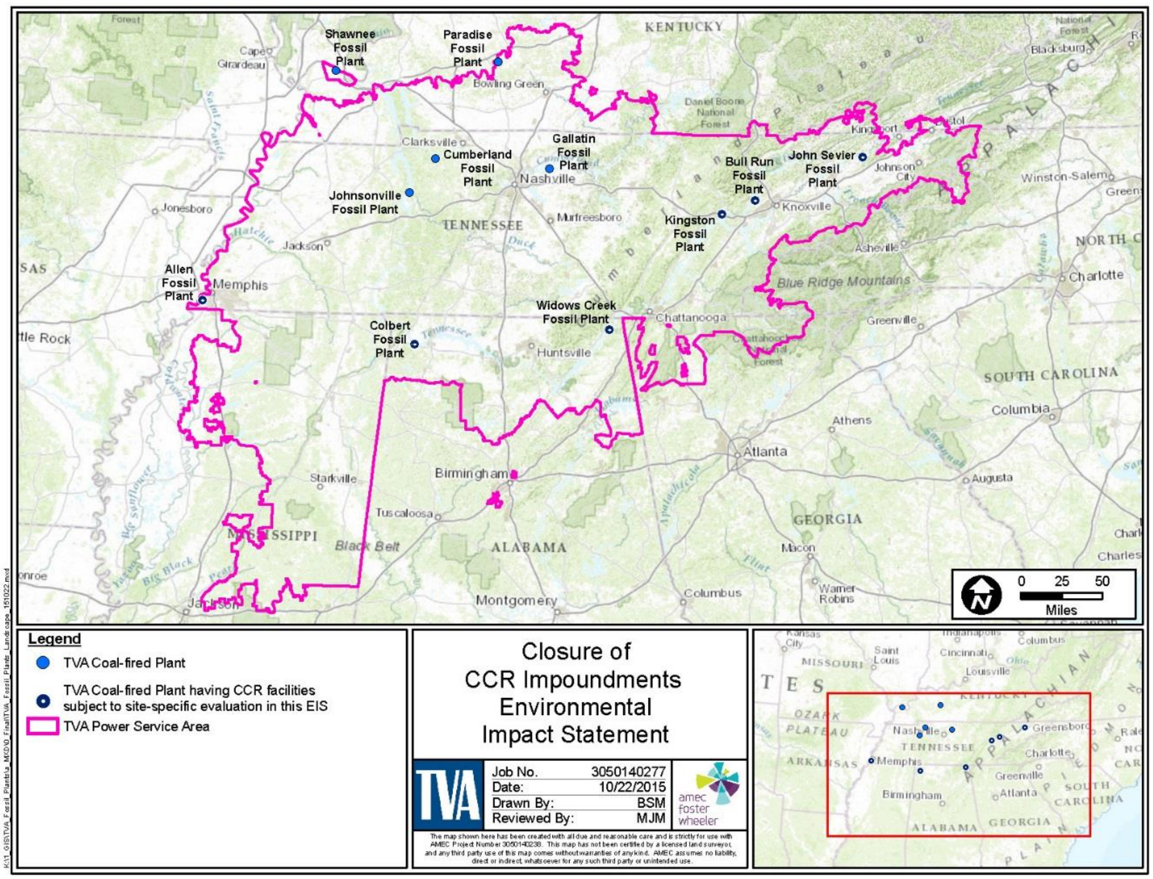


Figure 1-1. TVA Coal-Fired Power Plants

Historically, TVA has managed storage of CCR materials in ash impoundments or dry landfills. After the dike failure and ash spill at the Kingston Fossil Plant in 2008, TVA's Board of Directors directed TVA staff to review and address systems, controls, and standards related to CCRs. The outcome of that review was the plan to convert wet storage of CCRs to dry storage and close ash impoundments. This is being done on a project by project basis, subject to the technical feasibility, availability of resources and environmental review.

On April 17, 2015, the EPA established national criteria and schedules for the management and closure of CCR facilities (80 Federal Register 21302) (herein referred to as the CCR Rule). Table 1-1 provides a schedule of key regulatory milestones associated with both inactive impoundments (those not receiving CCR after October 19, 2015) and active ash impoundments. Figure 1-2 provides a conceptual framework for consideration of ash impoundment closure.

CLASSES OF ASH IMPOUNDMENTS UNDER EPA's CCR RULE:

Inactive Impoundment: An inactive surface impoundment is defined as a CCR surface impoundment that no longer receives CCR on or after October 19, 2015 and still contains **both** (emphasis added) CCR and liquids on or after October 19, 2015 (EPA 2015, 40 CFR § 257.53).

Active Impoundment: An active impoundment receives CCR on or after October 19, 2015.

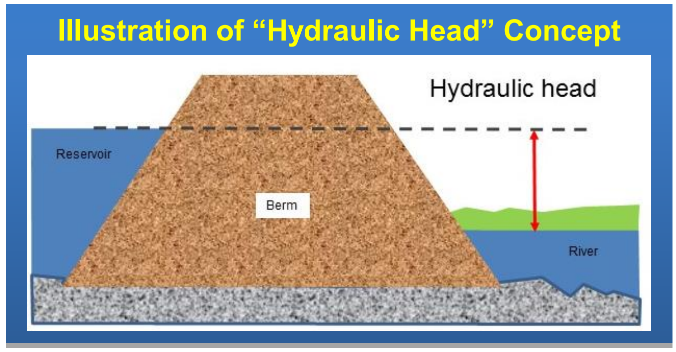
Closed Impoundment: A closed impoundment no longer contains water though it may contain CCR and would be capped or otherwise maintained.

Based on its technical studies and review, EPA determined that if done properly either Closure-in-Place or Closure-by-Removal would be equally protective of human health and the environment. EPA observed that most facilities would be closed in place because of the difficulty of removing CCRs and costs. TVA's analyses support this EPA determination.

EPA purposefully structured its CCR Rule to encourage utilities to accelerate the closure of CCR impoundments because of the decrease in groundwater risk and increased structural stability that results from eliminating the downward hydraulic pressures of ponded water. These pressures are often referred to as "hydraulic head" which is defined as the force exerted by a column of liquid expressed by the height of the liquid above the point at which the pressure is measured. As promulgated, EPA excluded impoundments that are closed by April 2018 from the rule's other substantive requirements. It said: "EPA adopted this approach to create an incentive to expedite the closure of these units, with all of the significant risk mitigation that such a measure would entail" (80 FR 21302-21408 [April 17, 2015]). TVA proposed accelerated closure of 10 of its impoundments in Part II of the Draft PEIS.

On April 18, 2016, after release of the Draft PEIS, EPA asked the D.C. Circuit Court of Appeals to remand and vacate the accelerated closure incentive in a partial settlement of litigation challenging the CCR Rule (environmental groups argued that the rule had been improperly promulgated). This does not affect EPA's technical determination that accelerated closure will significantly reduce structural failure and groundwater contamination risks. Because of this pending regulatory change, TVA decided not to use the April 2018 incentive closure date as a significant factor in its consideration of the reasonableness of Closure-in-Place or Closure-by-Removal. Instead, TVA takes into account the five-year timeframe that EPA set for completing impoundment closures, 40 Code of Federal Regulations [CFR §257.102(f). EPA determined that almost all impoundments could be closed within that period. (EPA identifies reasons that this five-year closure deadline can be extended on a case-by-case basis, but indicated that there is a high threshold for doing this extension.) Closure early is environmentally preferable to closure later and this still remains an important consideration in TVA's analyses.

TVA has coal-combustion power plants and ash impoundments in Alabama, Kentucky, and Tennessee (Figure 1-1 and Table 1-2).



The ash impoundments within TVA's system vary in size, and are represented by those that are less than 10 acres (ac) to those that are nearly 400 ac. Many of the existing ash impoundments are decades old, and the larger impoundments contain millions of cubic yards (yd^3) of CCR material. As part of this PEIS, TVA is evaluating impacts of closing inactive and active impoundments as well as other impoundments that are not subject to the CCR Rule (e.g., plant is no longer generating power or CCR but still has storage basins that have not been closed to final grade).

This PEIS is organized in two parts:

> **Part I:** A Tier I PEIS that addresses the closure of CCR impoundments at its coal-combustion power plants as illustrated in Figure 1-2. Conclusions reached from such a programmatic analysis generally should be applicable to any CCR ash impoundment in the TVA system.
>
> **Part II:** An integrated analysis of ten site-specific ash impoundment closures at each of six generating stations within TVA's system of coal-combustion power plants. These coal-combustion power plants include Allen (ALF), Bull Run (BRF), Kingston (KIF), and John Sevier (JSF) in Tennessee and Widows Creek (WCF) and Colbert (COF) in Alabama. Part II consists of a tiered analysis that integrates the findings and conclusion of the Tier I document.

The PEIS programmatically considers all TVA ash impoundment closures and the environmental effects of two primary ash impoundment closure methods: (1) Closure-in-Place; and (2) Closure-by-Removal.

This PEIS was developed in accordance with the National Environmental Policy Act (NEPA); 42 United States Code (USC) §§ 4321 et seq.; Council on Environmental Quality (CEQ) regulations for implementing NEPA, 40 CFR Parts 1500-1508; and TVA's procedures for implementing NEPA.

Table 1-1. CCR Rule Regulatory Timeframe

Activity	Regulatory Timeframe
Inactive CCR Impoundment	
"Inactive CCR Impoundment" – No longer receives CCR but may contain both CCR and liquids (§ 257.53)	October 19, 2015
Closure Notice (§ 257.100) Progress Reports	December 17, 2015 Annually
Complete Closure	Within 5 years of initiation of closure activities
Existing Active CCR Impoundment	
Location Restrictions (§§ 257.60 – 257.64)	October 17, 2018
Design Criteria (§ 257.71)	October 17, 2016
Structural Integrity (§ 257.73) • Identification marker • Structural stability assessment	 December 17, 2015 October 17, 2016
Air Criteria (§ 257.80) Fugitive Dust Control Plan	October 19, 2015
Hydrologic and Hydraulic Capacity (§ 257.82)	October 17, 2016
Inspections (§ 257.83 (a))	October 19, 2015
Groundwater Monitoring (§ 257.90) • Corrective Action – assessment of corrective measures	October 17, 2017 Initiate assessment within 90 days of finding an exceedance or immediately if a release is detected. Implement corrective action within 90 days of selecting a remedy.
Closure (§ 257.101)	After October 19, 2015
Recordkeeping, Notification, and Internet Requirements (§§ 257.105 – 257.107)	October 19, 2015
Later CCR Impoundment/Ash Impoundment Closure	
If cannot meet groundwater protection standards, location restriction, or safety assessment requirements, cease receipt of CCR	Within 6 months
Close impoundment	Within 5 years of initiation of closure activities
Closure extension for factor's beyond a facility's control	< 40 ac in size = 2-year extension > 40 ac in size = up to five 2-year extensions
Post-Closure Care (§ 257.104)	30 years after closure

Source: EPA 2015c

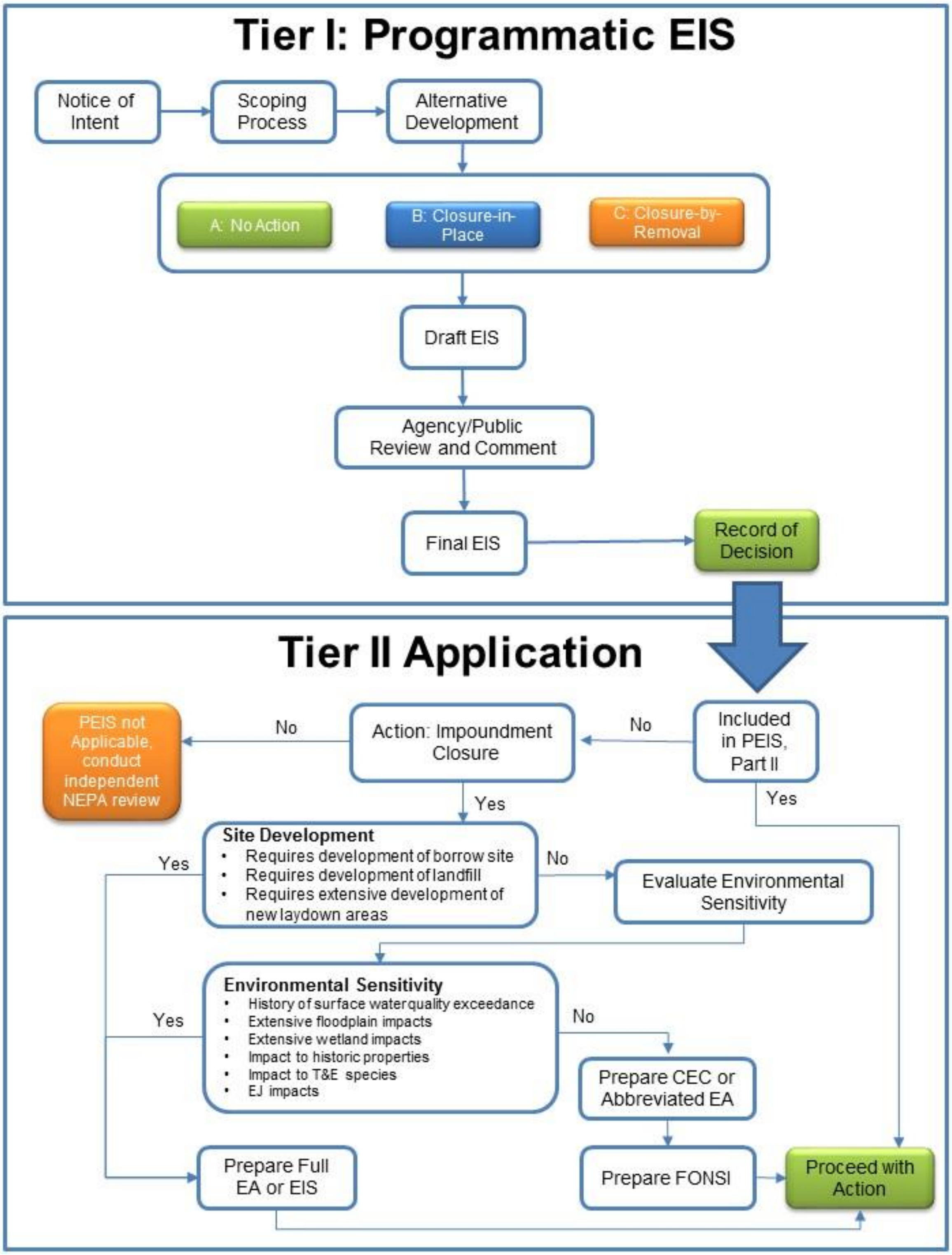


Figure 1-2. Tiered NEPA Process for TVA Ash Impoundment Closure

Table 1-2. TVA Fleet-wide Coal-Fired Power Plants

Plant	Location	Plant Status	Number of Ash Impoundments	Ash Impoundment Status	CCR Material
Allen Fossil Plant (ALF)	Shelby County, Tennessee	Three coal-fired units to retire once CC facility is active.	2	Inactive-1 Active-1	Fly ash and boiler slag
Bull Run Fossil Plant (BRF)	Clinton, Anderson County, Tennessee	Active	2	Inactive	Bottom ash, and fly ash
Colbert Fossil Plant (COF)	Tuscumbia, Colbert County, Alabama.	Four coal-fired units retired in April 2016	1	Active	Bottom ash and fly ash
Cumberland Fossil Plant (CUF)	Cumberland City, Houston County, Tennessee	Active	2	Active	Bottom ash and gypsum
Gallatin Fossil Plant (GAF)	Gallatin, Sumner County, Tennessee	Active	4	Active	Bottom ash and fly ash
John Sevier Fossil Plant (JSF)	Rogersville, Hawkins County, Tennessee	Inactive	1	Inactive	Bottom ash
Johnsonville Fossil Plant (JOF)	New Johnsonville, Humphreys County, Tennessee,	Retired by December 31, 2017	1	Active	Bottom ash and fly ash
Kingston Fossil Plant (KIF)	Harriman, Roane County, Tennessee	Active	2	Inactive	Bottom ash and fly ash
Paradise Fossil Plant (PAF)	Drakesboro, Muhlenberg County, Kentucky	Active	3	Active	Boiler slag, gypsum and fly ash
Shawnee Station Fossil Plant (SHF)	Paducah, McCracken County, Kentucky	Active	1	Active	Bottom ash
Widows Creek Fossil Plant (WCF)	Stevenson, Jackson County, Alabama	Retired by October 15, 2015	3	Inactive	Bottom ash, fly ash and gypsum

1.2 Purpose and Need

During 2015, TVA produced approximately 3.9 million tons of CCRs, with approximately half being synthetic gypsum and 33 percent being fly ash (Table 1-3). Of the 3.9 million tons, 1.3 million tons or 34 percent were utilized or marketed, which is a decrease from the 2.8 million ton annual average for 2006–2008, mostly due to reduced demand resulting from the recent recession. In 2015, the beneficial reuse rate of CCRs increased from the 2010 to 1024 average of 26 percent to 34 percent. The main beneficial uses of CCRs are in the manufacture of wallboard, roofing, cement, concrete and other products (TVA 2015). The CCRs that are not beneficially reused are currently stored in landfills and impoundments at or near coal plant sites.

Following the dike failure and ash spill at Kingston in December 2008, TVA committed to assessing the stability of its impoundments and converting its CCR management facilities from wet to dry storage. TVA has been implementing long-term stability improvements at impoundments to reduce the potential consequences of structural failures and risk to surface and groundwater from CCR releases. The remaining conversion to dry CCR storage projects is expected to be completed in four to 6 years (TVA 2015).

Table 1-3. CCRs Generated by TVA from 2010-2015

	Production (tons)		Utilization (Percent)	
CCR Material*	**2010-2014 Average**	**2015**	**2010-2014 Average**	**2015**
Fly Ash	1,647,924	1,124,402	22.3%	26.0%
Bottom Ash	330,733	247,553	0.1%	0.0%
Boiler Slag	468,723	389,616	65.0%	73.3%
Synthetic Gypsum	2,363,139	2,122,196	23.4%	34.4%
Total	4,810,519	3,883,767	25.5%	33.6%

* Does not include Char and Spent Bed Material that are no longer produced at TVA facilities.

The purpose of this programmatic action is to support the implementation of TVA's goal to eliminate all wet CCR storage at its coal plants by closing CCR impoundments across the TVA system, and to assist TVA in complying with EPA's CCR Rule.

1.3 Related Environmental Reviews and Consultation Requirements

TVA previously conducted the following environmental reviews, which are relevant to this PEIS concerning ash management:

- Development of Ash Management Strategy Allen Fossil Plant, Final Environmental Assessment, 2006
- Allen Fossil Plant Emission Control Project, Final Environmental Assessment, 2014
- Kingston Dry Fly Ash Conversion Final Environmental Assessment, 2010
- Kingston Fossil Plant Bottom Ash Dewatering Facility Draft Environmental Assessment, 2015
- Bottom Ash and Gypsum Mechanical Dewatering Facility Bull Run Fossil Plant Final Environmental Assessment, 2012

- Widows Creek Fossil Plant Gypsum Removal Project Final Environmental Assessment, 2009
- Installation of Emission Control-Equipment and Associated Facilities at Gallatin Fossil Plan Final Environmental Assessment, 2012
- Johnsonville Fossil Plant Ash Pond Dike Stabilization Environmental Assessment, 2010

1.4 Decision to be Made

TVA must decide how to close its wet CCR impoundments. TVA has committed to managing all of its future CCR production in dry storage landfills, closing its existing wet CCR impoundments, and complying with the CCR Rule. TVA's decision will consider factors such as environmental impacts, economic issues, availability of resources, and TVA's long-term goals.

1.5 Identification of the Project Scope

The geographic scope of this programmatic analysis includes the TVA region as identified in Section 1.1, specifically the 11 counties within the TVA region where TVA's coal-fired power plants are located. Additional information regarding each of the ten CCR impoundments considered in Part II (proposed to be closed within a 5-year period is summarized in Table 1-4.

Table 1-4. Summary of CCR Impoundments Evaluated in Part II

Plant	Site	Size	Primary CCR Type	CCR Volume (yd^3)
ALF (Cyclone)[1]	West Impoundment	22 ac	Fly ash and boiler slag	250,000
BRF(Pulverized Coal)	Sluice Channel	5.5 ac	Bottom ash	27,000
BRF (Pulverized Coal)	Fly Ash Impoundment	33 ac	Fly ash	3,500,000
COF (Pulverized Coal)	Ash Impoundment 4	52 ac	Bottom ash and fly ash	3,200,000
JSF (Pulverized Coal)	Bottom Ash Impoundment	42 ac	Bottom ash and fly ash	770,000
KIF (Pulverized Coal)	Stilling Impoundment	25 ac	Bottom ash and fly ash	700,000
KIF (Pulverized Coal)	Sluice Trench	6 ac	Bottom ash	10,000
WCF (Pulverized Coal)	Main Ash Impoundment Dredge Cell Upper and Lower Ash Stilling Impoundments	350 ac (110 ac in Dredge Cell and 240 ac in other impoundments)	Bottom ash, fly ash, and gypsum	25,000,000

[1] Cyclone units produce slag and pulverized coal units produce bottom ash.

TVA prepared this PEIS in compliance with NEPA, regulations promulgated by the CEQ and TVA's procedures for implementing NEPA. TVA has determined that the resources listed below are potentially impacted by the alternatives considered. These resources were identified based on internal scoping as well as comments received during the public scoping period.

- Air Quality
- Climate Change
- Land Use
- Prime Farmland
- Geology and Seismology
- Groundwater
- Surface Water
- Floodplains
- Vegetation
- Wildlife
- Aquatic Ecology
- Threatened and Endangered Species
- Wetlands
- Socioeconomics and Environmental Justice
- Natural Areas, Parks and Recreation
- Transportation
- Visual Resources
- Cultural and Historic Resources
- Noise
- Solid Waste and Hazardous Waste
- Public Health and Safety

TVA's action will address the requirements of Executive Order (EO) 11988 (Floodplains Management), EO 11990 (Protection of Wetlands), EO 12898 (Environmental Justice), EO 13112 (Invasive Species), and EO 13653 (Preparing the United States for the Impacts of Climate Change); and applicable laws including the National Historic Preservation Act of 1966 (NHPA), Endangered Species Act of 1973 (ESA), Clean Water Act (CWA) and Clean Air Act (CAA).

1.6 Summary of Public and Agency Coordination Process

To initiate the scoping period for the PEIS, TVA published a Notice of Intent (NOI) that it was going to prepare this PEIS; sent notifications to a broad range of federal, state, and local agencies; established a PEIS Web site; and provided a number of means for the public to provide comments verbally and in writing.

TVA's public and agency involvement process for the Draft PEIS included a public notice and a 45-day public review of the Draft PEIS. This public review period was later extended 14 days until March 9, 2016 in response to several requests. To solicit public input, the availability of the Draft PEIS was announced in regional and local newspapers. A news release was issued to the media and posted to TVA's Web site. The document was posted on TVA's Web site and hard copies were made available by request. TVA's agency involvement included circulation of the Draft PEIS to local, state, and federal agencies and federally recognized tribes as part of the review. A list of agencies and tribes notified of the availability of the Draft PEIS is provided in Chapter 6.

During the public comment period on the Draft PEIS, TVA conducted 10 public meetings at fossil plants across the Valley. TVA has also provided information about the PEIS and the associated public comment periods to TVA's Federal Advisory Committee Act groups, the Regional Energy Resource Council (RERC) and the Regional Resource Stewardship Council (RRSC). The TVA RERC held a meeting on January 21-22, 2016 and were provided presentations concerning CCR management, conversion from wet handling to dry handling and impoundment closures (Appendix B). RERC recommended that: "TVA, with its mission in environmental stewardship, should ensure that it has a robust policy on monitoring of CCR facilities to ensure that TVA is not causing environmental damage."

TVA received approximately 70 comment submissions which included letters, e-mails, petition-style submissions, comment forms, and submissions through the project Web site. The comment submissions were signed by more than 650 individuals. The comment submissions were carefully reviewed and synthesized into comment statements (Appendix A). The most frequently mentioned topics included comments regarding the public involvement process, project purpose and need, range of closure alternatives, identification of the preferred alternative, need to comply with other federal and state requirements, need for full public disclosure, beneficial use of CCR and a range of environmental resource issues such as, groundwater, surface water, transportation, wildlife, floodplains, wetlands, air quality, socioeconomics/environmental justice, land use, safety, and waste management. Additional comments regarding Part II, the site-specific reviews were also received.

In response to comments received by TVA from the public, agencies and other interested parties, TVA has revised the text of the PEIS and has included a response to comments in Appendix A. Appendix B provides the presentation that was made for the RERC group. Agency correspondence is included in Appendix C. TVA will not make final decisions any earlier than 30 days after the Notice of Availability of the Final PEIS is published in the Federal Register. Agency correspondence is included in Appendix C.

1.6.1 Notice of Intent

On August 27, 2015, TVA published the NOI in the Federal Register announcing that it planned to prepare an EIS to address the closure of CCR impoundments at its coal-fired power plants. The NOI initiated a 30-day public scoping period, which concluded on September 30, 2015. In addition to the NOI in the Federal Register, TVA published notices regarding this effort in regional and local newspapers; issued a news release to media; and posted the news release on the TVA Web site to solicit public input.

1.6.2 TVA's Project Web Site

TVA established a Web site https://www.tva.gov/environment/reports/ccr as a platform for additional public outreach. It is intended for use as a central location for distributing information to the public. The project Web site includes:

- A summary of the project
- The Project NOI
- The Draft PEIS
- Contact information for the TVA project lead
- Groundwater monitoring data
- Presentation materials that TVA provided at the public meetings.

In addition to the ability to submit written comments, TVA provided the public two web-based means to submit comments during the scoping period. An email address was provided which the public could submit comments or questions. The email address (ccr@tva.gov) will be used throughout the duration of the NEPA review process. Second, a web-based comment submittal form was available to the public during the scoping period, as part of TVA's Comment Management Web site. This form was available to the public during the scoping period and was available during the comment period on the Draft PEIS.

1.7 Required Permits and Licenses

Depending on the decisions made respecting the proposed actions, TVA may need to obtain or seek amendments to the following permits:

- National Pollutant Discharge Elimination System (NPDES) permit for storm water runoff from construction activities.
- Modification of existing NPDES permits due to dewatering or outfall location changes to discharges.
- Actions involving wetlands and/or stream crossings will be subject to federal CWA Section 404 permit requirements as well as state Section 401 water quality certification.
- Section 408 Rivers and Harbors Act by the U.S. Army Corps of Engineers (USACE) for actions involving work near levees.
- Submittal of closure plans to the respective state agency with a closure design that meets state solid waste regulations and CCR Rule requirements.
- Submittal of a Groundwater Monitoring Plan for the closed ash impoundments/landfills, if necessary.

Necessary permits will be evaluated based on site-specific conditions.

CHAPTER 2 – ALTERNATIVES

2.1 Summary of Alternatives

This chapter provides a description of the alternatives considered by TVA for ash impoundment closure at its coal-fired power plants. TVA's range of alternatives is consistent with both the scope and content of alternatives considered by EPA in the CCR Rule (EPA 2015) and the framework for evaluating CCR impoundment closure options prepared by the Electric Power Research Institute (EPRI 2016c). It is recognized that there are key features of each closure scenario that are consistent across all facilities, but that specific work elements and their relative impacts are expected to vary on a plant-specific basis.

TVA developed three alternatives to the proposed action:

- Alternative A – No Action
- Alternative B – Closure-in-Place
- Alternative C – Closure-by-Removal

Each of these alternatives are described below.

EPA's View of Alternatives:

EPA determined that either Closure-in-Place or Closure-by-Removal can be equally protective of human health and the environment if done properly

~CCR Rule Preamble

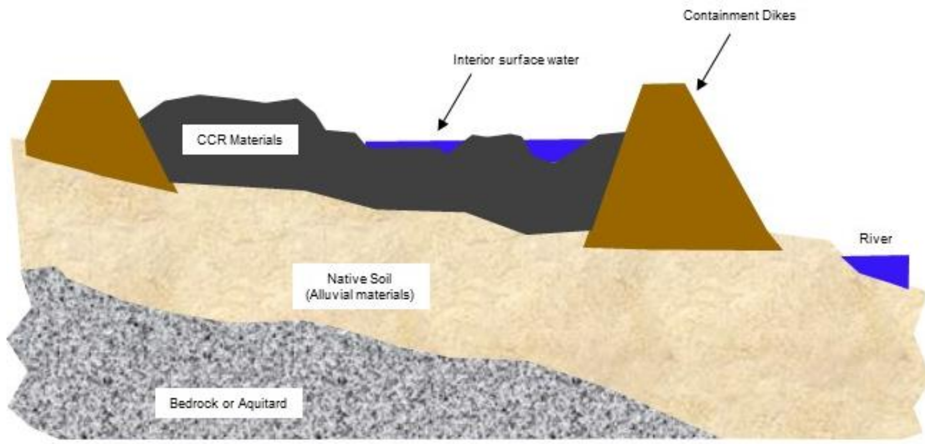
(80 Federal Register 2103, p. 21412)

2.2 Project Alternatives

2.2.1 Alternative A – No Action

Under the No Action Alternative, TVA assumes it would not close any of the ash impoundments at its coal-fired power plants. This is included because applicable regulations require consideration of a No Action Alternative in order to provide a baseline for potential changes to environmental resources. However, the No Action Alternative is inconsistent with TVA's plans to convert all of its wet CCR systems to dry systems. It also will be inconsistent with the general direction of EPA's CCR Rule. No closure activities (i.e., no dewatering or cover system construction) will occur under the No Action Alternative (Figure 2-1). The impoundments would continue to receive storm water and other process wastewaters. TVA will continue safety inspections of structural elements to maintain stability, and all impoundments will be subject to continued care and maintenance activities.

The No Action Alternative also is not consistent with other actions that TVA could be required to take in response to regulatory programs in addition to the CCR Rule. For example, the Tennessee Department of Environment and Conservation (TDEC) issued TVA an administrative order that requires it to evaluate and remediate, if necessary, CCR risks at its plants in Tennessee, except Gallatin. (Gallatin is subject to ongoing litigation.) Under this order, TDEC may require TVA to take additional or different actions to address CCR risks at its plants. The TDEC Order and other environmental regulatory programs help ensure that CCR management activities at TVA's plants will continue to be protective of human health and the environment.



Pre-construction Ash Pond—No Action Alternative (Typical)

Figure 2-1. Illustration of No Action Alternative

2.2.2 Alternative B – Closure-in-Place

Closure-in-Place (Figure 2-2) involves stabilizing the CCR in place and installing a cover system. It would take less than 5 years to close an impoundment in place, depending on its size, the distance to the cover system borrow area location, and the condition of the road network between the borrow location and impoundment being closed. Relevant construction related information regarding Alternative B is summarized in Table 2-1 for the range of CCR impoundments managed by TVA.

Table 2-1. Summary of Relevant Fleet-wide Construction Data for Alternative B

Parameter	Estimated Quantities (per impoundment)
Size of Impoundment	<10 to 370 ac
Borrow Material Requirements	<15,000 to 4,300,000 yd^3
Closure Costs[1]	<$3,500,000 to $200,000,000
Duration of Closure	Less than 5 years
Average Truckloads of Borrow/Day[2]	Up to 175 (i.e., traffic count of 350 trips per day)
Construction Workforce	Up to 100

[1] Cost estimates are preliminary and subject to refinement based on design and construction bidding process
[2] Assumes 15 yd^3 per load.

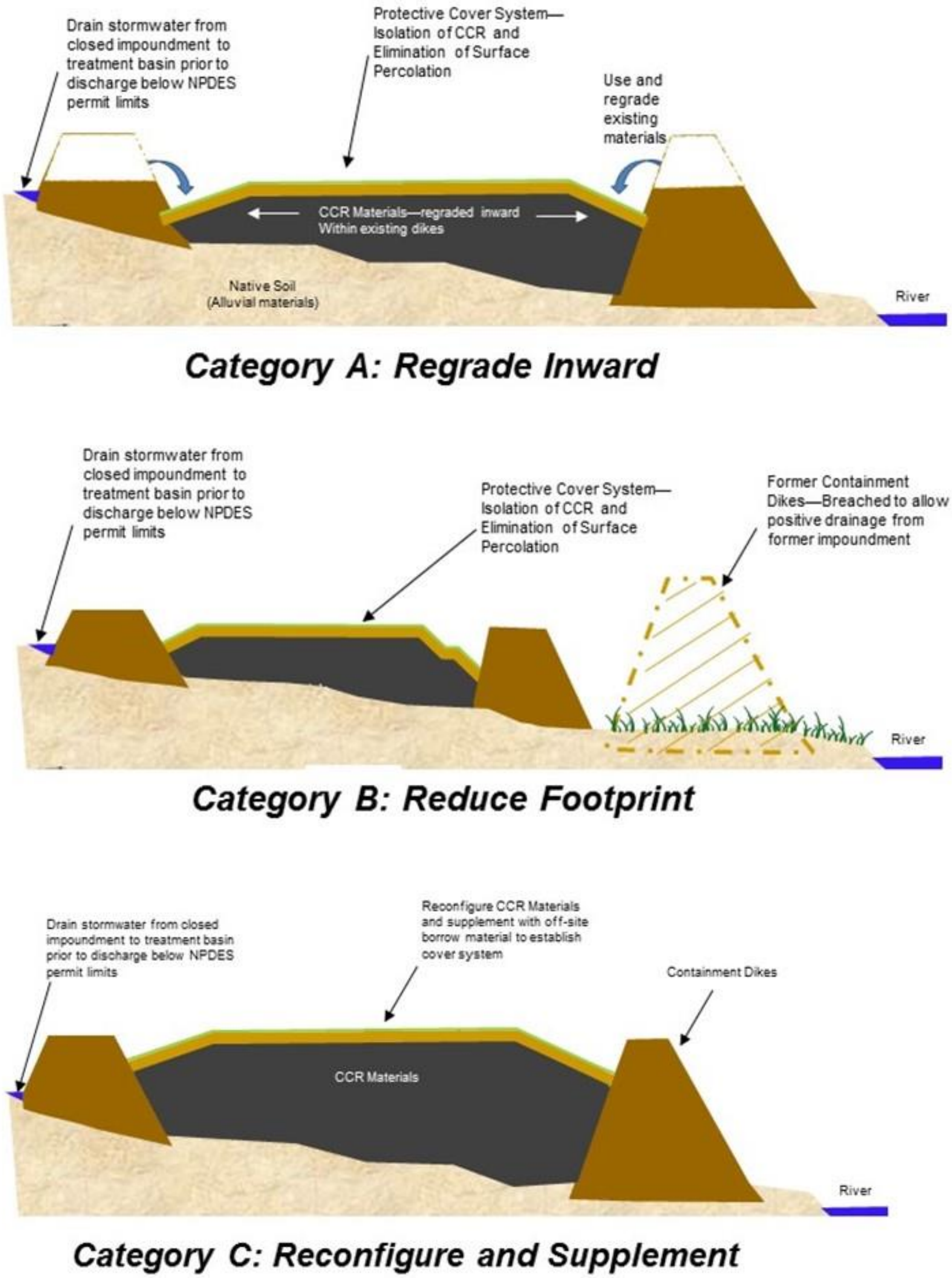


Figure 2-2. Illustration of Post-construction Condition for Closure-in-Place Options

As described by EPRI in their framework analysis (EPRI 2016c) the Closure-in-Place alternative involves a range of individual component actions that must be considered as part of the impact assessment process (Table 2-2).

Table 2-2. Summary of Proposed Activities for Closure-in-Place Alternative

Process water flow rerouting - piping modifications and/or diversion channel	✓
Closure contouring	✓
Dewatering of free water within impoundment	✓
Clearing/grubbing	✓
Temporary subsurface drainage installation (where required)	✓
Drainage improvements/interim grading	✓
Material drying	✓
Utility reroutes	✓
Demolition/abandonment of site features	✓
Haul road improvements/construction	✓
Load and transport borrow material for filling and grading	✓
Installation of temporary storm water structures	✓
Installation of temporary cover soil	✓
Construction of stability improvement features	✓
Modifications to stilling impoundment (if required)	✓
Installation of temporary vegetative cover	✓
Installation of temporary erosion control measures	✓
Placement of bridging material such as rock or geogrid and installing a sump or drainage system to help dewater the material	✓
Final closure grading	✓
Geomembrane installation	✓
Installation of closure cover system drainage layer	✓
Installation of cover soil	✓
Installation of vegetation layer	✓
Installation of permanent subsurface drainage structures (where required)	✓
Installation of permanent surface water structures	✓
Installation of permanent erosion control features	✓

Note: NPDES limits will be maintained at all times; discharges will be routed through and sampled at permitted NPDES outfalls as required.

Primary actions common to all impoundment closures under Alternative B – Closure-in-Place include:

- Ensure berm stability – Previous TVA and EPA studies have determined berm safety ratings under static conditions and recommended improvements, as appropriate. TVA implemented these recommendations on a site-specific basis. As part of CCR Rule compliance, TVA is currently evaluating the seismic stability of all CCR impoundments and will make appropriate modifications to ensure that the berm stability is at a level that meets or exceeds industry acceptable factors of safety using conservative assumptions. The proposed closure grades of the impoundments will be evaluated prior to construction and any needed improvements to the berms will be made as part of the closure system construction.

- Consider opportunities for beneficial use of ash – TVA continuously evaluates opportunities to beneficially reuse ash. Such reuse may include incorporation of bottom ash from CCR impoundments as part of the impermeable cover system.
- Lower ash impoundment water level – Liquid is dewatered from the impoundment either actively (e.g., extraction wells, pumps, and/or trenches) or passively (e.g., gravity drainage). Dewatering will be undertaken in a manner to comply with conditions of existing NPDES permits or TVA will work with appropriate federal/state agency to obtain necessary approvals.
- Identify temporary laydown areas and borrow areas – TVA anticipates temporarily using approximately 5 to 10 ac per site for vehicle and equipment parking, materials storage, and construction administration. TVA will identify on-site or off-site borrow areas.
- Grade to consolidate CCR, reduce footprint and promote site drainage – CCR layer is stabilized such that it is structurally suitable as a base layer. This stabilization could include pore dewatering, addition of amendments (e.g., Portland cement), and/or compaction. TVA will try to optimize the use of existing CCR material to achieve final grade (see options below). Fill/borrow material will be used to supplement CCR material and contoured to provide adequate storm water management.
- Install cover system (see Cover System Sub-Alternatives) – TVA will install a cover system which either meets or exceeds CCR Rule cover system performance standards ($1x10^{-5}$ permeability) or state cover system requirements. Storm water management infrastructure will maintain positive drainage. The cover system must control, minimize, or eliminate to the maximum extent practicable, post-closure infiltration of liquids into the CCR and releases of CCR, leachate, or contaminated run-off to groundwater or surface waters.
- Install or expand groundwater monitoring system to ensure an adequately robust system is in place that meets or exceeds federal or state requirements. States may require groundwater monitoring, assessment, and if appropriate, corrective action.
- Closure documentation – Prepare documentation to demonstrate that appropriate closure activities were successfully implemented.
- Post-closure care – Long-term operations and maintenance activities (e.g., maintaining the cover system, monitoring, and reporting) are implemented, as necessary.

Related and support activities may also be required for each closure activity. Such activities may include the following:

- Rerouting of water systems and piping to prevent future release of plant service water systems or other drainage to the closed ash impoundment. Alternative wastewater treatment may be required.

EPA-Required Design and Performance Standards for Cover Systems:

- Permeability less than $1x10^{-5}$ cm/sec
- Infiltration layer that contains a minimum of 18 inches of earthen material or other materials that achieve equivalent reduction in infiltration
- Erosion layer that contains a minimum of 6 inches of earthen material that is capable of sustaining native plant growth or other materials that provide equivalent protection from wind and water erosion
- Design minimizes disruption of cover integrity by accommodating settling and subsidence
- Control infiltration of liquids into the CCR and releases of leachate to the ground or surface waters.

★The final cover permeability must be less than or equal to the permeability of the bottom liner system or natural subsoil present, and TVA will meet or exceed federal and state requirements.

- Development of interior or exterior access roads to facilitate movement of equipment and/or transport of borrow/fill material.
- Site preparation and development of temporary laydown areas to support construction activities.
- Transportation of suitable borrow material from either on-site or off-site locations (Note: all borrow material from off-site locations are expected to be from previously permitted borrow sites for the ten ash impoundment closures discussed in Part II).

Several alternate technologies are available for use in developing a cover system for each subject impoundment (Figure 2-3). EPA has identified both design and performance standards for a cover system that are sufficient to provide for environmental protection (see inset).

The technologies considered by TVA for closure-in-place provide a range of acceptable approaches that integrate various components including vegetative cover soils, low permeability zones consisting of compacted clays or geomembranes, geocomposite grids to promote interior drainage and either natural or synthetic turf. Each of these technologies prevent contact of CCR materials with percolating rainwater, promote controlled runoff to appropriate storm water discharge or detention systems and improves the aesthetics of the closed ash impoundment. Borrow volume requirements, construction cost, and maintenance requirements are key considerations in the selection of each technology.

General sub-alternatives that incorporate the above technologies that are available for consideration on a site-specific basis include the following.

Alternative B-1 – Standard Cover System

A standard soil cover system will have permeability less than or equal to the permeability of any bottom liner system or natural subsoils present or a permeability no greater than $1x10^{-5}$ centimeters per second (cm/sec). The infiltration layer must contain a minimum of 18 inches of earthen material (e.g., compacted clay layer). The erosion layer must contain a minimum of 6 inches of earthen material that is capable of sustaining native plant growth. The design must accommodate settling and subsidence to protect the cover system integrity. Individual states may require greater thickness of the infiltration and erosion layers, such as Tennessee which requires permeability no greater than $1x10^{-7}$ cm/sec, a 24-inch infiltration layer, and a 12-inch erosion layer (see Figure 2-3).

Alternative B-2 – Geosynthetic-Protective Soil Cover System

A combination of a geosynthetic liner and protective cover soils excludes the need for the compacted clay layer. This cover system will achieve a permeability performance less than or equal to the standard cover system (better). An example geosynthetic-protective soil cover system from bottom to top includes a geomembrane liner barrier layer (infiltration layer)(e.g., high density polyethylene), geocomposite drainage layer, and a minimum of 18 to 24 inches of a protective soil cover (the top 6 to 12 inches of earthen material being capable of sustaining native plant growth-erosion layer) (see Figure 2-3).

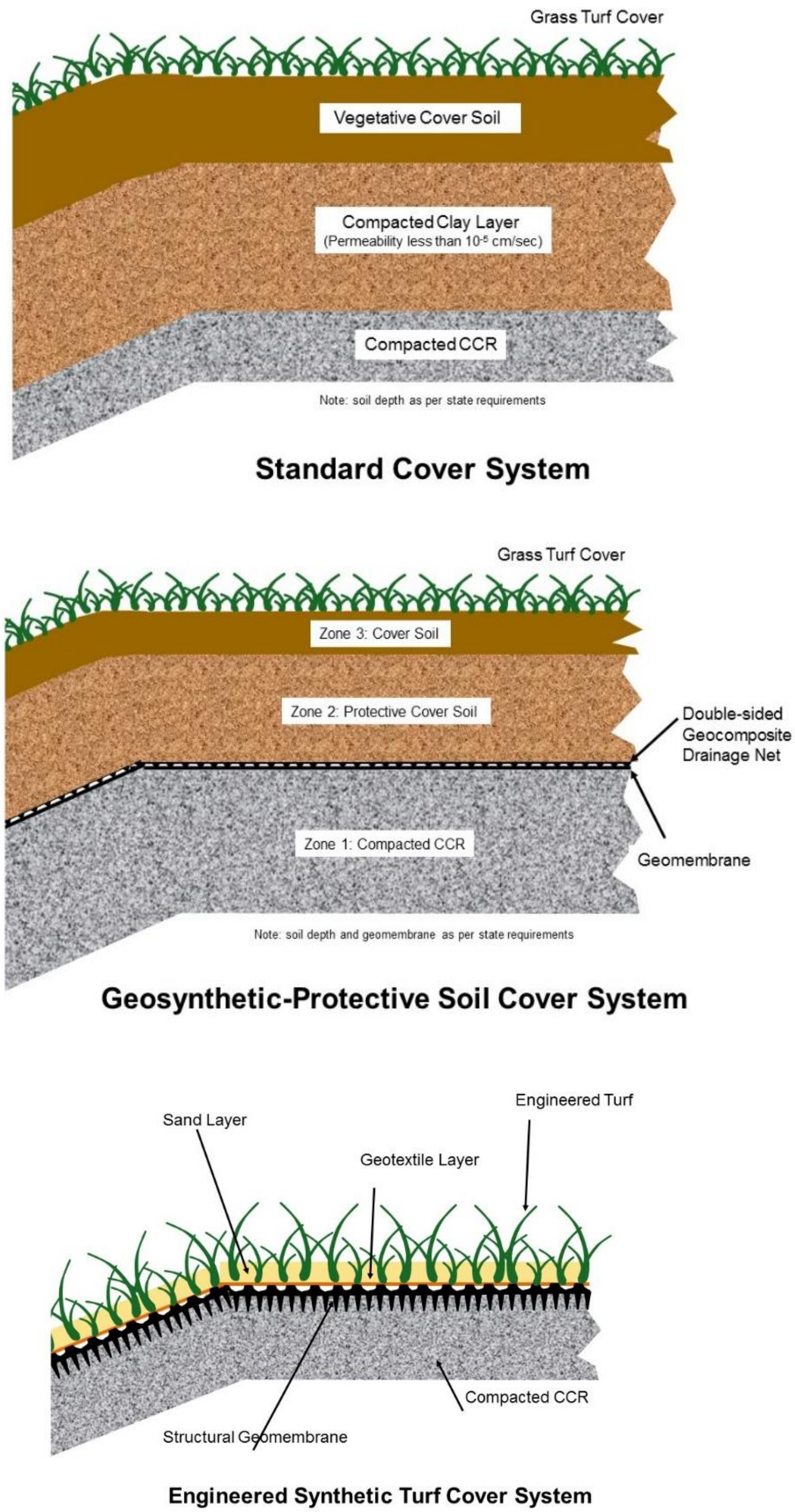


Figure 2-3. Examples of Cover System Sub-alternatives

Alternative B-3 – Engineered Synthetic Turf Cover System
An engineered synthetic turf cover system from top to bottom will include synthetic turf on top to provide protection from ultraviolet degradation and erosion (erosion layer). It will have sand infill to act as ballast against wind uplift on the synthetic turf layer. Below that will be a drainage system and then the geomembrane liner barrier layer (infiltration layer) (see Figure 2-3).

TVA has also been studying the potential use of flowable fill as a means of closing impoundments that will beneficially re-use CCRs in lieu of soil and other natural materials. A pilot study has been initiated at GAF in consultation with the TDEC to use the Flue Gas Desulfurization (FGD) scrubber material as a feedstock for the production of an Engineered Fill (EF) product that can be generated on-site and beneficially used in the closure of the ash impoundments. The purpose of the EF pilot study is to evaluate the performance of various mixes of EF, select a preferred mix design for the full-scale implementation of the project and determine whether the EF material is suitable for beneficial reuse based on EPA requirements provided in the CCR Rule. Among its qualities are uniformity, known strength in place, higher bearing capacity, lower permeability, increased stability and its capacity to set under water. Expected benefits of the EF application are to improve the cementitious properties of the CCRs to generate a fill material that self-compacts and solidifies, providing a fill material that can be pumped to an area of the ash ponds in order to improve soft subgrade conditions and provide enough strength to allow for construction equipment to grade the ash ponds to drain and construct a closure cover system. Depending on the outcome of the pilot study, TVA may expand the application of this technology as a viable component of closure design at other facilities.

No federal post-closure care measures are required if CCR is removed (Alternative C, below). Based on the EPA rule, it is anticipated that the states will further define monitoring and corrective action requirements. TDEC is assessing all ash storage in the state and may require monitoring, assessment activities, corrective action, and post-closure recordkeeping requirements for closed inactive ash impoundments similar to the CCR Rule requirements for active ash impoundments. Alabama and Kentucky are defining their monitoring and corrective action requirements for CCR impoundments. In anticipation of this, TVA has outlined the following process as a built-in mitigation measure that will be implemented as appropriate, in coordination with state regulatory agencies to help ensure environmental protection for closure of inactive impoundments:

1. Design and implement a groundwater monitoring system.
2. Identify statistical procedures for evaluation of groundwater monitoring data.
3. Further assess groundwater conditions in proximity to closed ash impoundment.
4. If needed, identify corrective measures to prevent further releases or remediate identified releases.

For active ash impoundments, a similar process for groundwater assessment and protection will be implemented to ensure compliance with CCR Rule requirements and minimize environmental impacts.

2.2.3 Alternative C – Closure-by-Removal

Closure-by-Removal (Figure 2-4) involves excavating and relocating the CCRs from the ash impoundment in accordance with federal and state requirements to an approved on-site or off-site disposal facility. Relevant construction related information regarding Alternative C is summarized in Table 2-3.

The CCR may also be beneficially used in products or structural fills. Closure-by-Removal involves a range of individual component actions that must be considered as part of the impact assessment process (Table 2-4).

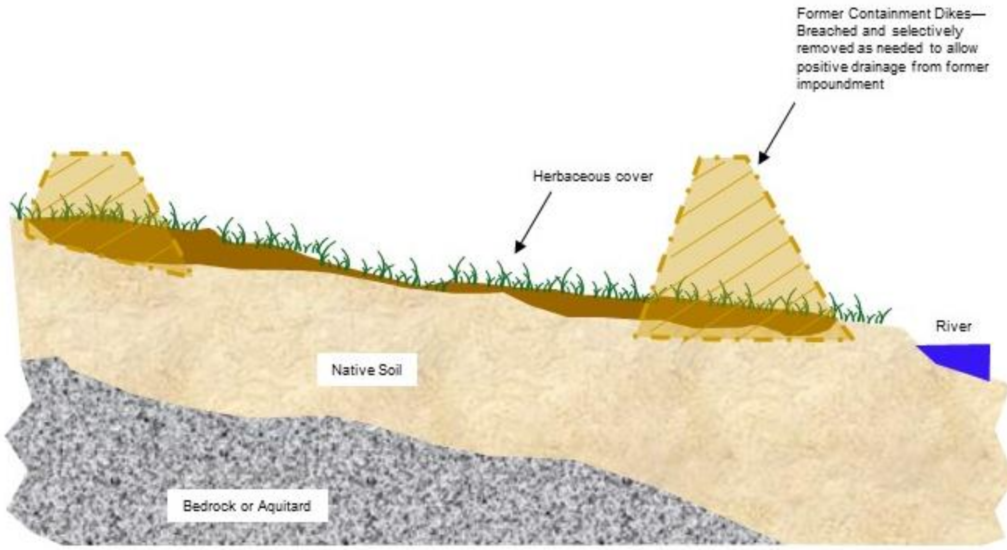


Figure 2-4. Illustration of Post-Construction Condition for Closure-by-Removal Alternative

Table 2-3. Summary of Relevant Fleet-wide Construction Data for Alternative C

Parameter	Quantities (per Impoundment)
Plant Ash Impoundment Area	<10 to 370 ac
Borrow Material Requirements	<15,000 to 4,300,000 yd^3
CCR Removal	<250,000- 25,000,000 yd^3
Average Truckloads Borrow/Day[4]	Up to 175 (i.e., traffic count of 350 trips per day)
Construction Workforce	Up to 100
Alternative Mode of Transport	
Truck Transport of CCR	
Cost of Closure[1]	< $20,000,000 to $2,300,000,000
Average Truckloads CCR/Day[2]	Up to 100 (i.e., traffic count of 200 trips per day)
Duration of Closure	2.7 years to 170 years
Rail Transport of CCR	
Cost of Closure[1]	< $23,000,000 to $2,060,000,000
Average Rail Cars CCR/Day[3]	Up to 11 rail cars per day
Duration of Closure	2.7 years to 84 years

[1]Cost estimates are preliminary and subject to refinement based on design and construction bidding process
[2]Material will be dried to a reasonable degree to support transport. Assumes 10 yd^3 per load for CCR. Constraints due to increased distance to landfill and landfill operational hours limit truck transport rate.
[3] Up to 100 yd^3 per rail car. The number of rail cars loaded per day depends on the volume of CCR excavated and dried prior to loading. Some TVA facilities have limited areas within or near impoundments that can be used for processing and handling prior to loading.
[4] Assumes 15 yd^3 per load for borrow material.

Table 2-4. Summary of Proposed Activities for Closure-by-Removal Alternative

Process water flow rerouting - piping modifications and/or diversion channel	✓
Closure contouring	✓
Dewatering of free water within impoundment	✓
Clearing/grubbing	✓
Temporary subsurface drainage installation (where required)	✓
Drainage improvements/interim grading	✓
Material drying	✓
Utility reroutes	✓
Demolition/abandonment of site features	✓
Haul road improvements	✓
Installation of temporary storm water structures	✓
Modifications to stilling impoundment (if required)	✓
Excavate dried/stabilized CCR	✓
Load and transport CCR to off-site landfill	✓
Load and transport borrow material for filling and grading	✓
Final site preparation of abandoned impoundment	✓
Installation of cover vegetation	✓
Installation of permanent erosion control features	✓

The duration of Closure-by-Removal projects will depend on a number of factors including, primarily, the amount of CCR material needing to be removed from the impoundment and the amount of borrow material needing to be moved to the site to fill in the excavated hole. TVA estimates that these projects would take between 2.7 and 170 years to complete. Key actions associated with this alternative may include:

- Dewater the ash impoundment water – As with Alternative B, an impoundment must first be dewatered either actively or passively. Dewatering is undertaken in a manner that complies with existing NPDES permits or TVA will work with appropriate federal/state agency to obtain necessary approvals.
- Consider opportunities for beneficial use of ash.
- Identify on-site or off-site permitted management facilities for CCR disposal (including lining the bottom of an ash impoundment and then replacing CCR; removing CCR from one or more impoundments on-site to another impoundment on-site [e.g., at WCF the Upper and Lower Stilling Basins could be closed by consolidating CCR into the primary ash impoundment]; or removing CCR from one or more impoundments and relocating it to another TVA permitted landfill).
- Determine borrow material options (e.g., on-site or off-site).
- Design, permit and construct appropriate load-out facilities.
- Excavate CCR and liner (if any) and transport to a Subtitle D permitted landfill.
- Fill and grade ash impoundment, preventing future impoundment of water.
- Revegetate with native plants.
- Closure documentation – Determine that CCR materials in the impoundment and any areas affected by releases from the CCR impoundment have been removed to the accepted level and groundwater monitoring demonstrates that all concentrations of the assessment monitoring constituents do not exceed background levels or maximum contaminant levels.

TVA focused the analysis of this alternative on the use of existing Subtitle D permitted landfills or other approved disposal facilities rather than constructing a new on-site or off-site landfill. Assessing, designing, permitting and constructing a new landfill for receipt of CCR materials requires a prolonged timeline (5 to 10 years) and represents a significant additional uncertainty regarding proposed ash impoundment closures. This process, combined with other closure activities, is expected to take longer than the five-year period for closure. It also may not be possible to construct a new landfill at some TVA sites because of constraints related to the existing site infrastructure, geologic factors, wetlands, endangered species, or other environmental factors.

For the following reasons, TVA did not address in further detail constructing new landfills as a variation of the Closure-by-Removal Alternative.

- The process to design, permit and construct a new landfill or modify an existing landfill is extensive. A wide range of factors must be considered in siting a new landfill including avoiding, if practicable, potential impacts to sensitive resources such as: wetlands; habitat for endangered species; floodplains; cultural resources; prime farmlands; environmental justice populations; and problematic geology, such as karst, that could substantially increase costs as well as complicate the permitting process.

- Detailed design typically follows the completion of initial siting studies. This includes identification of the location of existing plant infrastructure, grading plans, site preparation plans, access road designs, load-out facilities and truck washing stations, liner and cover system designs, leachate collection systems and other features. Once the design is sufficiently advanced, existing permits must be modified or new permits must be obtained, as appropriate, before construction can begin. These permitting processes often include opportunities for public review and comment and include:
    1. NPDES permit for land disturbance and storm water runoff from construction activities.
    2. Fugitive dust requirements in the plant's existing air permit must be met or appropriately modified.
    3. If wetlands or streams are potentially impacted, a Section 404 permit would have to be obtained from the USACE as well as a state Section 401 water quality certification. In addition, in Tennessee, a TDEC Aquatic Resources Alteration Permit may be required.
    4. The landfill itself would require a solid waste disposal permit from the applicable state permitting agency.

- As a federal agency, TVA will have to assess proposed landfills under NEPA before it could make a decision to construct a landfill. The NEPA review process is likely to take more than 12 months to complete.

2.2.4 Modes of Material Transport

TVA considered several modes of transport of bulk materials that may be required for impoundment closure alternatives. Potential modes of transport include truck, rail and barge. Advantages and disadvantages of each mode are summarized in Table 2-5 and factor into the applicability and appropriateness of the transport method. Primary factors considered include:

- Volume of material;
- Distance from impoundment to a permitted landfill or borrow area;
- Availability of the infrastructure to manage the transfer of material;
- Cost effectiveness; and
- Schedule.

Table 2-5. Advantages and Disadvantages of Transport Methods

Haul Method	Advantages	Disadvantages
Truck	• Sites (borrow sites, ash impoundments and landfills) are readily served by roads • Does not require special loading/unloading infrastructure • Can accommodate earlier closure for lower volume materials	• Lower volume per load • Requires more vehicles due to smaller vehicle capacities • Potential for increased impacts (air quality, noise, vibration, road deterioration) to road system and to adjacent land uses • Increased risk of crashes on roadways • Movement of large quantities of CCR would impede closing in 5 years
Barge	• Good for shipments of large quantities • Good for shipments over longer distances • Relatively less impact to roadside land uses • Relatively safer than shipping by truck or rail from a crash/accident standpoint	• Borrow sites not typically served by barge • Requires loading/unloading infrastructure (chutes, conveyors, etc.), increasing cost and potentially impeding closing in 5 years • Landfills not typically served by barge (may require some trucking from barge unloading location) • Potential for spills to water bodies • Transport hindered if water levels are low or during flood events
Rail	• Good for shipments of large quantities • Good for shipments over longer distances • Relatively less impact to roadside land uses • Relatively safer than shipping by truck from an crash standpoint	• Borrow sites not typically served by rail • Requires more extensive loading/unloading infrastructure (chutes, conveyors, etc.), increasing costs and potentially impeding closing in 5 years • Landfills not typically served by rail (may require some trucking from rail unloading location)

2.2.4.1 Transport of Borrow Material

TVA considered the potential use of truck, barge and rail as modes to transport borrow material under Alternatives B and C. Use of rail and barge to transport borrow material were eliminated from detailed consideration as these modes are not suitable for short-duration, local movement of borrow materials. The volume of borrow material required is generally considered to be small (relative to CCR volumes) and borrow material is likely to come either from on-site or from previously developed off-site borrow sites. Furthermore, use of trucking does not require the development of secondary facilities (rail spur, loading/unloading systems, stockpile areas, etc.) that may be required to load and unload materials to/from rail and barge facilities. Such facilities are typically not found at borrow sites and if developed, would still require truck use to haul materials to the loading facilities. Development of such facilities would also result in additional environmental impacts (land use, wetlands, water resources, etc.) and would require additional environmental permitting. Therefore, for Alternatives B and C, trucking is considered to be the only feasible mode of transportation for the movement of borrow material.

2.2.4.2 Transport of CCR Material

TVA considered three methods of transporting CCR off-site under Alternative C: barge, truck, and rail.

2.2.4.2.1 Barge Transport

Barge transport of CCR would require equipment, loading and unloading infrastructure at both TVA's coal-fired plant and at a location near the receiving landfill and contracting with a barge transportation service. While many of TVA's coal-fired plants have barge facilities, these facilities are configured and designed to off-load coal from barges. They are not configured with supporting loading systems (stockpile areas, loading infrastructure such as conveyors and clamshell dredges, etc.) for CCR. A barge intermodal terminal equipped to unload CCR would need to include: a dock for unloading (including sheet piling, moorings and foundations); containment areas; clamshell buckets or front end loaders to move the CCR off the barge to a stockpile area prior to being placed on another mode of transport (rail or truck); conveyors or loaders to load the CCR onto another mode of transport; and infrastructure to support the other modes of transport (rail spurs, paved haul roads). All of the transfers of CCR from one mode of transport to another would need to occur within an area that has an approved spill containment system. Construction of an intermodal terminal would likely cost several million dollars. The duration of construction would vary, based on site conditions, permitting requirements and availability of materials and labor.

Development of such supporting loading systems at each plant would be costly, potentially increase closure schedules and would result in additional environmental impacts. Permitting of such facilities is expected to require a range of studies including navigation impact assessments, site-specific aquatic ecosystem studies and assessments (fish and mussel surveys) and other studies. These studies, coupled with extensive Section 10/404 permitting, would likely require two to three years to complete. Similarly, substantial environmental impacts (terrestrial as well as aquatic ecosystems) and cost may also be incurred to develop barge unloading facilities to serve receiving landfills under this alternative. Barge unloading facilities are not typical near permitted landfills. Therefore, CCR hauled by barge would still need to be unloaded and shipped via truck to a receiving Subtitle D landfill. As a federal agency, TVA also would have to assess the potential impacts of constructing and operating this infrastructure under NEPA.

Even if a barge transfer facility is near a permitted landfill, there exists the risk of CCR spills in the water during loading, shipping, and unloading at the transfer facility. For example, several barge accidents occurred in the Monongahela River, Pennsylvania resulting in the release of CCR (Hallowell and McPhedran 2015). There is also the likelihood that an existing barge transfer facility would need to be modified to handle the off-loading of CCR from a barge. Developing the loading and unloading infrastructure, along with the time to remove CCR, would likely exceed the five-year closure period. Because of these factors, and uncertainty related to environmental permitting of these facilities, this mode of transportation was eliminated from consideration as unfeasible.

2.2.4.2.2 Truck Transport

Truck transport of CCR under Alternative C would require the use of large numbers of vehicles and operators. Trucking is a technically feasible mode of transport because it uses the existing roadway infrastructure that already serves the plant site and the receiving landfill. Truck loading operations are highly dependent on the rate at which CCR can be safely excavated, dried and moved to truck loading facilities. Prior to leaving a given TVA site, all trucks would be required to pass through a truck washing station. TVA carefully considered these factors and determined that the rate of truck loading is 100 trucks per day. Trucks would not require special loading/unloading infrastructure and can be effective in meeting short schedules for impoundment closures where CCR volumes are relatively small (e.g., 600,000 yd^3 or less). In contrast, because the volume per truck is much smaller than that of either rail or barge, the use of trucks could require more trucks for transportation where CCR volumes are large. Such long removal durations and increased number of trucks would increase the risk of impacts (air quality, noise, vibration, road deterioration) to the road system and to adjacent land uses (homes, businesses, schools, etc.). Longer durations and an increased number of trucks could also result in a greater potential for motor vehicle collisions, which could result in increased property damages, personal injuries or even fatalities.

2.2.4.2.3 Rail Transport

Rail transport of CCR would require initial steps similar to transport by truck including CCR excavation, drying and loading onto trucks to transport to a rail loading facility. TVA would need to install CCR loading infrastructure (e.g., concrete removal pad, push walls, loading equipment, stormwater controls) near an existing or new rail siding. Each of the coal-fired power plants has active or inactive rail sidings associated with the delivery of coal but up to a mile of new rail siding could be required to facilitate the handling of rail cars to transport CCR off-site. New rail sidings could require grading, culverts, road crossings and switches. TVA would need to contract with a rail transportation service in the form of a rail carrier. Rail cars may need to be lined to prevent spills or releases as was the case for the of CCR at KIF. Rail facilities would have to be expanded and improved at most of TVA's plants to support CCR loading operations.

An assessment of permitted Subtitle D landfills in Tennessee, Kentucky and northern Alabama in 2015 identified only a small percentage (5 to 10 percent) of landfills that could accept waste directly by rail. The competition to use the capacity at these few rail-served landfills is expected to be considerable if other utilities are required or choose to move CCR to off-site landfills. In addition to increasing costs, available capacity likely would be decreased quickly. There may be other landfills near rail lines, but additional infrastructure still would be needed to unload CCR material. Because the CCR is not likely to be off-loaded directly from rail to a permitted landfill (unless a rail spur is designed, permitted and constructed), some amount of over-the-road trucking will be needed to haul the CCR to a landfill.

The cost effectiveness of shipping by rail is also a factor. Shipments of larger CCR volumes over longer distances would help offset the costs of constructing loading and unloading infrastructure. However, the cost of constructing necessary infrastructure and the cost of rail transport itself likely would make rail transport of CCR off-site very expensive compared to the Closure-in-Place Alternative. Additionally the rate of CCR removal by rail is expected to be similar to that of truck transport as rail loading operations are highly dependent on the rate at which CCR can be safely excavated, dried and moved to rail loading facilities. TVA carefully considered these factors and determined that the average rate of rail loading is 11.1 rail cars per day, a volume that is similar to the rate determined for truck transport.

Additionally, there is substantial time and uncertainty related to environmental permitting of rail loading and unloading facilities as well as for the temporary area used to dry CCR before movement. The necessary environmental and construction permits could easily take 18 to 24 months to acquire. Because the Kingston ash spill cleanup was done under the Comprehensive Environmental Response, Compensation, and Liability Act, on-site permitting requirements were not applicable. Completing these additional permit processes would add to the time it would take to complete Closure-by-Removal and would likely extend closure beyond the five-year period allowed for closure under the CCR Rule. Rail transport of CCR was conducted at KIF during the spill cleanup but the circumstances were unique. TVA constructed two temporary rail spurs on the ball field area due to the project's emergency status. These double set of tracks allowed for one set of train cars to be prepped (e.g., lined) prior to loading while loading occurred on the other set of train cars. The ball field area was adjacent to where CCR was being dredged and was able to be used as a processing area. The ball field was allowed by TDEC as an interim ash stack with the provision that the tracks would be removed and the processing area cleaned up upon completion of recovery actions. TVA has almost completed activities to comply with the TDEC conditions. The ball field area is now the planned location of the bottom ash dewatering facility. As a result, TVA does not have the space available at KIF for a separate CCR processing area and rail spur that it previously had. Similarly, other TVA plants do not appear to have the area available to build rail spurs up to the edge of CCR impoundments and therefore, CCR will have to be dug up and trucked to a processing area adjacent to an existing rail spur for loading.

It is possible that site-specific conditions may align to support rail transport off-site of CCR at some sites, but it is unlikely that rail transport would make the Closure-by-Removal Alternative compare more favorably to Closure-in-Place from an environmental or economic standpoint.

2.2.5 Screening Factors to Evaluate Alternatives

Recognizing the potential pathways for exposure and risk related to existing ash impoundments (Figure 2-5), TVA developed a series of factors important in the screening and evaluation of project alternatives.

In determining whether an alternative is a reasonable action, TVA conducted a screening analysis to determine the reasonability of the “action” alternatives by evaluating a range of key issues and factors and the feasibility of undertaking closure activities. Key factors that TVA considered included the following:

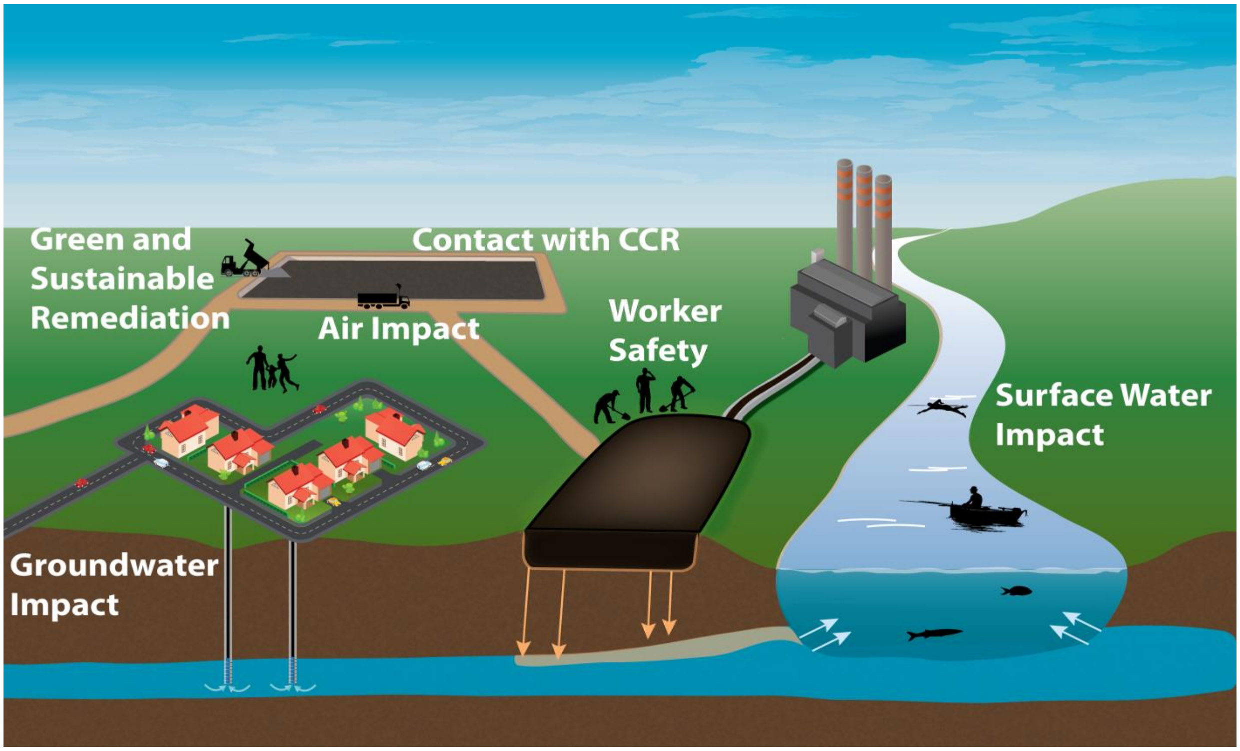


Figure 2-5. Framework Pathways for CCR-Related Risk (Source: EPRI 2016c)

- *Volume of CCR Materials.* The size of an ash impoundment and volume of CCR will affect closure activities and appropriateness of an alternative.
- *Schedule/Duration of Closure Activities.* Time necessary to complete closure activities at an ash impoundment will affect the reasonability of closure alternatives. Under the CCR Rule, closure must be completed within 5 years. (There are limited exemptions that could be used to provide more time for closure, but these would not normally be applicable.)
- *Stability.* Stability of the CCR facilities was evaluated by Dewberry Consultants (2010 through 2013). Safety ratings under static conditions were determined to be adequate at ash impoundments in previous studies submitted to EPA or needed mitigation, and if so, measures were taken to improve safety ratings to achieve at a minimum, an adequate safety rating. TVA is currently evaluating the seismic stability of all CCR facilities and will make appropriate modifications to ensure that the berm stability is at a level that meets or exceeds industry acceptable factors of safety using conservative assumptions. The proposed closure grades of the facilities will be evaluated prior to construction, and any needed improvements to the berms will be made as part of the closure system construction.
- *Risk to Human Health and Safety Relating to Closure Activities.* Closure activities entail a range of construction activities that represent a potential risk to the health and safety of the workforce and the public. Worker safety is a particular concern as heavy equipment and difficult working conditions would occur for any closure activities. Excavations into the CCR impoundment required under the Closure-by-Removal Alternative are particularly dangerous as noted by reports of accidents leading to injury or death in the industry. As discussed in *Challenges of Closing Large Fly Ash Ponds*, accidents, near misses and fatalities have been reported at impoundments during

operations and closure activities (Seymour, et al. 2013, Johnson 2014, Mitchell 2006). Equipment, such as bulldozers and trucks, can become bogged down, disabled and engulfed. For example, while removing fly ash from an impoundment in Kentucky, an excavator was operating approximately 200 ft from the edge of the impoundment when the exposed surface of the fly ash slid over an underlying soft, apparently saturated area. As a result, the fly ash and water engulfed the excavator resulting in the death of the operator.

During the CCR recovery activities at KIF, one worker fatality occurred. TVA does consider worker safety its highest goal and its goal is to minimize risk to work safety. Despite constant attention to safety, accidents still happen. As discussed in Section 3.16, sites having large volumes of CCR that are considered for Closure-by-Removal would result in extensive trucking operations that would increase transportation risks.

- *Potential Effects to Water Resources.* Potential human health risk was also considered by reviewing the results of groundwater monitoring, other data and the incidence of surface water releases to receiving waterbodies.
- *Potential Effects to Wetlands.* Under the CWA, wetlands are protected because of their ecologic significance. EPA has long identified wetlands protection as a high priority.
- *Risk to Adjacent Environmental Resources.* Risk of potential release and degradation of environmental resources (air, groundwater, surface water, ecological receptors, and factors related to the human environment) with a potential nexus to the CCR impoundment is an important consideration for alternative development.
- *Mode and Duration of Transport Activities.* The activities related to transport of borrow (Alternative B and Alternative C) and CCR removal and transport (Alternative C) require the movement of a large number of vehicles and operators (Figure 2-6). For those impoundments containing greater volumes of CCR, the duration of removal activities would extend for prolonged periods. This would result in greater environmental impacts associated with noise and emissions, degradation of roadway infrastructure (for truck movement, but probably for rail movements too when trucks have to be used to move CCR from the rail unloading facility to the landfill), increased risk of injuries and death, and increased potential for accidental releases. Based on TVA's analyses, higher volume movements also would threaten the ability to close impoundments within 5 years.
- *Risk to Human Health and Safety Related to Transport of Borrow and CCR.* Transport of borrow or CCR by truck increases transportation risks. National statistics show as truck miles increase, crashes with injuries and fatalities increase. National statistics indicate that from 2001 to 2009, there were 132 fatalities per 1 million miles traveled and more than 1,600 injuries per million miles traveled (Atherton 2016). Trucks often weigh 20 to 30 times as much as passenger cars and are taller with greater ground clearance, which can result in smaller vehicles under-riding trucks in crashes (IIHS-HLDI 2014). Loaded trucks also require a greater distance to stop than cars (20 to 40 percent farther or even greater on wet and slippery roads). In multiple-vehicle fatal crashes involving a passenger vehicle and a large truck, 97 percent of the fatalities were occupants of the passenger vehicle (IIHS-HLDI 2014). The number of people killed in a large truck crash was 16 percent higher in 2014 than in 2009.

As the number of truck movement miles increase, both for Alternatives B and C, the risk of traffic crashes, including personal injuries and fatalities, increases. A Kentucky Transportation Center September 2013 investigation of heavy truck crashes in Kentucky analyzed crash data for 2008-2012 (Green et al. 2013). The number of annual crashes involving trucks ranged from 7,442 to 9,092 while the number of fatal crashes involving trucks ranged from 70 to 105. For the five-year period studied, truck crashes represented 6.4 percent of all crashes, 5.5 percent of injury crashes, and 12.2 percent of fatal crashes. The statewide crash rate per 100 million vehicle miles (MVM) ranged from 163 to 226. On rural roadways that are characteristic of the roads serving TVA generating stations, statewide crash rates ranged from 183 to 217 per 100 MVM on two-lane roadways. Therefore, there is the potential for increased crash rates on roadways being used by heavy trucks to haul either borrow or CCR.

A 2012 study published by the National Highway Traffic Safety Administration (NHTSA), stated that “large trucks were more likely to be involved in a fatal multiple-vehicle crash as opposed to a fatal single-vehicle crash than were passenger vehicles (81 percent of fatal crashes involving large trucks are multiple-vehicle crashes, compared with 58 percent for fatal crashes involving passenger vehicles)” (NHTSA 2012).

Finally, as described above, transport of CCR materials by barge or rail operations must consider a range of factors that determine reasonableness and environmental impact including the volume of CCR materials to be removed (cost-effectiveness and duration of removal operations), logistics related to supporting infrastructure (loading and unloading facilities), the availability of off-loading terminals at receiving landfills, increased risk of injuries and death, and increased potential for accidental release.

- *Excessive Cost.* Excessive closure costs may affect the reasonableness of an alternative.

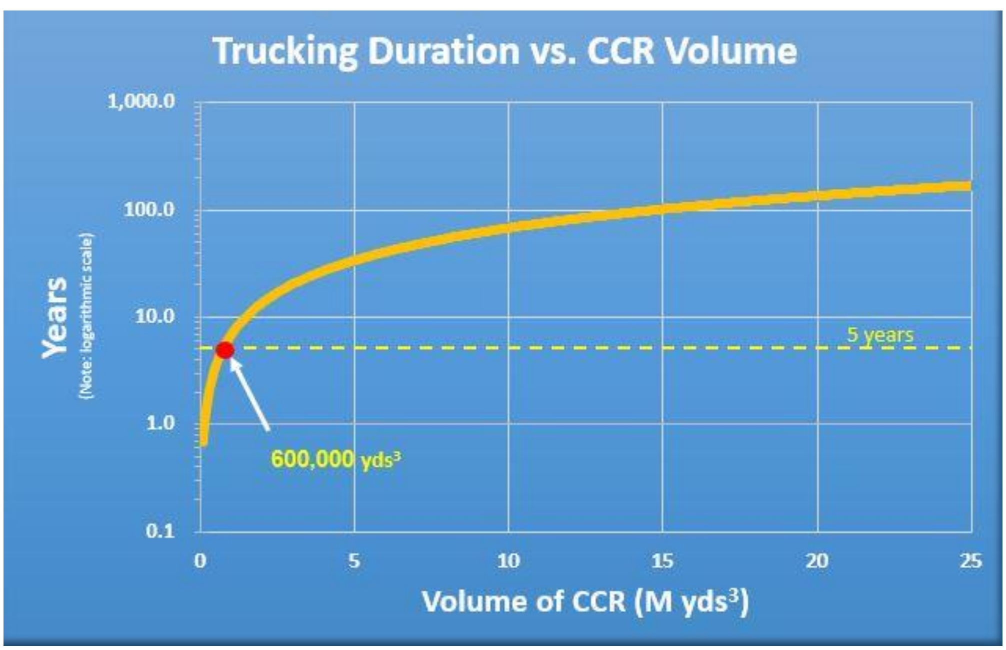


Figure 2-6. Duration of Trucking vs. CCR Removal Volume

2.3 EPRI Relative Impact Framework

Working with a contractor, the EPRI has developed a comprehensive analytical tool, the "Relative Impact Framework,"(RIF) to assess and compare the potential health and environmental impacts of the two CCR impoundment closure alternatives, Closure-in-Place and Closure-by-Removal (EPRI 2016c). At sites where the Framework is applicable, this PEIS, TVA has independently assessed the health and environmental impacts for each impoundment closure alternative, and has considered EPRI's methodology and analyses. Results from EPRI's assessment substantiate and support TVA's conclusions. This section provides more information about the EPRI RIF assessment and results.

What are "Constituents"?

The term "*constituent*" is used to describe any group of chemicals within a particular environmental medium (air, soil, water). Within water, constituents are transported as dissolved substances, or solutes, which may be naturally occurring or contaminants.

EPRI researches, develops, and demonstrates solutions to technical issues affecting the generation, delivery, and use of electricity. EPRI is a nonprofit organization that was created by the electric utility industry in response to Congressional concerns following the 1965 blackout of parts of the Northeast, including New York City. Although funded by the utility industry, it is an independent entity, and its advisory council consists of individuals with diverse backgrounds including members from public utility commissions, environmental and consumer advocacy groups, academia, and financial institutions.

EPRI's RIF provides a systematic approach to quantify potential relative impacts to environmental media associated with each closure scenario, including constituents in groundwater, surface water, and ambient air. In addition to environmental media, the RIF also provides an approach to quantify potential relative impacts to safety of workers and nearby residents from construction activities, including the transportation of materials to and from the site, in addition to potential relative impacts the sustainability of natural resources (e.g., energy, water and materials) associated with each closure alternative.

Consistent with EPA's technical determinations underlying its CCR Rule, EPRI's RIF results of the hypothetical site show that either closure method would have positive effects on groundwater and surface water if conducted properly. However, for the hypothetical site the assessment results indicated that for the configuration modeled, the Closure-by-Removal option would have a greater beneficial impact on surface water and groundwater quality than Closure-in-Place if the water table intersects the CCR, while the Closure-in-Place option would have greater beneficial impact if the water table is below the CCR (refer to EPRI 2016b or EPRI 2016a for explanation of these results). Closure-in-Place would still have beneficial impacts on surface and groundwater quality even when CCR intersects with the water table, but the benefits would not be as great as those resulting from Closure-by-Removal. In contrast, the Closure-by-Removal Alternative has significantly greater adverse impacts compared to Closure-in-Place on public and worker safety (more injuries and fatalities), greater air quality impacts and greater emissions of greenhouse gases. The overall conclusion that TVA draws from these results is that in most situations, Closure-in-Place likely will be more environmentally beneficial than Closure-by-Removal, especially when the amount of borrow and CCR material that must be moved to and from a site is substantial. This does not mean that Closure-by-Removal would necessarily be environmentally unacceptable on a site-specific basis.

To evaluate relative impacts of Closure-in-Place versus Closure-by-Removal for the CCR facilities that TVA is proposing to close, EPRI considered the similarity of site-specific features to its hypothetical site. Features considered in this step included the type of CCR facility (impoundment vs. landfill), proximity to a river, proximity of potential air receptors to haul route and landfill, background groundwater quality (i.e., water that is fresh and not brackish or degraded), volume/area of CCR, characteristics related to truck transport, type of cover system, and other factors. Next, more detailed features of the TVA CCR impoundments and closure operations were evaluated and qualitatively compared to modeled results for the hypothetical site. Each of the TVA sites was analyzed by site feature and RIF pathway using the factors presented in Table 2-6.

Table 2-6. Site Features and Pathways Considered in the EPRI Relative Impact Framework

Site Features	Pathway
• CCR volume and CCR impoundment acreage • Receptor distance to haul road between CCR impoundment and landfill • Receptor distance to CCR impoundment • Receptor distance to landfill • Trucking characteristics (travel distance, load volume, trips/day, distance and road type) • Number of working days per year • Surface water flow rate • Cover system type	• High mobility constituent in groundwater • Low mobility constituent in groundwater • High mobility constituent in surface water • Low mobility constituent in surface water • Air daily maximum concentration • Air annual concentration • Air cumulative exposure • Green and Sustainable Remediation • On-site worker safety • Off-site worker safety

Source: EPRI, 2016a

The following general observations are from the qualitative application of the Relative Impact Framework to the specific facilities that TVA has proposed to close.

Groundwater: EPRI's results indicated that there was a negligible difference between Closure-in-Place and Closure-by-Removal with respect to low mobility constituents under both the intersecting and non-intersecting groundwater conditions. By comparison, for high-mobility constituents, EPRI found that Closure-in-Place was often predicted to have greater beneficial impact than Closure-by-Removal under the non-intersecting groundwater condition, and Closure-by-Removal was often predicted to have greater beneficial impact than Closure-in-Place under the intersecting groundwater condition. Groundwater monitoring, assessment of results and implementation of corrective measures, as appropriate, will further mitigate possible residual impacts from Closure-in-Place.

Low Mobility vs. High Mobility CCR Constituents

CCR-related constituents may be classified into two groups based on the ease with which the chemical is transported within water (i.e., "mobility"). Mobility depends on such factors as chemical speciation, pH, and other factors.

High Mobility CCR constituents are generally considered to be those that are readily transported within water and include Boron; whereas *Low Mobility* CCR constituents are those that are more slowly transported in water and include Arsenic (V).

- **Surface Water:** For surface water, only a negligible difference in impacts between the Closure-in-Place and Closure-by-Removal Alternatives was typically predicted with respect to both low and high mobility constituents for both the intersecting and non-intersecting groundwater conditions.

- **Air:** For all of the air pathways, Closure-in-Place was predicted to have a less adverse impact than Closure-by-Removal.[1]

- **Green and Sustainable Remediation:** Closure-in-Place was predicted to have a less adverse impact on green and sustainable remediation.

- **Safety:** Closure-in-Place was expected to have a less adverse impact on safety than Closure-by-Removal.

Further discussion of the qualitative assessment as it pertains to individual CCR impoundments can be found in Part II for appropriate environmental resources.

The observations from EPRI's RIF assessment helps to confirm TVA's conclusion and EPA's determination that either Closure-in-Place or Closure-by-Removal would be equally protective if conducted properly. EPA predicted that most CCR impoundments would be closed in place because of the expense and difficulty of closing by removal.

2.3 Summary of Public and Agency Scoping Process

TVA received 48 responses to the NOI to prepare the PEIS. These responses included 18 individual responses, one form letter (submitted by 26 individuals), and two sets of comments from groups of interested parties. TVA also received comments from the Alabama Department of Environmental Management (ADEM), Kentucky Department of Environmental Protection (KDEP), TDEC and the U.S. Fish and Wildlife Service (USFWS).

[1] The terms "beneficial" and "adverse" were used in the EPRI observations in a general sense to characterize the impacts of the two closure alternatives at the TVA sites. Importantly, an adverse impact does not necessarily equate to human or ecological harm.

Participants submitted a variety of comments and opinions ranging from requesting TVA to keep ash impoundments open to protect wildlife habitat; to close all ash impoundments; to support for Closure-by-Removal or Closure-in-Place. Several commenters also requested that TVA consider beneficial reuse of coal ash and consider alternative closure options. Concerns relating to groundwater quality, impacts of off-site disposal on low-income and minority populations, compliance with the CCR Rule and TDEC Order, the need for public involvement, and the applicability of a programmatic review were also expressed.

TVA also received agency letters from the USFWS field offices in Kentucky, Tennessee, and Alabama. In its letter, the USFWS noted that TVA should work with the local field office to ensure the most recent information regarding federally listed species and designated critical habitat is assessed. The USFWS also requested that TVA continue to consult with state and federal resources throughout the planning process. A TDEC letter requested that TVA consider impacts to air quality, groundwater and surface water impacts, beneficial use of ash, and identify all actions required to obtain the proper permits from TDEC.

The following is a brief summary of the most prevalent issues and comments expressed during the scoping period:

- TVA should consider keeping the ash impoundments open for future wildlife use, especially for bird habitat at the ALF East Impoundment.
- TVA should consider beneficial use of CCR.
- TVA should consider impacts of off-site disposal of CCR on low-income and minority populations.
- Groundwater impacts should be considered.
- Surface water impacts should be considered.
- TVA must demonstrate compliance with the EPA CCR Rule and the TDEC Order.

2.4 Comparison of Alternatives

The environmental impacts of Alternative B and Alternative C are analyzed programmatically in detail in this section and are summarized in Table 2-7. These summaries are derived from the information and analyses provided in the Affected Environment and Environmental Consequences sections of each resource in Chapter 3.

Table 2-7. Summary and Comparison of Alternatives by Resource Area

Issue Area	Alternative A – No Action	Alternative B – Closure-in-Place	Alternative C – Closure-by-Removal
Closure Cost	$0	<$3.5 to $200 million	<$20 million to $2.3 billion (Truck) <$23 million to $2.1 billion (Train)
Air Quality	No impact	Temporary minor impacts from fugitive dust and emissions from equipment and vehicles during construction and transport of borrow material.	Notably greater emissions (relative to Alternative B) from fugitive dust and emissions from equipment and vehicles during construction and transport of borrow and CCR material. For sites with large volumes of CCR magnitude of impact would be greater due to increased operation of on-site equipment and increased duration and frequency of off-site trucking. No exceedances of NAAQS expected for sites in attainment areas. No further deterioration of air quality is anticipated in the non-attainment areas for particulates and ozone.
Climate Change and Greenhouse Gases (GHG)	No impact	Construction and trucking operations of borrow material contributes to emissions of GHG.	Construction and trucking operations of CCR removal and borrow material contributes to emissions of GHG. For sites with large volumes of CCR, magnitude of impact would be greater due to increased operation of on-site equipment and increased duration and frequency of off-site trucking.
Land Use	No impact as no change in industrial land use	No impact as no change in industrial land use. Temporary impacts associated with the conversion of some vacant areas to laydown areas.	No impact as no change in industrial land use. Impacts associated with the conversion of some vacant areas to laydown areas. Minor beneficial impact as land could be reused for an alternative use following closure.
Prime Farmland	No impact	No impact	No impact
Geology and Seismology	Marginal improvement to static and seismic factor of safety of the impoundment.	Stable under static conditions. Stability increased by removal of hydraulic head. Seismic stability under evaluation and mitigable.	No impacts or risks of failure.
Groundwater	Risk to groundwater is not reduced.	Reduction of hydraulic input reduces risk of migration of constituents to groundwater.	Reduces risk to groundwater by removing CCR from impoundment. Less short term benefit for sites having high volume of CCR materials.
Surface Water	Risk to surface water is not reduced.	Risk to surface water would be reduced. Construction-related impacts would be negligible.	Risks to surface water would be reduced. Construction-related impacts would be negligible.
Floodplains	Impacts to floodplains unchanged.	Reduces risk and extent of CCR migration into surface water during potential flooding event.	Removes risk of CCR migration into surface water during potential flooding event. Potential to incrementally increase floodplain storage.

Table 2-7. Summary and Comparison of Alternatives by Resource Area

Issue Area	Alternative A – No Action	Alternative B – Closure-in-Place	Alternative C – Closure-by-Removal
Vegetation	No impact	Limited to construction-phase disturbance of largely industrialized environmental settings that lack notable plant communities. Minor and adverse in the short term, but minor and positive in the long term.	Limited to construction-phase disturbance of largely industrialized environmental settings that lack notable plant communities. Minor and adverse in the short term, but minor and positive in the long term.
Wildlife	No impact	Minor impact to predominantly previously disturbed low quality habitats during the construction phase.	Minor impact to predominantly previously disturbed low quality habitats during the construction phase.
Aquatic Ecology	No impact	No adverse impact	No adverse impact
Threatened and Endangered Species	No impact to threatened or endangered species.	No impact to threatened or endangered species. For sites that require limited tree removal potential impacts to threatened and endangered species would be minor.	No impact to threatened or endangered species. For sites that require limited tree removal potential impacts to threatened and endangered species would be minor.
Wetlands	No impact	No direct impact. Potential minor indirect impact may occur during construction. These would be minimized through BMPs.	No direct impact. Potential minor indirect impact may occur during construction. These would be minimized through BMPs.
Socioeconomic Resources	No impact	Short-term beneficial increases in employment and income during construction.	Short-term beneficial increases in employment and income. The larger the CCR volume the longer the benefits would last due to increased construction periods. Potential impacts to community services due to increased demand on workforce and equipment.
Environmental Justice	No impacts to EJ communities.	Impacts associated with the transport of borrow material (construction related noise, exposure to fugitive dust and exhaust emissions) to or from identified EJ communities. These impacts would be short term and generally minor.	Impacts associated with the transport of borrow and CCR material (construction related noise, exposure to fugitive dust and exhaust emissions) to identified EJ communities. For sites with large volumes of CCR, magnitude of impact would be greater due to increased duration and frequency of off-site truck and rail transport.
Natural Areas, Parks and Recreation	No impacts	Potential long-term impact if recreational sites are closed as a result of impoundment closure activities.	Potential long-term impact if recreational sites are closed as a result of impoundment closure activities.
Transportation	No impacts	Temporary minor impacts from transport of borrow material.	Impact magnitude dependent upon CCR volume and removal duration. For sites with large volumes of CCR magnitude of impact would be greater due to increased duration

Table 2-7. Summary and Comparison of Alternatives by Resource Area

Issue Area	Alternative A – No Action	Alternative B – Closure-in-Place	Alternative C – Closure-by-Removal
			and frequency of off-site trucking resulting in additional impacts to local traffic and increase need for roadway maintenance. Impacts on level of service of roadway network notably greater for sites having large CCR volumes and short removal durations, resulting in increased risk of injuries and deaths.
Visual Resources	No impacts	Minor impacts during construction. Beneficial in long term.	Minor impacts during construction. Beneficial in long term.
Cultural Resources	No impacts	No impacts due to use of previously disturbed lands.	No impacts due to use of previously disturbed lands.
Noise	No impacts	Temporary minor construction noise impacts from equipment and vehicles.	Minor construction noise impacts from equipment and vehicles. For sites with large volumes of CCR, magnitude of impact would be greater due to increased duration and frequency of off-site truck and rail transport.
Solid and Hazardous Waste	No impacts	Minimal amounts generated during construction activities and managed in permitted facilities.	Minimal amounts generated during construction activities and managed in permitted facilities.
Public Health and Safety	No reduction in public health and safety risks to groundwater and surface water.	Temporary potential for impacts during construction activities and transportation of borrow material.	Potential for impacts during construction activities and transportation of borrow material and CCR. Increased risk associated with deep excavation of CCR impoundments. Notably greater risk to worker safety and traffic related safety associated with sites having high CCR volumes
Cumulative Effects	No impacts	Beneficial cumulative impact to groundwater quality associated with TVA plant sites from closure of CCR impoundments.	Beneficial cumulative impact to groundwater quality associated with TVA plant sites from removal of CCR from impoundments. Adverse cumulative impact to traffic operations within the TVA region. Cumulative impacts to air quality, noise, land use, natural resources socioeconomics, EJ communities and public health and safety would be expected and greater than Alternative B due to greater trucking and secondary effects on regional landfill capacity.

2.5 Alternatives to be Carried Forward for Detailed Analysis

Initial screening analysis by TVA determined that Alternative A – No Action would not be a reasonable alternative. Nonetheless, Alternative A – No Action is discussed in Part I of the PEIS to provide a benchmark against which to compare the environmental effects of the proposed action alternatives, Alternatives B and C.

Alternative B – Closure-in-Place and Alternative C – Closure-by-Removal both meet the purpose and need to close ash impoundments and are reasonable alternatives for this PEIS. In the preamble to the CCR Rule, EPA determined that either Closure-in-Place or Closure-by-Removal can be equally protective of human health and the environment if done properly (80 FR 21412). Therefore, TVA analyzed both alternatives the PEIS.

EPA observed that most impoundments would be closed using the Closure-in-Place Alternative because of the difficulty of demonstrating that all CCR in the impoundment and any areas affected by CCR releases from the impoundment were addressed appropriately and the cost of the Closure-by-Removal Alternative.

Site-specific analysis for closure activities at individual ash impoundments will tier off the programmatic analysis, will re-evaluate the reasonableness of alternatives under consideration and will result in the identification of a preferred closure alternative.

2.6 Summary of Mitigation Measures

Mitigation measures identified in Chapter 3 to avoid, minimize, or reduce adverse impacts to the environment are summarized below. Any additional project-specific best management practices (BMPs) will be identified on a site-specific basis.

- Fugitive dust emissions from site preparation and construction will be controlled by wet suppression and BMPs (CAA Title V operating permit incorporates fugitive dust management conditions).
- Erosion and sedimentation control BMPs (e.g., silt fences, truck washes) will ensure that surface waters are protected from construction impacts.
- Consistent with EO 13112, disturbed areas will be revegetated with native or non-native, non-invasive plant species to avoid the introduction or spread of invasive species.
- BMPs will be used during construction activities to minimize and restore areas disturbed during construction.
- TVA will implement supplemental groundwater mitigative measures that could include monitoring, assessment, or corrective action programs as mandated by state requirements and the CCR Rule. State requirements provide an additional layer of groundwater protection to minimize risk.

This page intentionally left blank

CHAPTER 3 – AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.1 Air Quality

3.1.1 Affected Environment

Air quality is a vital resource that impacts us in many ways. Poor air quality can affect our health, ecosystem health, forest and crop productivity, economic development and our enjoyment of scenic views. This section summarizes current conditions and trends over the past 35 years for key air quality issues. Air quality within the TVA region has steadily improved over the past 35 years.

The CAA is the comprehensive law that affects air quality by regulating emissions of air pollutants from stationary sources (such as power plants) and mobile sources (such as automobiles). It requires the EPA to establish National Ambient Air Quality Standards (NAAQS) and directs the states to develop State Implementation Plans to achieve these standards. This is primarily accomplished through permitting programs that establish limits for emissions of air pollutants.

For the purpose of this PEIS, the affected environment is the TVA Power Service Area (PSA) shown in Figure 3-1. This service area includes the 178 counties in a seven state region and has an estimated population of about 10 million people. Additional focus is on the 11 counties where TVA's coal-fired power plants are located. The primary air quality parameters of concern for this PEIS are five criteria air pollutants (carbon monoxide [CO], nitrogen dioxide [NO_2], ozone, particulate matter [PM], and sulfur dioxide [SO_2), as well as hazardous air pollutants and volatile organic compounds.

3.1.1.1 Criteria Air Pollutants

EPA has established NAAQS for the five criteria air pollutants: CO, NO_2, ozone, PM, and SO_2. There are two different standards for particulate matter. Primary standards protect public health, while secondary standards protect public welfare (e.g., visibility, crops, forests, soils, and materials). Class 1 areas are locations where air quality is deemed especially sensitive such as national parks and wilderness areas and receive heightened protection under the Clean Air Act. There are a number of Class 1 areas in and near the TVA PSA (e.g., Mammoth Cave National Park).

Ambient air monitors measure concentrations of these pollutants to determine attainment with these standards. Areas where these measurements exceed the standards are designated as non-attainment areas. New emissions sources to be located in or near these areas are subject to more stringent air permitting requirements. Anderson and Roane counties in Tennessee, where BRF and KIF are located, are non-attainment for $PM_{2.5}$. Shelby County, Tennessee, where ALF is located, is in nonattainment for ozone. The State of Tennessee has filed a petition to have the area re-designated as attainment. All other coal-fired power plants are located in attainment areas for all of the NAAQS.

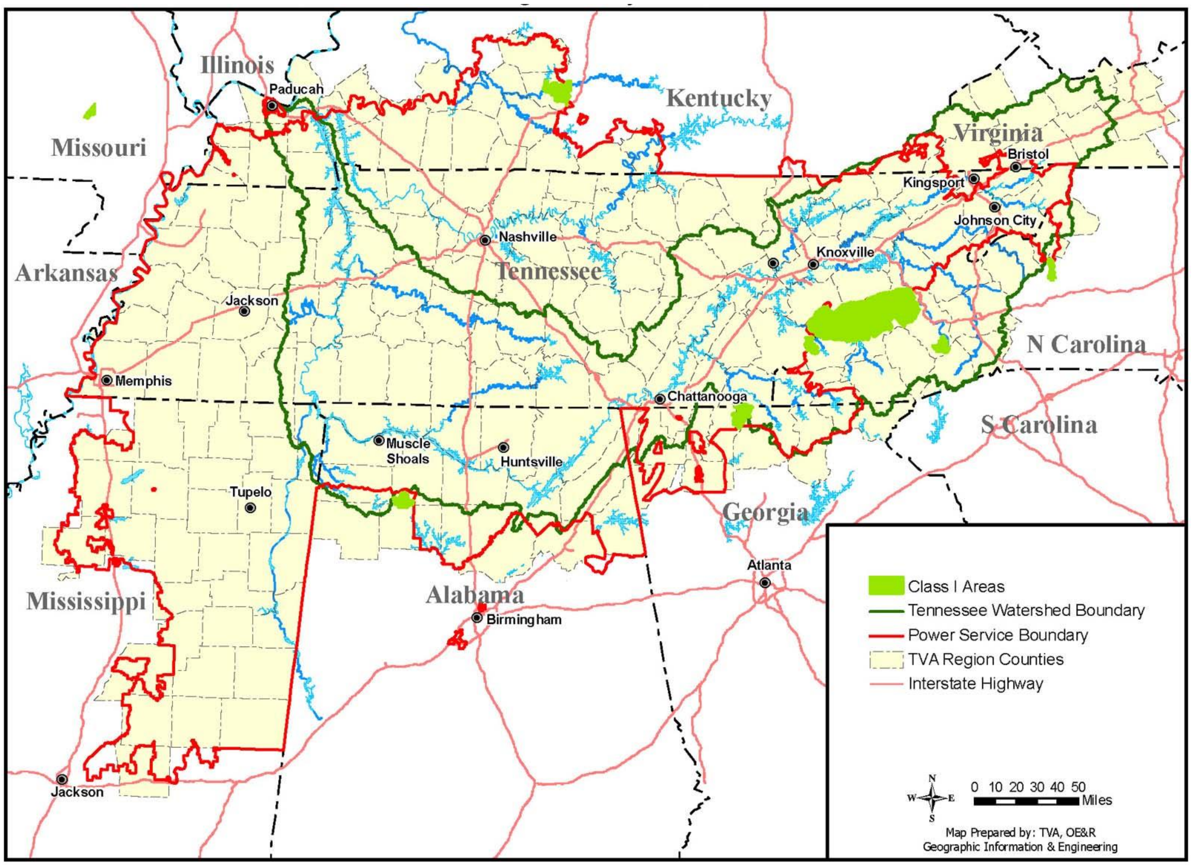


Figure 3-1. TVA Service Area and Class I Air Quality Areas

3.1.1.1.1 Sulfur Dioxide

SO_2 is a colorless gas with a sharp odor that can cause respiratory problems at high concentrations. SO_2 also combines with other elements to form sulfate, a secondary pollutant that contributes to acid deposition, regional haze and fine particle concentrations.

TVA's SO_2 emissions have decreased by 94 percent since 1974. This reduction is largely the result of TVA's installation of FGD systems on coal plants and recent coal plant retirements. Currently, all of TVA's coal-fired power plants are in SO_2 attainment areas.

3.1.1.1.2 Nitrogen Oxides

Nitrogen oxides (NO_x) are a group of highly reactive gases, including NO_2 that contain varying amounts of nitrogen and oxygen. NO_x emissions contribute to ground-level ozone, fine particulate matter, regional haze, acid deposition and nitrogen saturation. Natural sources of NO_x include lightning, forest fires and microbial activity; major sources of human-produced NO_x emissions include motor vehicles, electric utilities, industrial boilers, nitrogen fertilizers and agricultural burning.

Regional annual NO_x concentrations declined by 52 percent between 1979 and 2013 and by 63 percent since the peak concentration in 1988. Average regional concentrations are well below the NO_x annual NAAQS standard. Across the TVA system, NO_x emissions have been decreased by 91 percent since 1995. All TVA coal-fired power plants are located in NO_x attainment areas.

3.1.1.1.3 Ozone

Ozone is a gas that occurs both in the stratosphere (10 to 30 mi above the Earth's surface) and at ground level where it is the main ingredient of smog. While stratospheric ozone is beneficial due to its role in absorbing ultraviolet radiation, ground-level ozone is an air pollutant that can damage lung tissue and harms vegetation at sufficiently high concentrations. The ozone NAAQS applies to ground-level ozone. Ozone is a secondary pollutant which is not directly emitted by any source; it is formed by a chemical reaction between NO_x and volatile organic compounds (VOCs) in the presence of sunlight. Because ozone formation depends on sunlight, ozone concentrations are highest during the summer and greater in areas with hot summers, such as the southeastern United States.

In 2008, EPA lowered the 8-hour ozone standard from 80 parts per billion (ppb) to 75 ppb. Shelby County, Tennessee is currently designated in attainment with all of the NAAQS except ozone. The EPA has designated Shelby County as a non-attainment area for ozone based on 2008-2010 data. The state of Tennessee has filed a petition to have the area re-designated based on 2009-2011 data demonstrating attainment with the 2008 ozone NAAQS of 75 ppb. TVA plans to replace the coal-fired units at ALF, located in Shelby County, with combined cycle/combustion turbines which will reduce NO_x and VOCs emissions significantly and could contribute to a reduction in ozone levels in the area (see Section 3.25, Cumulative Effects). On October 1, 2015, EPA lowered the 8-hour ozone standard to 70 ppb (80 FR 65292) (October 26, 2015). The effect of this action on attainment has yet to be fully determined.

3.1.1.1.4 Particulate Matter

PM consists of small solid "dust" particles or liquid droplets. PM is regulated by size class: PM less than 10 micrometers (µm) in diameter (PM_{10}), and PM less than 2.5 µm in diameter ($PM_{2.5}$).

Particles emitted directly from a pollution source are called primary particles, whereas those formed after emission—by the chemical and physical conversion of gaseous pollutants—are called secondary particles.

When inhaled by humans, large particles are filtered by the nose and throat, while fine particles can be drawn deeper into the lungs. Consequently, fine particles have more adverse health impacts. Exposure to high levels of fine particles can impact the respiratory and cardiovascular systems, particularly in elderly people and those with respiratory or cardiovascular disease.

PM has many natural and human-made sources. Natural sources include windblown dust, forest fires, volcanoes, and ocean spray, while human-made sources include motor vehicles, fossil-fuel combustion, industrial processes, mining, agricultural activities, waste incineration and construction.

Part of Anderson County and all of Roane County are classified as non-attainment for $PM_{2.5}$. TVA's BRF and KIF are located in these non-attainment areas. SO_2 (a precursor pollutant for $PM_{2.5}$) reductions across the TVA system should help these counties achieve attainment.

There are no non-attainment areas for PM_{10} in the TVA region.

3.1.1.1.5 Carbon Monoxide

Carbon monoxide (CO) is a colorless and odorless gas formed when carbon in fuel is not burned completely. At high concentrations, CO can aggravate heart disease and even cause death. Major CO sources include motor vehicles, off-road sources (i.e., construction equipment, airplanes and trains), metals processing and chemical manufacturing. The primary natural source of CO is wildfires. Electric utilities are not a major source of CO emissions and account for 1 percent of the total CO emissions in the United States. All counties within the TVA region are in attainment for CO.

3.1.1.2 Other Air Pollutants and Air Quality Concerns

Other pollutants that could affect air quality include hazardous air pollutants and VOCs.

3.1.1.2.1 Hazardous air pollutants (HAPs)

Hazardous air pollutants (HAPs) are toxic air pollutants, which are known or suspected to cause cancer or other serious health effects or adverse environmental effects. The CAA identifies 187 pollutants as HAPs. Most HAPs are emitted by human activity, including motor vehicles, factories, refineries and power plants.

3.1.1.2.2 Volatile organic compounds

VOCs are compounds that have a high vapor pressure (i.e., readily evaporate at ambient temperatures) and low solubility in water. The most common sources of man-made VOCs are petrochemical storage and transport, chemical processing, motor vehicles, paints and solvents. Natural sources of VOCs include vegetation, biological decay and forest fires. In many areas of the Southeast, natural sources contribute up to 90 percent of total VOCs. TVA does not emit a significant amount of VOC emissions. While VOCs are not a criteria pollutant, they are important because they are a precursor to ground-level ozone.

3.1.2 Environmental Consequences

3.1.2.1 Alternative A – No Action

Alternative A will involve no changes to the current conditions, and previously generated CCR will continue to be stored in the existing ash impoundments. No additional or new air quality impacts would be associated with this alternative. Current air quality in the vicinity of the ash impoundments is expected to be consistent with approved state air pollution implementation plans. Therefore, no significant impacts to air quality would occur with this alternative.

3.1.2.2 Alternative B – Closure-in-Place

Alternative B will involve several activities that potentially would result in air emissions. These activities include dewatering of surface water, equipment removal, grading and compaction of CCR, transport of borrow material and installation of approved closure systems (see Section 2.2). For inactive impoundments within TVA's system, these activities would generally require less than 5 years for completion. Similar or longer durations may be required for closure activities for other ash impoundments. Relevant data on size, fill material quantities, number of dump trucks for hauling fill material per day are summarized in Table 2-1.

Potential air quality impacts from the dewatering, compacting, filling in, contouring, installing cover system, and planting of vegetation include dust and emissions from equipment. Earth-moving activities (dozing, grading, and fill placement) and equipment movement on the on-site and off-site unpaved haul roads will be the principal sources of fugitive dust.

This dust could affect particulate levels. Emissions from equipment that use diesel or gas as fuel may include particulates, CO, CO_2, HAPS, NO_x, ozone, SO_2 and VOCs. However, the total amount of these emissions would be temporary, small and would result in minimal off-site impacts. Air quality impacts from construction activities would be temporary and would be dependent upon both man-made factors (e.g., intensity of activity, control measures), and natural factors (e.g., wind speed, wind direction, soil moisture).

The amount of borrow/fill material required to cover these ash impoundment areas varies from less than 15,000 yd^3 to a high of 4,300,000 yd^3, with most requiring less than 150,000 yd^3.

The equipment that will be required for this alternative includes dozers (up to 10), compactors (up to five), dump trucks (up to 20), scrapers/pans (up to 10), track hoes (up to five), cranes and diesel pumps. With the exception of the dump trucks, the equipment will be used on-site and any air quality impacts would be limited to the immediate site area. However, up to 350 truck trips (175 trucks of 15 yd^3 capacity) per day would be traveling between the site and the borrow areas (some are on-site and others will be within 30 mi of the site) during the construction period. These dump trucks would operate both on-site and off-site.

It is estimated that the largest fraction (greater than 95 percent by weight) of fugitive dust emissions would be deposited within the construction site boundaries. The remaining fraction of PM would be subject to longer-range transport. TVA requires all contractors to keep construction equipment properly maintained and also to use BMPs (such as covered loads and watering unpaved haul roads) to minimize dust, if necessary. TVA power plants have fugitive dust control plans as required under existing Title V permits. In addition, the CCR Rule requires fugitive dust control plans. Closure activities will follow these fugitive dust control plans.

A recent study conducted by EPRI has evaluated the impact of impoundment closure on particulate emissions for a hypothetical CCR impoundment in Tennessee. Under a closure scenario similar to Alternative B, EPRI found that $PM_{2.5}$ and PM_{10} emissions exceeded the baseline condition. Additionally, EPRI found that on average, modeled (plus background) $PM_{2.5}$ and PM_{10} daily maximum concentrations exceeded the NAAQS 1 day per year at this hypothetical site, and modeled (plus background) $PM_{2.5}$ annual average concentrations exceeded the NAAQS criteria during any given year of the modeled period. When exceedances of the NAAQS levels were predicted to occur, Closure-by-Removal resulted in larger exceedances than Closure-in-Place for daily maximum PM_{10} and $PM_{2.5}$ concentrations, and Closure-in-Place and Closure-by-Removal had similar exceedances for annual average $PM_{2.5}$ (EPRI 2016c). It is expected therefore, that for all sites these emissions would have potential adverse short term local effects on air quality. However, overall, regional impact on air quality is expected to be minor.

Additionally, new emission control technologies and fuel mixtures have significantly reduced vehicle and equipment emissions. As a result of the equipment maintenance requirements, use of BMPs by construction companies, and continued improvement of emission control measures and fuel blends, emission and dust impacts are expected to be reduced.

3.1.2.3 Alternative C – Closure-by-Removal
This alternative involves dewatering of surface water, removal of CCR in accordance with state requirements, filling-in and contouring, and planting of vegetation. These activities may require from 2 years to 170 years to complete, depending on the amount of CCRs to be removed. The relevant data on size, quantities of CCR, and dump trucks required to remove the CCR each day are shown in Table 2-3.

Under this alternative, the amount of CCR that would have to be dewatered, excavated, and hauled to permitted landfills is large ranging from less than 145,500 to 25,000,000 yd^3. The CCR material transported off-site would be dried to a reasonable degree to support transport.

The quantity of dump trucks required to move this amount of material is potentially very large, and due to logistical considerations and the availability of equipment, it is likely that closure of the large ash impoundments would require significantly more than 2 years for completion. Based on the estimates in Figure 2-7, the number of daily round-trip truck trips would have to increase from the estimated maximum of 350 per day for the Closure-in-Place Alternative to transport borrow material, to several thousand per day for the larger impoundments to transport CCR and borrow material.

Under this alternative, borrow material also would have to be transported to the site similar to the process discussed for Alternative B. The types of impacts discussed for Alternative B are similar to these impacts but impact magnitude could be much greater based on the larger volumes of CCR and borrow material excavated and transported. BMPs, similar to those for Alternative B, will be implemented, as appropriate. In addition, permitted landfills receiving CCR will have fugitive dust plans to minimize air impacts from managing the CCR.

In the analysis of the closure of the hypothetical CCR impoundment in Tennessee, EPRI also evaluated the potential effects of a closure scenario similar to Alternative C. EPRI found that this scenario has a more negative impact than the Closure-in-Place alternative when considering both $PM_{2.5}$ and PM_{10}, likely due to the larger number of emission sources and the closer proximity of some emissions sources (roadways) to the residential community. $PM_{2.5}$ emissions markedly exceeded the baseline condition and occasionally exceeded the NAAQS criterion for both the annual average and 24-maximum values (EPRI 2016c). It is expected, therefore, that for all sites these emissions would have potentially notable and long term (depending on CCR volume) adverse local effects that would be greater than those evident under Alternative B.

3.2 Climate Change and Greenhouse Gases
3.2.1 Affected Environment
The average temperature in the United States has increased by 1.3°F to 1.9°F since record keeping began in 1895; most of this increase has occurred since about 1970. The most recent decade has been reported as the nation’s warmest on record, and temperatures in the United States are expected to again rise. However, this increase has not occurred uniformly across the United States with the Southeast showing almost no increase. Because human-induced warming is superimposed on a naturally varying climate, the temperature rise has not been, and will not be, uniform or smooth across the country over time (Melillo et al. 2014). Globally, it appears that the temperature has not increased for almost 18 years based on satellite measurements.

The 2014 National Climate Assessment concluded global climate is projected to continue to change over this century and beyond. The amount of warming projected beyond the next few decades is directly linked by these studies to the cumulative global emissions of greenhouse gas and particulates. By the end of this century, the 2014 National Climate Assessment concluded a 3°F to 5°F rise can be projected under the lower emissions scenario and a 5°F to 10°F rise for a higher emissions scenario. As with all future scenario modeling exercises, there is an important distinction to be made between a “prediction” of what “will” happen and a “projection” of what future conditions are likely given a particular set of assumptions (Melillo et al. 2014).

The Southeastern United States is one of the few regions globally that does not exhibit an overall warming trend in surface temperature over the 20th century. This “warming hole” also includes part of the Great Plains and Midwest regions in the summer. Historically, temperatures increased rapidly in the Southeast during the early part of the 20th century, then decreased rapidly during the middle of the 20th century. Since the 1960s, temperatures in the Southeast have been increasing. Recent increases in temperature in the Southeast have been most pronounced in the summer season, particularly along the Gulf and Atlantic coasts. However, temperature trends in the Southeast over the period of 1895 to 2011 are found to be statistically insignificant for any season. Generally, in the Southeast, the number of extreme hot days has tended to decrease or remain the same while the number of very warm summer nights has tended to increase. The number of extreme cold days has tended to decrease. Global warming is a long-term trend, but that does not mean that every year will be warmer. Day-to-day and year-to-year changes in weather patterns will continue to produce variation, even as the climate warms. Generally, climate change results in Earth’s lower atmosphere becoming warmer and moister, resulting in the potential for more energy for storms and certain severe weather events. Trends in extreme rainfall vary from region to region (Kunkel et al. 2013).

3.2.1.1 Natural Greenhouse Gas Emissions

The sun is the primary source of energy for the Earth’s climate. About 30 percent of the sun’s energy that reaches Earth is reflected back to space by clouds, gases and small particles in the atmosphere. The remainder is absorbed by the atmosphere and the surface. The Earth’s temperature depends on the balance between the energy entering and leaving the planet’s system. When energy is absorbed by the Earth’s system, global temperatures increase. Conversely, when the sun’s energy is reflected back into space, global temperatures decrease.

In nature, CO_2 is exchanged continually between the atmosphere, plants and animals through processes of photosynthesis, respiration and decomposition, and between the atmosphere and oceans through gas exchange. Billions of tons of carbon in the form of CO_2 are annually absorbed by oceans and living biomass (i.e., sinks) and are annually emitted to the atmosphere through natural and man-made processes (i.e., sources). When in equilibrium, carbon fluxes among these various global reservoirs are roughly balanced.

3.2.1.2 Greenhouse Effect

Similar to the glass in a greenhouse, certain gases, primarily CO_2, nitrous oxide (N_2O), methane (CH_4), hydroflurocarbons (HFCs), perflourocarbons (PFCs) and sulfur hexafluoride (SF_6), absorb heat that is radiated from the surface of the Earth. It is believed that increases in the atmospheric concentrations of these gases cause the Earth to warm by trapping more heat. The common term for this phenomenon is the “greenhouse effect,” and these gases are typically referred to as GHGs. Atmospheric levels of CO_2 are currently increasing at a rate of 0.5 percent per year. Atmospheric levels measured at Mauna Loa in Hawaii and at other sites around the world reached 400 parts per million in 2013, higher than the Earth has experienced in over a million years.

While water vapor is the most abundant GHG in the atmosphere, it is not included in the list of GHGs because changes in the atmospheric concentration of water vapor are generally considered to be the result of climate feedbacks related to the warming of the atmosphere, rather than a direct result of human activity. That said, the impact of water vapor is critically important to projecting future climate change, and quantifying the effect of feedback loops on global and regional climate is the subject of ongoing data collection and active research.

The modeling projections of warming depend largely on the amount of GHG accumulating in the atmosphere. GHGs can remain in the atmosphere for different amounts of time, ranging from a few years to thousands of years. GHGs are assigned global warming potentials, a measure of the relative amount of infrared radiation they absorb, their absorbing wavelengths and their persistence in the atmosphere (Table 3-1). All of these gases remain in the atmosphere long enough to become well mixed, meaning the amount that is measured in the atmosphere is roughly the same all over the world, regardless of the source of the emissions.

Table 3-1. Major Man-Made Greenhouse Gases and Their Global Warming Potentials

Gas	Global Warming Potential
Carbon dioxide (CO_2)	1
Methane (CH_4)	28
Nitrous oxide (N_2O)	265
Hydroflourocarbons (HFCs)	4-12,400
Perfluorocarbons (PFCs)	6,630-11,100
Sulfur hexafluoride (SF_6)	23,500

Source: Intergovernmental Panel on Climate Change (IPCC) 2014

3.2.1.3 Greenhouse Gas Emissions

Electric utilities are one of the major emitters of CO_2 as a result of the combustion of coal, natural gas and other fossil fuels.

In 2013, worldwide man-made annual CO_2 emissions were estimated at 36 billion tons, with sources within the United States responsible for 14 percent of this total. U.S. electric utilities, in turn, emitted 2.039 billion tons in 2012, roughly 32 percent of the U.S. total. CO_2 emissions from TVA-owned generating facilities were 81,248,765 tons in 2012 and 72,154,380 tons in 2013; these accounted for about 4 percent of annual U.S. electric utility emissions (TVA 2015).

3.2.1.4 Climate Adaptation

TVA has, in accordance with the requirements of EO 13514 – Federal Leadership in Environmental, Energy, and Economic Performance and EO 13653 – Preparing the United States for the Impacts of Climate Change, adopted a climate adaptation plan that establishes adaptation planning goals and describes the challenges and opportunities a challenging climate may present to its mission and operations. The goal of TVA's adaptation planning process is to ensure that TVA continues to achieve its mission and program goals and to operate in a secure, effective and efficient manner in a changing climate.

TVA manages the effects of climate change on its mission, programs and operations within its environmental management processes. TVA's Environmental Policy provides objectives for an integrated approach related to providing cleaner, reliable and affordable energy, supporting sustainable economic growth and engaging in proactive environmental stewardship. The policy includes the specific objective of stopping the growth in volume of emissions and reducing the rate of carbon emissions by 2020 by supporting a full slate of reliable, affordable, lower-CO_2 energy-supply opportunities and energy efficiency.

3.2.2 Environmental Consequences

3.2.2.1 Alternative A – No Action

Alternative A will involve no changes to the current conditions at the existing ash impoundments. Operation and maintenance activities would continue to generate small amounts of climate and GHGs from equipment and vehicles used in operation and maintenance of the ash impoundments. However, because such emissions are negligible, no changes to climate will occur.

3.2.2.2 Alternative B – Closure-in-Place

Changes to climate and GHGs can result from the discharge of large quantities of heat, moisture, CO_2 and NO_x to the atmosphere. GHG emissions associated with this alternative relate to the emissions produced in conjunction with composite liner construction and the operation of combustion engine equipment during construction.

The equipment and vehicles that will be required for this alternative includes dozers (up to 10), compactors (up to five), dump trucks (up to 20), scrapers/pans (up to 10), track hoes (up to five), cranes, and diesel pumps per site. Relevant construction data for this alternative are summarized in Table 2-1. Emissions from this equipment will include heat, moisture, CO_2, and potentially NO_x.

A recent study conducted by EPRI has evaluated the impact of impoundment closure on GHG emissions for a hypothetical CCR impoundment in Tennessee. Under a closure scenario similar to Alternative B, EPRI found that the largest negative impacts are from increased NO_x emission and total energy used. The adverse impacts of Closure-by-Removal are a minimum of three-fold (for NO_x emissions) and a maximum of nine-fold (for GHG emissions) greater than the adverse impacts of Closure-in-Place (EPRI 2016b).

However, all these impacts are expected to be comparatively small, and temporary. Therefore, no changes to climate or significant increases in greenhouse gases are anticipated.

3.2.2.3 Alternative C – Closure-by-Removal

This alternative will use the same types of equipment and vehicles as Alternative B, only in greater quantities because of excavation and transport of CCR material to a permitted on-site or off-site landfill. Construction duration will be increased due to time needed to excavate CCR from impoundments. It is anticipated that grading efforts and borrow material transport will be similar to those efforts for Alternative B.

In the analysis of the closure of the hypothetical CCR impoundment in Tennessee EPRI also evaluated the potential effects of a closure scenario similar to Alternative C. EPRI found that this scenario results in significantly greater (minimum of three-fold for NO_x emissions) and a maximum of nine-fold (for GHG emissions) relative to the adverse impacts of in-place closure scenario (EPRI 2016c).

While this alternative will use more equipment for extended periods of time, associated impacts would be small and temporary. Therefore, no changes to climate or significant increases in greenhouse gases are anticipated.

3.3 Land Use

3.3.1 Affected Environment

Major land uses in the TVA region include forestry, agriculture, and urban/suburban/ industrial (U.S. Department of Agriculture [USDA] Natural Resources Conservation Service [NRCS] 2013). Of the non-Federal land area, about 12 percent is classified as developed and 88 percent as rural. Rural undeveloped lands include farmlands (28 percent of the rural area) and forestland (about 60 percent of the rural area). High rates of urban and suburban growth since 1982 have caused a large increase in developed lands within the TVA region. As a result, both cropland and pastureland have decreased in area since 1982 (USDA NRCS 2013).

Approximately 53 percent of the TVA region is forested (USFS 2014). Forestland is predicted to decrease between 1992 and 2020 in the majority of counties in the TVA region, with several counties in the vicinity of Memphis, Nashville, Huntsville, Chattanooga, Knoxville and the Tri-Cities area of Tennessee predicted to lose more than 10 percent of forest area (Wear et al. 2007). Most of the TVA region in Mississippi, as well as some rural parts of Tennessee and Kentucky are predicted to show little change or a small increase in forestland by 2020. About 97 percent of the forestland in the TVA region is classified as timberland (USFS 2014), forestland that is producing or capable of producing more than 20 cubic feet of merchantable wood per acre per year and is not withdrawn from timber harvesting by law.

Agriculture is a major land use and industry in the TVA region. In 2012, 41 percent, almost half of the farmland (47.0 percent), was classified in 2012 as cropland, which includes hay and short-rotation woody crops (USDA NRCS 2013). A quarter (24.6 percent) of the farmland was pasture and the remainder was woodland or devoted to other uses such as buildings and other farm infrastructure.

Land use associated with TVA coal-fired power plants is predominately industrial and classified as high intensity developed and developed open space. Other land cover types within the facilities include open water (impoundments) and barren land. Land surrounding the facilities that are also owned by TVA include a variety of undeveloped land uses with varying cover types, including forest, old fields, and ruderal/early-successional.

3.3.2 Environmental Consequences

3.3.2.1 Alternative A – No Action

Under Alternative A, TVA will not close any of the ash impoundments; therefore there would be no change in land use.

3.3.2.2 Alternative B – Closure-in-Place

Under Alternative B, ash impoundments will be closed in-place with an approved cover system (see Section 2.2) using borrow material from a previously permitted site. Since most of the lands within the project area are considered to be previously developed, the resulting land use of the site is consistent with the current use of the site. Closure of the ash impoundments would convert the existing impoundment from open water to an area with terrestrial land cover. However, this area would still be located within the TVA plant site and be used for industrial purposes; therefore closure of the ash impoundment would not result in the conversion of any land uses in the short term. Over a longer period, it is possible that closed impoundments could be put to other uses. If this is proposed, additional environmental reviews would be conducted. Additionally, borrow material would be obtained from a permitted site and, therefore, would have no secondary impacts on land use at that site. Therefore, no changes in land use would occur with this alternative.

Lands expected to be used for construction-related activities would be located within the existing TVA facility property. Short-term impacts would include the temporary conversion of the some vacant areas to laydown areas to support various construction-related activities (i.e., vehicle and equipment parking, storage, and construction administration). Upon completion of construction activities, it is anticipated that these areas would be restored to their previous condition and use.

3.3.2.3 Alternative C – Closure-by-Removal

Land use impacts associated with closure activities under Alternative C would be similar to those identified under Alternative B. As with Alternative B, construction activities associated with impoundment closure and the transport of CCR to either an on-site or off-site landfill would not impact the land use at the disposal site as this would be a previously permitted and developed facility. Additionally, borrow material would be obtained from a permitted site and, therefore, would have no secondary impacts on land use at that site. However, under this alternative there would be a broader range of future land use options at these sites as impoundments closed-by-removal would not be subject to future restrictions under the CCR Rule and these lands may be available for future industrial or non-industrial use. If this is proposed, additional environmental reviews would be conducted. However, all of the impoundments are located in areas developed for industrial use which does limit future non-industrial use options for these sites in the short term.

3.4 Prime Farmland

3.4.1 Affected Environment

Various state laws and local ordinances regulate land use, although a large portion of land in the TVA region is not subject to local zoning ordinances. The 1981 Farmland Protection Policy Act (7 CFR Part 658) requires all federal agencies to evaluate impacts to prime and unique farmland prior to permanently converting to land use incompatible with agriculture. Prime farmland soils have the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops. These characteristics allow prime farmland soils to produce the highest yields with minimal expenditure of energy and economic resources. In general, prime farmlands have an adequate and dependable water supply, a favorable temperature and growing season, acceptable acidity or alkalinity, acceptable salt and sodium content and few or no rocks. Prime farmland soils are permeable to water and air, not excessively erodible or saturated for extended period and are protected from frequent flooding.

Farms in the TVA region produce a large variety of products that varies across the region. While the proportion of land in farms is greatest in Mississippi, southern Kentucky, and central and western Tennessee, the highest farm income occurs in northern Alabama and Georgia (TVA 2015b). Region-wide, the major crop items by land area are forage crops (hay and crops grown for silage), soy, corn and cotton. The major farm commodities by sales are cattle and calves, poultry and eggs, grains and beans, cotton and nursery products (NRCS 2013).

Approximately 22 percent of the TVA region is classified as prime farmland (NRCS 2014). An additional 4 percent of the TVA region would be classified as prime farmland if drained or protected from flooding.

Lands owned by TVA as agent for the United States and operated in conjunction with coal-fired power plant sites are typically located on river terrace and floodplain landscapes along major river systems. Soils within such landscapes are often characterized as prime or unique farmland or farmland of statewide importance because of their improved fertility, drainage and capacity to support agricultural production. Although the soils within a given project area may have the physical characteristics of prime farmland, lands at sites that have been dedicated to industrial uses are removed from the prime farmland category under the Farmland Protection Policy Act and its implementing regulations.

3.4.2 Environmental Consequences

3.4.2.1 Alternative A – No Action

Since there would be no conversion of farmland to other uses, no impacts to prime farmland would occur.

3.4.2.2 Alternative B – Closure-in-Place

Actions associated with Alternative B may occur on project sites having soils with prime farmland characteristics. However the project area and laydown areas are typically highly disturbed features of plant sites and are not expected to exhibit prime farmland soil characteristics. Additionally, these areas are dedicated to industrial uses and are, therefore, exempt from regulation under the Farmland Protection Policy Act. Since borrow material used to close the impoundments would be obtained from a previously permitted site, there would be no additional secondary impact to lands with prime farmland soils.

3.4.2.3 Alternative C – Closure-by-Removal

Prime farmland impacts associated with closure activities under Alternative C would be the same as identified under Alternative B. The permitted disposal site would be dedicated to an industrial use and would not be considered prime farmland. Therefore, there would be no impacts to prime farmland resulting from implementation of Alternative C.

3.5 Geology and Seismology

3.5.1 Affected Environment

3.5.1.1 Regional Geology

The TVA region encompasses portions of five major physiographic provinces and six smaller physiographic sections (Figure 3-2) (Table 3-2) (Fenneman 1938, Miller 1974). Physiographic provinces and sections are areas of similar land surfaces resulting from similar geologic history.

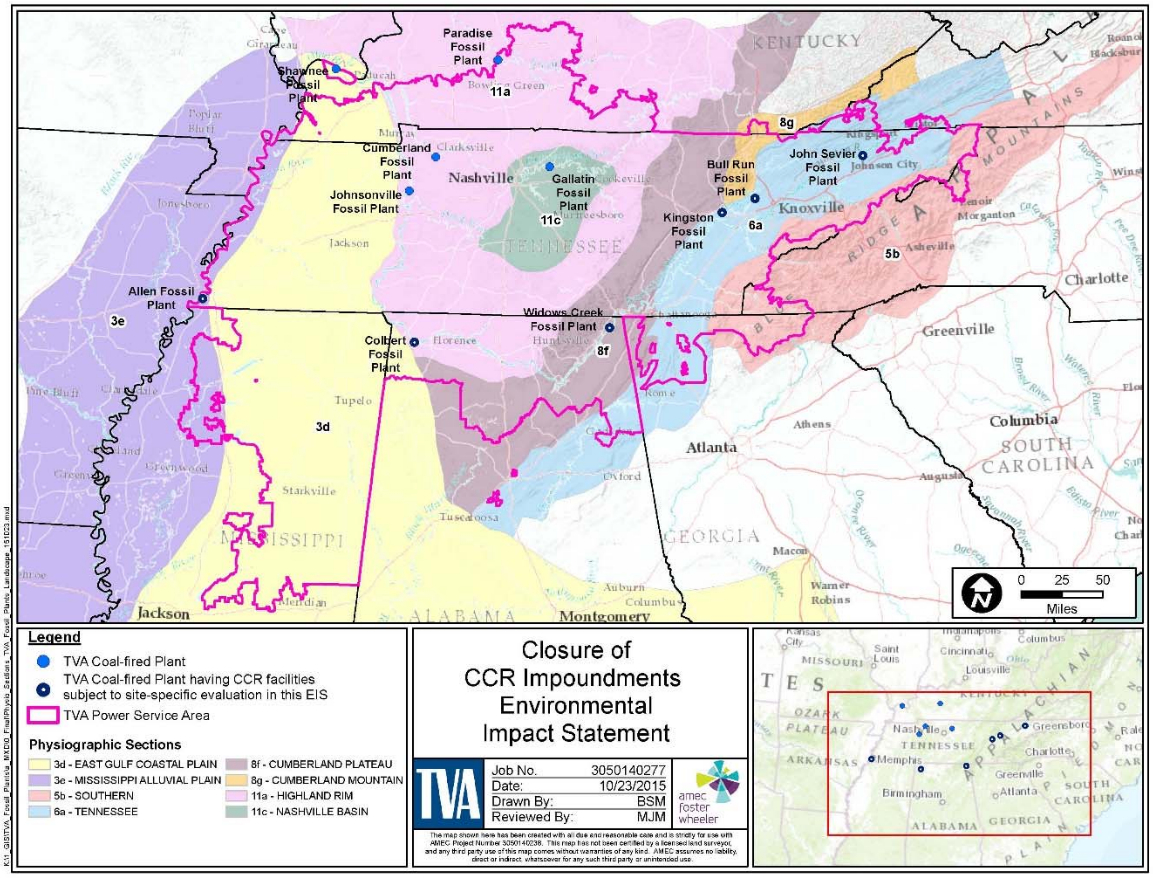


Figure 3-2. Physiographic Sections of the TVA Region (Adapted from Fenneman 1938)

Table 3-2. Summary of Geologic Characteristics at TVA Coal-Fired Power Plants

Plant Name	Physiographic Province	Bedrock	Landscape Position	Overlying Soils	Source
ALF	Coastal Plain	Alluvium	River Terrace	Alluvium	Stantec 2010b
BRF	Valley and Ridge	Chickamauga Formation	River Terrace	Alluvium	URS 2012
COF	Interior Low Plateaus	Tuscumbia Limestone	River Terrace	Alluvium	Stantec 2010a
CUF	Interior Low Plateaus	Various Cambrian to Mississippian strata: meteorite impact structure	River Terrace	Alluvium	TVA 2015
GAF	Interior Low Plateaus	Bigby-Cannon Limestone, Hermitage Formation, Carters limestone, Lebanon limestone	River Terrace	Alluvium	Dewberry Consultants 2013
KIF	Valley and Ridge	Conasauga Shale/Rome Formation	River Terrace	Alluvium	Benziger and Kellberg 1951, AECOM 2009
PAF	Interior Low Plateaus	Sturgis and Carbondale Formations	River Terrace	Alluvium	Stantec 2009c
JOF	Interior Low Plateaus	Chattanooga Shale, Camden Formation	River Terrace	Alluvium	Stantec 2010e
JSF	Valley and Ridge	Sevier Shale	River Terrace	Alluvium	Stantec 2010c
SHF	Coastal Plain	Clayton and McNairy Formations	River Terrace	Alluvium and loess	Stantec 2009a
WCF	Appalachian Plateau	Sequatchie Formation, Nashville Group and Stone River Group	River Terrace	Alluvium	TVA 2013

The easternmost part of the region is in the Blue Ridge physiographic province (Southern section), an area composed of the remnants of an ancient mountain chain. This province has the greatest variation in terrain in the TVA region. Terrain ranges from nearly level along floodplains at elevations of about 1,000 ft to rugged mountains that reach elevations of more than 6,000 ft. The rocks of the Blue Ridge have been subjected to much folding and faulting and are mostly shales, sandstones, conglomerates, and slate (sedimentary and metamorphic rocks of Precambrian and Cambrian age). No TVA coal-fired plants are located within this province.

The Valley and Ridge province (Tennessee section) is located west of the Blue Ridge province and includes lands containing the JSF, KIF and BRF plants. The province has complex folds and faults with alternating valleys and ridges trending northeast to southwest. Ridges have elevations of up to 3,000 ft and are generally capped by dolomites and resistant sandstones, while valleys have developed in more soluble limestones and dolomites. The dominant soils in this province are residual clays and silts derived from *in-situ* weathering. Karst features such as sinkholes and springs are numerous in the Valley and Ridge province. “Karst” refers to a type of topography that is formed when rocks with a high carbonate content, such as limestone and dolomite, are dissolved by groundwater to form sink holes, caves, springs and underground drainage systems.

The Appalachian Plateau province is an elevated area west of the Valley and Ridge province and is comprised of the extensive Cumberland Plateau section and the smaller Cumberland Mountain section. WCF is the only TVA coal-fired generating station in this province. The Cumberland Plateau rises about 1,000 to 1,500 ft above the adjacent provinces and is formed by layers of near horizontal Pennsylvanian sandstones, shales, conglomerates and coals, underlain by Mississippian and older shale and limestones. The sandstones are resistant to erosion and have produced a relatively flat landscape broken by stream valleys. Toward the northeast, the Cumberland Mountain section is more rugged due to extensive faulting and has several peaks that exceed 3,000 ft in elevation. The province has a long history of coal mining and encompasses the Appalachian coal field (U.S. Geological Survey [USGS] 1996).

Two sections of the Interior Low Plateau province occur in the TVA region. The Highland Rim section includes CUF, COF and PAF and is a plateau that occupies much of central Tennessee and parts of Kentucky and northern Alabama. The bedrock of the Highland Rim is Mississippian limestones, chert, shale, and sandstone. The terrain varies from hilly to rolling to extensive, relatively flat areas in the northwest and southeast. The southern end of the Illinois Basin coal region (USGS 1996) overlaps the Highland Rim in northwest Kentucky and includes part of the TVA region. The Nashville Basin (also known as the Central Basin) section includes the Gallatin plant and is an oval area in middle Tennessee with an elevation about 200 ft below the surrounding Highland Rim. The bedrock is limestones that are generally flat-lying. Soil cover is usually thin and surface streams cut into bedrock. Karst is well developed in parts of both the Highland Rim and the Nashville Basin.

The Coastal Plain province and the Mississippi Alluvial Plain section encompasses much of the western and southwestern TVA region and includes both SHF and ALF plants (see Figure 3-2). Most of the Coastal Plain portion of the TVA region is in the extensive East Gulf Coastal Plain section. The underlying geology is a mix of poorly consolidated gravels, sands, silts and clays. Soils are primarily of windblown and alluvial (deposited by water) origin, low to moderate fertility and easily eroded. The terrain varies from hilly to flat in broad river bottoms. The Mississippi Alluvial Plain section occupies the western edge of the TVA region and much of the historic floodplain of the Mississippi River. Soils are deep and often poorly drained. The New Madrid Seismic Zone, an area of large prehistoric and historic earthquakes, is in the northern portion of the section.

Geologic hazards within the TVA operating area specifically associated with subsurface materials may include acidic soils, liquefiable soils, landslides, expansive soils, radon gas accumulation, and karst development or propagation. Each physiographic region's specific conditions should be considered when evaluating the hazard risk at a particular facility.

3.5.1.2 Regional Seismic Setting

Section 257.63 of the CCR Rule defines a seismic impact zone as "an area having a 2 percent or greater probability that the maximum expected horizontal acceleration, expressed as a percentage of the earth's gravitational pull (g) will exceed 0.10 g in 50 years." Figure 3-3 is a graphical representation of the 2014 National Seismic Hazard Map for TVA region. As summarized in Table 3-3, each of TVA's coal-fired facilities are located in areas where the expected Peak Ground Acceleration (PGA) is of 0.1 g or greater.

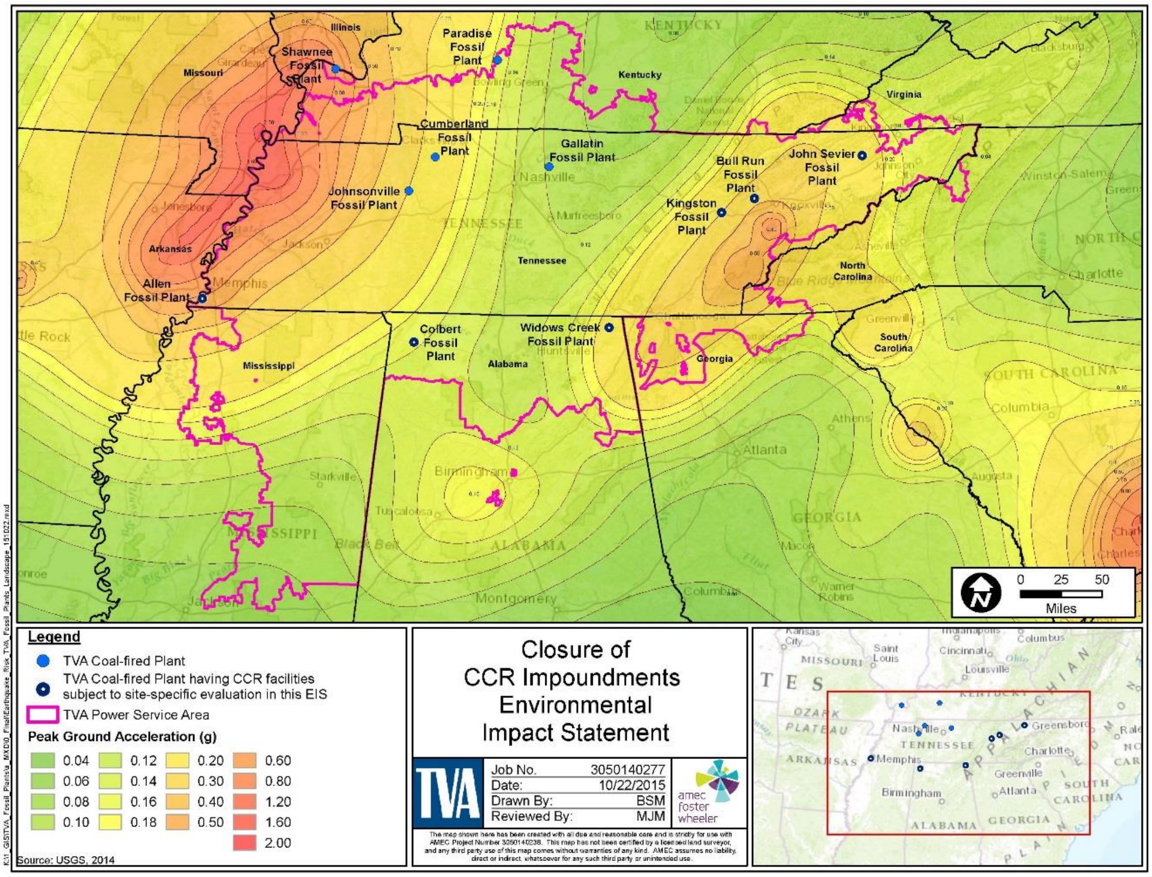


Figure 3-3. Seismic Peak Ground Acceleration Factors in the Vicinity of TVA Coal-Fired Plants

Table 3-3. PGA Values at TVA Coal-Fired Facilities

Plant	Peak Ground Acceleration (PGA)[1]	Seismic Zone
ALF	0.5 to 0.6	NMSZ
BRF	0.3 to 0.4	NMSZ, SASZ, SCSZ
COF	0.16 to 0.18	NMSZ, SASZ, SCSZ
CUF	0.2 to 0.3	NMSZ
GAF	0.1 to 0.12	NMSZ, SASZ
JOF	0.2 to 0.3	NMSZ
JSF	0.2 to 0.3	NMSZ, SASZ, SCSZ
KIF	0.3 to 0.4	NMSZ, SASZ, SCSZ
PAF	0.16 to 0.18	NMSZ, WVSZ
SHF	0.6 to 0.8	NMSZ
WCF	0.2 to 0.3	NMSZ, SASZ, SCSZ

Seismic zones of influence from Stantec 2009a,b,e
[1]Expressed as a fraction of standard gravity (g).
NMSZ = New Madrid Seismic Zone SCSZ = Sandhill Corner Shear Zone
SASZ = South American Shear Zone WVSZ = Wabash Valley Seismic Zone

ALF, COF, CUF, JOF, SHF and PAF are expected to experience from 0.14 g to 0.8 g PGA, and these plants fall within the influence of the New Madrid Seismic Zone (NMSZ). GAF is in a comparatively quiet seismic zone between the NMSZ and the East Tennessee Seismic Zone (ETSZ), but is nevertheless expected to undergo from 0.1 g to 0.14 g PGA, as projected by the USGS data. BRF, KIF, JSF and WCF are situated in an area influenced by the ETSZ, with projections of potential PGA values ranging from 0.2 g to 0.4 g.

The PGA values for the 2014 USGS map are adjusted based on site classification (hard rock, rock, dense soil/hard rock, etc.).

For sites that lie within zones that exceed 0.1 g, or for which adjusted values based on site conditions exceed 0.1 g, additional analysis is required to demonstrate that all structural components are designed to withstand seismic events. Site-specific data that are typically gathered to support additional analysis (if required) include geotechnical data that characterizes subsurface materials at the site (e.g., stratigraphic information from borings, shear-wave and compressional velocity data, and lithologic) and geophysical data from nearby deep wells.

An integral component of the seismic setting for a given facility must consider the presence and characteristics of faults. The regulatory requirement regarding faulting specifies that a setback distance of 200 ft is required from the outermost damage zone of a modern era (Holocene Era) fault (EPA 2015). A fault means "a fracture or a zone of fractures in any material along which strata on one side have been displaced with respect to that on the other side." This definition encompasses both tectonic faults (i.e., formed as a result of deep-seated, crustal scale tectonic processes) and associated secondary faulting, and non-tectonic faults (i.e., those formed as a result of shallow crustal or surficial processes). Non-tectonic faults, which are driven predominantly by gravitational forces, include those produced by slope failure processes (e.g., landslides), dissolution phenomena (e.g., karst collapse), evaporite migration (e.g., salt domes and salt flowage), volcanism (e.g., dike-emplacement and caldera collapse), sediment compaction (e.g., growth faults, subsidence) and unloading phenomena (e.g., pop-ups). Hanson et al. (1999) provides detailed discussions of the characteristics of both tectonic and non-tectonic faults and criteria to differentiate tectonic and non-tectonic surface deformation and to identify active blind faults.

An understanding of the general geologic and tectonic setting of the site, both at regional as well as local scale, provides important contextual information to evaluate the potential for Holocene faulting at sites subject to ash impoundment closure. Key data sources important in evaluating the complexity of the surface and subsurface conditions may include:

- Geologic maps showing known or inferred faults,
- The Quaternary fault and fold database maintained by the USGS,
- Site-specific geotechnical reports, and
- Web-based searches to identify recent or ongoing research related to active faulting in the vicinity of the site.

3.5.1.3 Static Stability of Ash Impoundment Berms

The static stability of all existing or new impoundment structures is an important consideration to ensure that berms have integrity and represent a low risk of failure. Potential instability under static conditions has important implications on the selection of the appropriate alternative for impoundment closure and the identification of mitigative measures to enhance static stability.

Typical considerations based on the CCR Rule (EPA 2015, Section 257.64, Unstable Areas) include site soil conditions that may result in significant differential settling. Conditions may also include local geologic or geomorphic features in addition to human made features or events. TVA has evaluated all of its ash impoundments within its system and they are static stable under the designed loads.

3.5.2 Environmental Consequences

3.5.2.1 Alternative A – No Action Alternative

Under the No Action Alternative, no additional CCR will be managed in these impoundments except for those that would be needed to temporarily manage CCR during the transition to dry ash storage. No closure activities (i.e., no dewatering of surface water or cover system construction) would occur under the No Action Alternative. However, the impoundments will continue to receive storm water and other process wastewaters. TVA will continue safety inspections of berms to maintain stability and all impoundments will be subject to continued care and maintenance activities.

In cooperation with EPA, TVA has evaluated the static stability of all impoundments at existing coal-fired power plants and has confirmed their stability under existing conditions (https://www.epa.gov/coalash/effort-assess-coal-combustion-residuals-ccr-disposal-units). TVA is also currently investigating seismic stability for all of its ash impoundments. Any identified deficiencies or unacceptable seismic risks at existing ash impoundments will be addressed through appropriate mitigative measures that may include rock toe, soil berm construction, and concrete/steel pile installation, or other measures, as appropriate.

Due to the eventual elimination of sluicing of CCR materials as TVA converts from wet CCR management systems to dry systems, the hydraulic influx to the subsurface beneath the impoundments would be reduced. Consequently, the static stability of the impoundments would remain the same or be slightly improved. Similarly, the seismic factor of safety would remain the same or be slightly higher due to the suspension of the hydraulic influx of materials into the existing ponds.

Consequently, this alternative is expected to result in a marginal improvement of both static and seismic safety factors associated with the existing ash impoundments relative to the operational condition in which ash impoundments received CCR materials.

3.5.2.2 Alternative B – Closure-in-Place

Structural integrity criteria for existing CCR surface impoundments (EPA 2015, Section 257.73(e) of the Rule), establishes guidelines for conducting initial and periodic static, seismic, and liquefaction safety factor assessments. If an impoundment can be configured to meet the liquefaction safety factor requirements by discontinuing CCR placement, dewatering of surface water and covering with a relatively impermeable barrier, geology in the vicinity of the impoundment would not be affected.

In cooperation with EPA, TVA has evaluated the static stability of all impoundments at existing coal-fired facilities. Where necessary, TVA has implemented recommendations to improve stability, and as a result, dike stability for all impoundments meets minimum safety factors under static conditions (https://www.epa.gov/coalash/effort-assess-coal-combustion-residuals-ccr-disposal-units). TVA is also currently investigating seismic stability for all of its ash impoundments. Any identified deficiencies or unacceptable seismic risks at existing ash impoundments will be addressed through appropriate mitigative measures that may include rock toe, soil berm construction, and concrete/steel pile installation, or other measures, as appropriate.

Under this alternative, impoundments will be dewatered to allow for consolidation of CCR materials and the installation of a low permeability closure system. As indicated in the CCR Rule (EPA 2015), dewatered CCR surface impoundments will no longer be subjected to hydraulic head so the risk of releases, including the risk that CCRs will leach into the groundwater, would be no greater than those from CCR landfills. Therefore, it is expected that both the static and seismic factor of safety would be increased for all dewatered impoundments under this alternative.

Impacts of this alternative associated with geological and seismic considerations are therefore positive relative to the No Action Alternative.

3.5.2.3 Alternative C – Closure-by-Removal

Under this alternative, impoundments will be dewatered, and all CCR materials will be excavated and transported to existing permitted disposal facilities. Existing berms will either be graded and removed or abandoned. However, completing these actions could take years, depending on the volume of CCR at a site.

No impacts or risks of failure would occur at the removal site from geological and seismic considerations with this alternative.

3.6 Groundwater

3.6.1 Affected Environment

3.6.1.1 Regulatory Framework for Groundwater

The Safe Drinking Water Act of 1974 established the sole source aquifer protection program which regulates certain activities in areas where the aquifer (water-bearing geologic formations) provides at least half of the drinking water consumed in the overlying area. No sole source aquifers exist in the TVA region (EPA 2015a).

This act also established the Wellhead Protection Program, a pollution prevention and management program implemented by each state, used to protect underground sources of drinking water and the Underground Injection Control Program to protect underground sources of drinking water from contamination by fluids injected into wells. Several other environmental laws contain provisions aimed at protecting groundwater, including Resource Conservation and Recovery Act (RCRA), the Comprehensive Environmental Response, Compensation and Liability Act and the Federal Insecticide, Fungicide, and Rodenticide Act.

The CCR Rule also establishes groundwater protection requirements. The final provisions of 40 CFR §257.60 require owners or operators of an active CCR surface impoundment to demonstrate that the unit meets the minimum requirements for placement above the “uppermost aquifer” no later than October 17, 2018. This time frame was set to allow owners and operators time to adequately study and characterize seasonal variations in the elevation of the top of the uppermost aquifer. Owners and operators must initiate closure of those units that fail to make this demonstration no later than six months from this determination, except in limited circumstances as discussed in the rule.

For clarity, EPA revised the definition of "uppermost aquifer" to specify that the measurement of the upper limit of the aquifer must be made at a point nearest to the natural ground surface to which the aquifer rises during the wet season (EPA 2015c). As specified under 40 CFR §257.60(a), EPA is requiring owners or operators of active impoundments to demonstrate that there will not be an intermittent, recurring, or sustained hydraulic connection between any portion of the base of the impoundment unit and the uppermost aquifer due to normal fluctuations in groundwater elevations (including groundwater elevations during the wet season).

What is the "Uppermost Aquifer"?

EPA defined this term to mean "the geologic formation nearest the natural ground surface that is an aquifer, as well as lower aquifers that are hydraulically interconnected with this aquifer within the facility's property boundary." (EPA 2015c, p. 21471)

The term "potentiometric surface" is often used to describe the elevation of the groundwater table. However, local site-specific hydrogeologic conditions or other factors within the aquifer system may cause the potentiometric surface to vary.

The CCR Rule allows for the differentiation of the uppermost aquifer from usable groundwater. At 40 CFR §257.60(a), the term uppermost aquifer is defined as including a shallow, deep, perched, confined or unconfined aquifer, provided it yields usable water, which may include considerations of water quality and yield. TVA will take into account state-specific interpretations of usable groundwater as it evaluates the depth to the uppermost aquifer at each of its sites.

For ash impoundments that actively receive CCR materials via sluicing, storm water and other process wastewaters, it may be difficult to determine the natural gradient of the uppermost aquifer as groundwater mounding beneath the ash impoundments may be encountered.

What is "Groundwater Mounding"?

Groundwater mounding is the local rise of the water table above its natural level resulting from a localized hydrologic input above the natural groundwater level. The shape and height of the mound depend on several factors including the recharge rate, hydraulic conductivity and thickness of the aquifer in the area.

3.6.1.2 Regional Aquifers

Three basic types of aquifers occur in the TVA region:

- Unconsolidated sedimentary sand
- Carbonate rocks
- Fractured non-carbonate rocks

Unconsolidated sedimentary sand formations, composed primarily of sand with lesser amounts of gravel, clay and silt, constitute some of the most productive aquifers. Groundwater movement in sand aquifers occurs through the pore spaces between sediment particles.

Carbonate rocks are another important class of aquifers. Carbonate rocks, such as limestone and dolomite, contain a high percentage of carbonate minerals (e.g., calcite) in the rock matrix. Carbonate rocks in some parts of the region readily transmit groundwater through enlarged fractures (cracks) and cavities created by dissolution of carbonate minerals by acidic groundwater.

Fractured non-carbonate rocks represent the third type of aquifer found in the region. These aquifers include sedimentary and metamorphic rocks (e.g., sandstone and granite gneiss), which transmit groundwater through fractures and openings in the bedrock.

In the TVA region, groundwater derived from carbonate rocks of the Valley and Ridge, Highland Rim and Nashville Basin is generally slightly alkaline and high in dissolved solids and hardness. Groundwater from mainly noncarbonated rocks of the Blue Ridge, Appalachian Plateaus and Coastal Plain typically exhibits lower concentrations of dissolved solids compared to carbonate rocks. However, sandstones interbedded with pyritic shales often produce acidic groundwater high in dissolved solids, iron and hydrogen sulfide. These conditions are commonly found on the Appalachian Plateaus and in some parts of the Highland Rim and Valley and Ridge (Zurawski 1978). The chemical quality of most groundwater in the region is within health-based limits established by the EPA for drinking water.

For the purpose of the programmatic approach, the assumption can be made that groundwater flow direction is reflective of site topography and local geology and is anticipated to discharge to the adjacent river systems as described in the site-specific reports.

3.6.1.3 Groundwater Use

Groundwater data are compiled by the USGS and cooperating state agencies in connection with the national public water use inventory conducted every 5 years (Bohac and Bowen 2012). The largest use of groundwater is for public water supply. Almost all of the water used for domestic supply and 66 percent of water used for irrigation in the TVA region is groundwater. Groundwater is also used for industrial and mining purposes. The use of groundwater to meet public water supply needs varies across the TVA region and is the greatest in West Tennessee (TVA 2015b).

Six major aquifers occur in the TVA region (Table 3-4). These aquifers generally align with the major physiographic divisions of the region. The aquifers include (in order of increasing geologic age):

- Quaternary age alluvium occupying the floodplains of major rivers, notably the Mississippi River.
- Tertiary and Cretaceous age sand aquifers of the Coastal Plain Province.
- Pennsylvanian sandstone units found mainly in the Cumberland Plateau section Carbonate rocks of Mississippian, Silurian and Devonian age of the Highland Rim section.
- Ordovician age carbonate rocks of the Nashville Basin section.
- Cambrian-Ordovician age carbonate rocks within the Valley and Ridge Province.
- Cambrian-Precambrian metamorphic and igneous crystalline rocks of the Blue Ridge Province.

Table 3-4. Aquifer, Well and Water Quality Characteristics in the TVA Region

Aquifer Description	Well Characteristics (common range, maximum)		Water Quality Characteristics
	Depth (ft)	Yield (gpm)	
Quaternary alluvium: Sand, gravel and clay. Unconfined.	10 to 75, 100	20 to 50, 1,500	High iron concentrations in some areas.
Tertiary sand: Multi-aquifer unit of sand, clay, silt and some gravel and lignite. Confined; unconfined in the outcrop area.	100 to 1,300, 1,500	200 to 1,000, 2,000	Problems with high iron concentrations in some places.
Cretaceous sand: Multi-aquifer unit of interbedded sand, marl and gravel. Confined; unconfined in the outcrop area.	100 to 1,500, 2,500	50 to 500, 1,000	High iron concentrations in some areas.
Pennsylvanian sandstone: Multi-aquifer unit, primarily sandstone and conglomerate, interbedded shale and some coal. Unconfined near land surface, confined at depth.	100 to 200, 250	5 to 50, 200	High iron concentrations are a problem; high dissolved solids, sulfide or sulfate are problems in some areas.
Mississippian carbonate rock: Multi-aquifer unit of limestone, dolomite and some shale. Water occurs in solution and bedding-plan openings. Unconfined or partly confined near land surface; may be confined at depth.	50 to 200, 250	5 to 50, 400	Generally hard; high iron, sulfide, or sulfate concentrations are a problem in some areas.
Ordovician carbonate rock: Multi-aquifer unit of limestone, dolomite and shale. Partly confined to unconfined near land surface.	50 to 150, 200	5 to 20, 300	Generally hard; some high sulfide or sulfate concentrations in places.

Approximately 60 percent of all groundwater withdrawals in 2010 were supplied by sand aquifers in West Tennessee and North Mississippi. Shelby County, Tennessee (Memphis, Tennessee) accounted for about 38 percent of the total public water supply regional pumping. The dominance of groundwater use over surface water in the western portion of the TVA region is due to the availability of prolific aquifers and the absence of adequate water resources in some areas.

This variation of groundwater use across the region is the result of several factors including groundwater availability and quality, surface water availability and quality, determination of which water source can be developed most economically and public water demand, which is largely a function of population. There are numerous sparsely populated, rural counties in the region with no public water systems. Residents in these areas are self-served by individual wells or springs.

In 2010, estimated average daily water withdrawals in the TVA service area totaled 16,395 million gallons per day (MGD) (Bohac and Bowen 2012). About 5.2 percent of these water withdrawals was groundwater and the remainder was surface water. Since 1950, groundwater and surface water withdrawals by public supply systems in Tennessee have greatly increased. The magnitude and rate of growth of withdrawals of surface water has exceeded groundwater. The annual increase in groundwater withdrawals for public supply in Tennessee averaged about 2.5 percent. Although these data are for Tennessee public water supplies, they are representative of the overall growth in water use for the TVA region (TVA 2015b).

The quality of groundwater in the TVA region largely depends on the chemical composition of the aquifer in which the water occurs (Table 3-4). The chemical quality of most groundwater in the region is within health-based limits established by the EPA for drinking water. Pathogenic microorganisms are generally absent, except in areas underlain by shallow carbonate aquifers susceptible to contamination by direct recharge through open sinkholes (Zurawski 1978).

Groundwater use in the vicinity of TVA coal-fired power plants is variable and generally limited to private water supply wells.

3.6.1.4 Conceptual Site Model

The power plants at which ash impoundments are located were constructed adjacent to large streams and reservoirs that provided a source of cooling water for coal-fired power generating facilities. In general, groundwater in the vicinity of TVA's ash impoundments is both influenced by the surrounding upland, local geological conditions and the hydrologic influence of the receiving waterbody.

Depths to the uppermost aquifer will be investigated by TVA at ash impoundments in accordance with the requirements of the CCR Rule.

The potential groundwater mounding under the unclosed impoundments as defined above may be expected to remain somewhat elevated even for an inactive impoundment (i.e., no additional CCR material inputs), due to the continued addition of storm water and other process wastewaters into the impoundment.

Because of this continued input of water to the impoundment, the quantity of water seeping vertically ("leachate" water) downward beneath the impoundment, subsurface flow may also be considered constant (EPRI 2016c). The extent to which such leaching may occur and how it may interact with the uppermost aquifer and receiving surface waters is dependent upon site-specific conditions such as soil permeability, water depth within the impoundment, volume of CCR materials and their composition and depth to the uppermost aquifer, etc.

In general, it is expected that for the majority of TVA ash impoundments, the groundwater flow direction is likely reflective of topography and local geology and would be toward the receiving water body. Actual groundwater levels and directional flow are currently under further investigation by TVA.

3.6.2 Environmental Consequences

3.6.2.1 Alternative A – No Action

Groundwater data from monitoring wells at TVA plants indicate that CCR constituents do impact groundwater at some locations on TVA sites. Typically these elevated constituents do not exceed Maximum Contaminant Levels (MCL) that EPA has set for finished drinking water to protect public health and that states and EPA uses to judge the quality of groundwater. In most cases, this impacted groundwater does not migrate off TVA property before the groundwater becomes assimilated with surface water. The extent to which this contamination migrates off TVA property, if it does, cannot be readily determined at every site. However, TVA has decades of monitoring data for aquatic species and surface water systems in the water bodies adjacent to its plants, which is the direct receptor for groundwater in most cases. These data do not show impacts. This is consistent with the studies, research, and analyses that TVA, TDEC, EPA, universities and others supervised, conducted, or reviewed to ascertain the health and environmental risks associated with the Kingston ash spill in December 2008. For sites where CCR constituents may impact groundwater off TVA property above water quality standards, the CCR Rule and other regulatory programs would require TVA to initiate corrective action to remedy such contamination.

Under Alternative A, impoundments will remain operational but will receive no new CCR except for those plants that would need to temporarily manage CCR during the transition to dry ash storage. No closure activities (e.g., dewatering of surface water or cover system construction) will occur. The impoundments may, however, continue to receive process water and storm water runoff from the plant site. They eventually would not receive any additional CCR materials.

For the No Action Alternative, it is anticipated that due to the eventual cessation of sluicing activities, there would be some reduction of hydraulic inputs to the subsurface beneath the impoundments. It is anticipated that some reduction of any groundwater mounding would be correspondingly reduced. The reduction of a groundwater mound would conceivably lower the hydraulic head pressures driving a downward gradient of water and associated constituents. Accordingly, this alternative potentially would reduce any ongoing movement of constituents to groundwater or surface water.

3.6.2.2 Alternative B – Closure-in-Place

Under Alternative B, the dewatering and subsequent grading and stabilization of the CCR materials in the impoundment provides an immediate reduction in the potential influx of leachate water moving from the impoundment through the subsurface vadose zone. The cover system with an approved closure system (see Section 2.2) over the compacted CCR not only prevents additional infiltration from precipitation, but also would facilitate management of storm water runoff. Elimination of the hydraulic inputs to the impoundment reduces the potential for migration of leachate to groundwater beneath the impoundment and to receiving surface waters.

Closure-in-Place activities will reduce risk to groundwater and improve water quality in comparison to the No Action Alternative. Even in cases where the elevation of the upper most aquifer is unknown and CCR intersects with groundwater, Alternative B provides the following benefits:

1. Elimination of process water reduces the hydraulic head, therefore reducing the pressure of water forcing ash contaminants into groundwater.
2. Installing a cover system improves groundwater quality by virtually eliminating rainfall infiltration through the impoundment, and reducing downward migration of contaminants into groundwater.
3. NPDES outfall water quality improves as contact with ash would cease following installation of a cover system; and the receiving river water quality would also improve.
4. Natural groundwater quality would eventually be reestablished.

TVA's on-going monitoring of similar ash management facilities at its plants also point to the effectiveness for those benefits mentioned above. In the case of Cumberland, when sluicing of CCRs changed from an open impoundment to sluicing in geomembrane-lined channels, groundwater parameters changed from occasionally exceeding some MCLs to below the MCL. This has been stable for approximately 3 years. Closure-in-Place with a geomembrane is considered to be one of the best options for improving groundwater quality beneath or downgradient of an ash impoundment or landfill.

Groundwater analytical data from the most recent sampling events from similar facilities at sites evaluated in Part II of this PEIS are available on TVA's project Web site (https://www.tva.gov/Environment/Environmental-Stewardship/Environmental-Reviews/Closure-of-Coal-Combustion-Residual-Impoundments).

Additional post-closure requirements will be required to maintain compliance with the CCR Rule. TVA will implement supplemental mitigative measures that include monitoring, assessment and corrective action programs as mandated by state requirements (see Section 2.2) and the CCR Rule. Such measures will further minimize risk from closed impoundments.

A recent study conducted by EPRI has evaluated the impact of impoundment closure on groundwater constituents of concern (COC) for a hypothetical CCR impoundment in Tennessee. EPRI analyzed two scenarios: one in which all CCR materials were located above the water table and a second in which the groundwater intersected the CCR materials. Under both closure scenarios, EPRI found that the in-place closure scenario has more beneficial impact on the groundwater pathway relative to the baseline scenario than Closure-by-Removal because a cap can be constructed more quickly than CCR can be excavated. During excavation, precipitation continues to infiltrate through the CCR into the underlying groundwater, whereas, after the cap has been constructed, infiltration of precipitation is greatly reduced relative to baseline. Under the non-intersecting scenario, the beneficial impacts of Closure-in-Place and Closure-by-Removal relative to the baseline scenario are greater for high mobility constituents [e.g., B, Mo, and Se(VI), about 15- to 35-fold more beneficial than baseline] than for low mobility constituents [e.g., As(V), about two-fold more beneficial than baseline]. Closure-in-Place has greater beneficial impact on the groundwater pathway than Closure-by-Removal for the high mobility constituents. This is because high mobility constituents respond more quickly to the beneficial actions undertaken during closure (EPRI 2016b).

By comparison, under the intersecting water table scenario, beneficial impacts of Closure-in-Place and Closure-by-Removal relative to the baseline scenario are greater for high mobility constituents (about 2- to 20- fold more beneficial than baseline) than for low mobility constituents (about 2-fold more beneficial than baseline). Closure-by-Removal has more beneficial impact on the groundwater pathway than Closure-in-Place. This is because the saturated CCR continues to act as a source to groundwater even after the cap has been constructed for the Closure-in-Place closure option (EPRI 2016b).

These findings are consistent with analyses that supported EPA's CCR Rule.

Considering the beneficial effects of removal of the hydraulic head from ash impoundments, the associated reduction in potential subsurface discharges from ash impoundments and the commitment to supplemental mitigative measures such as groundwater monitoring, as appropriate, the impacts of this alternative on groundwater would be beneficial and considerable, as compared to the No Action Alternative.

3.6.2.3 Alternative C – Closure-By-Removal

Alternative C includes dewatering of surface water, excavating and transporting of all CCR materials to an approved on-site or off-site disposal facility. As such, this alternative entails removing the potential source of COCs from the site.

As EPA identified in the CCR Rule, removal of the CCR materials will reduce groundwater risk in the impoundment area. The CCR being removed from an impoundment will be dried to an acceptable level prior to being loaded for off-site transport. The permitted landfills that receive CCR will be lined and have groundwater monitoring systems as required by their respective permits to minimize potential impacts to groundwater.

Groundwater benefits associated with this alternative include eliminating the potential interaction between the CCR and the uppermost aquifer. It will eliminate new groundwater risk from groundwater COCs migrating off-site.

In the analysis of the closure of the hypothetical CCR impoundment in Tennessee, EPRI also evaluated the potential effects of a closure scenario similar to Alternative C. EPRI found that this scenario has an incrementally more positive impact compared to baseline relative to the scenario similar to Alternative B (i.e., concentrations of all COCs are less than 100 percent of baseline), ranging from a 2 to 20-fold increase in positive impact for excavate and redispose (i.e., reduction in concentration). As described above, the Closure-by-Removal alternative has more beneficial impact on the groundwater pathway than Closure-in-Place (EPRI 2016b). However, for facilities having larger volumes of CCR, the extended duration of removal (up to 170 years) would effectively diminish benefits to groundwater quality improvement relative to Alternative B.

No federal post-closure care measures are required if an ash impoundment is closed under Alternative C – Closure-by-Removal. State requirements for post-closure certification will be implemented as needed.

Depending on the volume of CCR to be removed, the impacts of this alternative on groundwater are beneficial and could be considerable, as it eliminates subsurface discharges and eliminates COCs from the former CCR impoundment when the removal project is completed. However, until the project is completed, which could take up to 170 years, the benefit to groundwater quality is expected to be less than the Closure-in-Place Alternative because water infiltration through the CCR would essentially be stopped much earlier when the final cover system is in place.

3.7 Surface Water

3.7.1 Affected Environment

The affected environment that would possibly be impacted by TVA’s impoundment closures, as regulated by the CCR Rule, would span several watersheds including the Tennessee River, the Cumberland River, the Ohio River, the Green River and the Mississippi River.

3.7.1.1 Affected Watersheds

3.7.1.1.1 Tennessee River

The Tennessee River watershed covers approximately 41,000 square miles (mi^2). This area includes 129 counties within much of Tennessee and parts of Alabama, Kentucky, Georgia, Mississippi, North Carolina and Virginia. The larger TVA power service area (PSA) covers 80,000 mi^2 and includes 202 counties in the same seven states (TVA 2015b).

The Tennessee River watershed begins with headwaters in the mountains of western Virginia and North Carolina, eastern Tennessee and northern Georgia. At Knoxville, Tennessee, the Holston and French Broad rivers join to form the Tennessee River, which then flows southwest through the state—gaining water from three other large tributaries: the Little Tennessee, Clinch and Hiwassee rivers. The Tennessee River eventually flows into Alabama, where it picks up another large tributary, the Elk River. At the northeast corner of Mississippi, the river turns north and re-crosses Tennessee—picking up the Duck River, and continues to Paducah, Kentucky where it enters the Ohio River.

The total river elevation change from the maximum reservoir surface elevation at Watauga Dam (highest elevation on the system) to the minimum tailwater surface elevation at Kentucky Dam (lowest elevation on the system) is 1,675 ft in 828.6 river miles. The Tennessee River, the main river, has a fall of 515 ft in 579.9 river miles from the top of the Fort Loudoun Dam gates to the minimum tailwater elevation at Kentucky Dam. The mainstem fall is gradual except in the Muscle Shoals area of Alabama, where a drop of 100 ft is found in a stretch of less than 20 mi (TVA 1990).

The Tennessee River basin contains all but one of TVA's dams and covers most of the TVA region. The entire length of the Tennessee River is regulated by a series of nine locks and dams built mostly in the 1930s and 1940s that allow navigation to Knoxville. Virtually all the major tributaries have at least one dam, creating 14 multi-purpose storage reservoirs and seven single-purpose power reservoirs. This system of dams and their operation is the most significant factor affecting water quality and aquatic habitats in the Tennessee River and its major tributaries.

Major water quality concerns within the Tennessee River drainage basin include point and non-point sources of pollution that degrade water quality at several locations on mainstream reservoirs and tributary rivers and reservoirs. Toxic substances have also been found in sediment and fish in reservoirs that otherwise have good water quality. Other water quality concerns include occurrences of low dissolved oxygen levels downstream of dams, which stresses aquatic life and limits the ability of the water to assimilate wastes.

The principal water quality concerns in TVA reservoirs and watersheds on which coal-fired power plants are located are summarized in Table 3-5. This summary reflects the current understanding of the causes and effects of point and non-point sources of pollution on water quality (TVA 2015).

Point and non-point sources of pollution within TVA reservoirs and watersheds include:

- Heat-releases – Utility and industrial plants may release water into streams or lakes that has been heated above the ambient temperature of the body of water.
- Wastewater discharges – Sewage treatment systems, utilities, industry and others dispose of waste into streams and lakes.
- Runoff from agriculture, urban uses and mined land.
- Air pollution – Pollutant concentrations in the air can affect surface waters through rain and deposition.

Table 3-5. Principal Water Quality Concerns in TVA Reservoirs

Plant Name	TVA Reservoirs with Coal-Fired Plants	Uses Affected				Source	
		Aquatic Life	Fish Consumption	Recreation	Water Supply	Point	Non-Point
ALF	McKeller Lake/Mississippi River	Low Dissolved Oxygen	Chlordane	E. Coli		X	X
BRF	Clinch River, Melton Hill Reservoir		Polychlorinated Biphenyl (PCB)				X
COF	Tennessee River, Pickwick Reservoir				Algae		X
CUF	Cumberland River, Barkley Reservoir	Thermal	Mercury			X	X
GAF	Cumberland River, Old Hickory Reservoir			E. Coli		X	X
JOF	Tennessee River, Kentucky Reservoir			Aquatic Plants		X	
JSF	Holston River, Ft. Loudoun Reservoir		PCBs	Bacteria		X	X
KIF	Emory River, Watts Bar Reservoir	Low Dissolved Oxygen	PCBs			X	X
PAF	Green River		Mercury	Fecal Coliform		X	X
SHF	Ohio River		PCBs, Mercury and dioxin	E Coli		X	X
WCF	Tennessee River, Guntersville Reservoir			Aquatic Plants			X

Several of the waters discussed above and in Table 3-5 are listed as impaired in 303(d) lists published by their respective state's environmental agencies. However, those 303(d) listings are primarily for pollutants such as mercury from atmospheric deposition or toxic organics in contaminated sediments, not for constituents normally found in CCRs.

3.7.1.1.2 Cumberland River

The Cumberland River and its tributaries generally exhibit moderate to high concentrations of calcium and magnesium and a slightly alkaline pH because much of the basin is comprised of limestone and dolomitic bedrock. Low concentrations of dissolved solids in the upper Cumberland contrast with the generally higher concentrations of dissolved solids in the lower Cumberland watershed, due in part to a change in geology in the Nashville area. The area east of Nashville is underlain by Ordovician Age limestones and shales, which is more resistant and less soluble than the Mississippian Age limestones, found in the area west of Nashville. The first is more resistant and less soluble than the latter.

Generally, the mainstream Cumberland River exhibits lower suspended solids concentrations than its tributaries. The higher values in the lower Cumberland watershed tributaries are caused in part by differences in topography, land use, soil type and geology.

In general, water quality of the mainstem Cumberland River in the vicinity of GAF and CUF is good.

3.7.1.1.3 Ohio River

The lower Ohio River receives drainage from an extensive 204,000 mi^2 watershed that reaches into 13 states, encompassing much of the east central United States. The upper Ohio Valley is highly industrialized, and the sources of pollution from industrial and municipal sources are many and varied. Non-point source pollution, primarily from agricultural runoff and mining, also contributes to the sediment and pollution load. A series of locks and dams allows commercial navigation along the entire 981-mi length of the river from the Mississippi River to Pittsburgh, Pennsylvania. About 136 million metric tons of freight are transported on the Ohio River annually. TVA's SHF is located on the Ohio River at approximately Ohio River Mile 946 just downstream from Paducah, Kentucky.

The Ohio River supplies more than one-half of all surface water withdrawn in the state of Kentucky. It forms the northern boundary of Kentucky for a distance of 664 stream mi. The river system drains an area of 33,300 mi^2 in Kentucky (about 82 percent of the state). Identifying sources of contamination in such a large basin is difficult. The Ohio River Valley Water Sanitation Commission is responsible for evaluating water quality in the main stream.

Fish consumption advisories have been placed on paddlefish, paddlefish eggs (harvested for caviar), channel catfish, carp and white bass along the entire length of the Ohio River bordering Kentucky because of chlordane (a pesticide) and PCB contamination. Little Raven Creek, a tributary below Paducah, has a consumption advisory for all fish species due to PCB contamination. Also, the West Kentucky Wildlife Management Area Lakes, which are oxbow and overflow lakes that drain into the Ohio River below Paducah, have a consumption advisory for largemouth bass because of mercury contamination.

3.7.1.1.4 Green River

The Green River Basin is located in south central Kentucky and north central Tennessee. The drainage area is 9,273 mi^2, of which 377 mi^2 are in Tennessee. The Green River rises in Lincoln and Casey counties in Kentucky and flows generally westward for 330 mi to its confluence with the Ohio River just upstream from Henderson, Kentucky. A system of seven locks and dams enables navigation on the downstream portion of the Green River.

The upper basin is characterized by rugged, hilly terrain. The central part of the basin drains the Karst region, an area that is interlaced with large cave systems. The Karst region includes Mammoth Cave National Park. In the Karst region, surface streams are almost non-existent. Most of the water drainage is subterranean, eventually draining to the Green River via large springs. The lower basin consists primarily of alluvial plains. TVA's PAF is located on the Green River about 100 mi from the mouth.

The Green River basin contains about one-fourth of Kentucky's land area and is the largest drainage basin in the state. Reservoirs have been constructed by the USACE on the Rough, Nolin and Barren rivers, as well as on the mainstream of the Green River in the upper basin. The topography in this section of the Interior Low Plateaus is characterized by gently rolling terrain underlain by limestone in the upper basin and hills and broad flood plains underlain by sandstone, shale and coal in the lower basin.

Land uses in the upper basin include agriculture, urban areas and mining or drilling. Major sources of stream contamination in the upper basin are agriculture (sediment, nutrients and pesticides); mining or drilling (chloride); on-site and municipal wastewater treatment systems (decomposable organic matter, nutrients and bacteria); and urban storm water runoff (toxic metals, nutrients and sediment).

Concentrations of chloride in the upper basin of the Green River are higher than those recorded at other locations in the basin and have been associated with brines from oil production. However, dissolved solids concentrations in the upper basin were not high relative to those in other Kentucky streams. Concentrations of sulfate, another major component of dissolved solids were low in samples collected during 1987-1989. The relatively high median concentrations of nitrite [0.87 milligrams per liter (mg/l)] and suspended sediment (27 mg/l) were among the highest for Kentucky's monitoring locations. The high values possibly were due to agricultural and urban runoff and municipal wastewater discharges.

The major source of pollution in the Green River Basin is mining in the western coal-fields region of the lower basin. The river is very turbid or cloudy due to runoff from these coal fields and extensive barge traffic. Other sources of pollution in the basin include municipal wastewater-treatment plants and agricultural runoff. Two streams in the basin currently have fish consumption advisories in place for PCB contamination: Drakes Creek from the city of Franklin to the Barren River and Mud River from the city of Russellville to the Green River.

PAF is located at approximately Green River mile (GRM) 100. Overall, water quality is good in the Green River Basin. However, according to the 2012 303(d) List of Waters for Kentucky, approximately 330 stream miles have been identified on the 303(d) list of impaired streams for pH, dissolved solids and excessive fecal coliform (KDEP 2013). Three segments of the Green River are listed on the state 303(d) report as "fair," meaning they only partially support their designated uses. Two of these sites are upstream of the project site and one, a 22.5 mi section of the Green River downstream (GRM 71.9 to 94.4), is downstream of the plant. The downstream listing is due to fecal coliform from an unknown source. The listed pollutants of concern include fecal coliform and mercury in fish tissue. The listed probable sources of pollutants are resource extraction, land disposal and agriculture (KDEP 2013). Additionally, the Green River at GRM 189 to 290, approximately 90 mi upstream, is on the Nationwide Rivers Inventory. However, no Nationwide Rivers Inventory streams or Wild and Scenic Rivers are near PAF. (Jacobs Creek and the portion of the Green River adjacent to PAF are currently not assessed.) The Green River at PAF is not listed as impaired in Kentucky's 2012 303(d) list. A section downstream from GRM 94.4 to GRM 71.9 is listed for fecal coliform from an unknown source. This could not be caused by CCRs.

3.7.1.1.5 Mississippi River

The lower Mississippi River in the reach that borders west Tennessee is one of the largest rivers in the world. Its drainage basin includes nearly all of the United States between the Rocky Mountains and the Appalachian Mountains. The drainage basin is 1,247,000 mi^2 and includes the nation's most productive industrial and agricultural regions. Ships can travel the river for more than 1,800 mi from Minneapolis, Minnesota to the Gulf of Mexico. TVA operates the ALF on McKellar Lake which drains to the Mississippi River at Memphis, Tennessee.

The Mississippi River has an average daily discharge of 312,000 MGD at Memphis, Tennessee and 377,000 MGD at Vicksburg, Mississippi. In general, the quality of water in the Mississippi River is suitable for most uses. The median concentrations of alkalinity (106 mg/l), sulfate (55 mg/l), dissolved solids (239 mg/l) and nitrite plus nitrate (1.2 mg/l) were much less than the federal criteria for untreated drinking water supplies. About half of the sulfate in the Mississippi River is due to runoff over weathered rock and the other half is due to biochemical processes and human activities.

A fish consumption advisory for chlordane contamination is in effect for all fish species in the Mississippi River adjacent to Shelby County, Tennessee (Memphis) and McKellar Lake, Wolf River, Loosahatchie River and Nonconnah Creek, which are tributaries to the Mississippi River in Shelby County.

3.7.1.2 Characteristics of Ash Impoundment Discharges

TVA CCR impoundments include stilling basins, sluice channels, fly ash or bottom ash or gypsum impoundments and dredge cells that vary in size and CCR material composition. Typical operational characteristics of coal-fired power plants have included a wet sluicing operation whereby CCR materials are removed from the plant to CCR settling basins. Most of these settling basins contain surface water that is part of the overall treatment system designed to capture and collect CCR materials and improve water quality prior to discharge to receiving waters.

Water use to support hydraulic sluicing of CCR materials is typically facilitated by withdrawing water from the adjacent surface water body or reusing water that has been used for condenser cooling operations. Pumping rates to support CCR management within TVA coal-fired power plants range with the size of the plant and volume of material generated. Some impoundments are inactive. Some sites have been converted to dry handling of fly ash and some have been converted to dewatered CCR systems. Dry handling will have no CCR sluice water flow, however, dewatered CCRs may still have water flows after the CCR material has been separated. As summarized in Table 3-6, sluice water flow ranges from a low of 0.6 MGD at BRF to approximately 28 MGD at PAF. Additional storm water inputs and process water from the plant combine to contribute to an average total discharge flow from CCR impoundments that range from 8.5 MGD at COF to 33 MGD at PAF which demonstrates that the average CCR sluice flow accounts for between 60 percent and 90 percent of the total CCR impoundment discharge.

Table 3-6. CCR Impoundment Flow Estimates

Plant	CCR Type (by flow stream)	NPDES # and Outfall Number	Average Total Flow (MGD)	Average Ash Sluice Flow (MGD)
ALF	Fly ash and boiler slag	TN0005355, 002*	NA	NA
	Fly ash and boiler slag	TN0005355, 001	8.6	7.3
BRF	Bottom ash (sluice water recycled except for overflow to gypsum system)	TN0005410, 001		
	Gypsum	TN0005410, 001	11.0	0.6
	Fly ash (handled dry)	TN0005410	NA	NA
COF	Bottom ash and fly ash	AL0003867, 001	8.5	5.4
CUF	Bottom ash and gypsum	TN0005789, 001	21.7	12.8
GAF	Bottom ash and fly ash	TN0005428, 001	27.9	21.6
JSF	Bottom ash and fly ash	TN0005436		
JOF	Bottom ash and fly ash	TN0005444, 001	31.1	24.9
KIF	Bottom ash and fly ash	TN0005452, 001	15.6	0
	Bottom ash	TN0005452, 001	15.3	6.8
PAF	Fly ash and Bottom Ash	KY0004201, 001	33.4	27.8
	Bottom Ash	KY0004201, 002	28.3	28.3
SHF	Bottom ash and fly ash	KY0004219, 001	25.8	19.8
WCF	Bottom ash, fly ash and gypsum	AL0003875, 0001	31.4	20.4

*ALF Outfall 002 is inactive and has no surface discharge

Most CCR impoundments have NPDES permits that have monthly average and daily maximum limitations on the discharge of total suspended solids (TSS). Monthly average TSS NPDES permit limitations range from 15 to 30 mg/l and daily maximum limitations range from 70 to 100 mg/l.

The primary withdrawal usage for TVA's coal-fired power plants is for the condenser cooling water (CCW), which accounts for the majority of the thermal loading from operating plants. The discharge characteristics associated with CCW use (including thermal loading) would not be changed by CCR management activities. Raw and potable waters and storm water flows associated with ash impoundments would only be subject to temperature increases from natural cycles in solar radiation.

Additionally both passive and targeted wastewater treatment would be introduced as appropriate to comply with NPDES permit limits, and potentially applicable requirements under EPA's new Effluent Limitation Guideline for coal-fired power plants [80 FR 67838-67903 (November 3, 2015)]. TVA is reviewing the final Effluent Limitation Guidelines to determine what actions may be required for compliance. TVA is drafting renewal applications for NPDES permits that will address wastewater treatment for the plant site and discharges during impoundment closure, as appropriate.

3.7.2 Environmental Consequences

3.7.2.1 Alternative A – No Action Alternative

Under the No Action Alternative, TVA will not close any of the CCR impoundments. This alternative does not meet the purpose of complying with the CCR Rule or of achieving the overall TVA goal of closing CCR impoundments as part of its process to convert wet CCR storage to dry storage.

Under this alternative, the discharges from CCR impoundments would continue at plants for which the CCR impoundment is a component of the storm water or process water treatment system. However, the volume and rate of discharge would be reduced relative to the operating condition in which CCR would have been sluiced to the impoundment. Additionally, the hydraulic head would remain within the impoundment but likely would be reduced. Discharges will continue to comply with applicable permit limits and therefore, surface water quality adjacent to these facilities should remain approximately the same. Operational changes such as additional treatment, would be implemented as necessary to meet applicable permit limits, including new effluent guidelines.

Potential indirect impacts from the No Action Alternative include the potential for seepage from berms and groundwater and possible release to surface waters. Under this alternative, any pathways for transport of COCs as a result of lateral movement (seepage) through berms or groundwater flow to adjacent surface waters would continue but at a reduced level. However, TVA addresses seeps at its plants by stopping them (plugging them) and/or by capturing seep water and rerouting it to wastewater control systems and this would continue under the No Action Alternative.

3.7.2.2 Alternative B – Closure-in-Place

3.7.2.2.1 Surface Water Withdrawal and Discharge

The primary withdrawal of surface water plant-wide is for the CCW, which carries the majority (99.9 percent) of the thermal loading from the coal-fired plant sites. Raw and potable waters and storm water flows associated with CCR management activities would remain at ambient temperatures; therefore, no additional thermal impacts would be anticipated.

Impoundment closure under this alternative will typically result in isolation and rerouting of discharge water streams (storm water, plant sump and process water, etc.) to discontinue their discharge to the CCR impoundment. To the extent possible, the majority of the storm water flows will be managed through the implementation of BMPs and cleaning and maintenance plans and discharged to the receiving stream in accordance with NPDES permit limits.

Dewatering of the impoundment would begin once the process and storm water streams have been re-routed from the impoundment. After the flows are diverted, the impoundment will be dewatered by various means, including but not limited to natural dissipation; pumping into another impoundment and then discharging, and/or pumping directly to the permitted outfall to the receiving stream if allowed under the applicable permit or regulations. Rainfall and water levels would be monitored to determine the appropriate dewatering rate. Discharge flow rates would be maintained to ensure compliance with NPDES permit limits and protection of water quality in the receiving stream. This may require additional treatment. Additional monitoring of discharge constituents would be undertaken, as appropriate.

3.7.2.2.2 Construction Impacts

Under this alternative no alteration or modification of surface water resources would occur within the immediate project site or associated laydown areas with the implementation of BMPs.

Wastewaters generated during the proposed project may include construction storm water runoff, drainage of work areas, domestic sewage, non-detergent equipment washings, dust control and hydrostatic test discharges.

- **Surface Runoff** – Impoundment closure activities have the potential to temporarily affect surface water via storm water runoff. TVA will comply with all appropriate state and federal permit requirements. Appropriate BMPs would be followed and all proposed closure activities will be conducted in a manner to ensure that waste materials are contained. A Construction Storm Water Permit will be in effect that will require development of a project-specific Storm Water Pollution Prevention Plan. This plan will identify specific BMPs to address construction-related activities that would be adopted to minimize storm water impacts. Additionally, BMPs, as described in A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority (Bowen et al. 2012), would be used to avoid contamination of surface water in the project area. Therefore, no significant impacts to surface water would be expected due to surface water runoff from the construction site.
- **Domestic Sewage** – Portable toilets would be provided for the additional construction workforce as needed. These facilities would be managed and maintained appropriately to avoid any releases during the construction operation.
- **Equipment Washing and Dust Control** – Equipment washing and dust control discharges would be handled in accordance with BMPs described in the Storm Water Pollution Prevention Plan for water only cleaning and/or by the facility's individual NPDES Permit.
- **Hydrostatic Testing** – These discharges would be handled in accordance with the NPDES Permit, or in Tennessee, the TDEC General NPDES Permit for Discharges of Hydrostatic Test Water (TN670000).

With the implementation of appropriate BMPs, no significant impacts to surrounding surface waters are expected from construction activities.

3.7.2.2.3 Operational Impacts

In comparison to the No Action Alternative, Alternative B (Closure-in-Place) would greatly reduce discharges from existing CCR impoundments. Any hydraulic conductivity from groundwater to surface waters adjacent to the impoundments should be essentially eliminated by reduction of the hydraulic head in the impoundments and by consolidation and compaction of CCR. Installation of approved closure systems (see Section 2.2) would also greatly reduce any precipitation percolation through the CCRs, such that infiltration would be *de minimis*.

A recent study conducted by EPRI has evaluated the impact of impoundment closure on surface water for a hypothetical CCR impoundment in Tennessee. Under a closure scenario similar to Alternative B, EPRI analyzed the potential for COC releases from groundwater and the resultant effect on receiving surface waters. EPRI analyzed two scenarios: one in which all CCR materials were located above the water table, and a second in which the water table intersected the CCR materials. Under both closure scenarios, EPRI found that the in-place closure scenario provided about a 10-fold increase in beneficial impact compared to baseline (i.e., concentrations of all COCs, with the exception of Arsenic(V), are less than 100 percent of baseline. Arsenic(V) migrates very slowly, thus, surface water concentrations are the same for all scenarios including baseline (EPRI 2016b).

Impoundment closure will in most cases, also entail removal of existing CCR impoundment outfall structures. Storm water collected from within the closed impoundment and other site storm water will be managed and rerouted as appropriate in accordance with NPDES permitting requirements. As a result, CCR impoundment closure would reduce current surface water loadings through NPDES discharge points by hundreds to thousands of pounds of TSS each day at each plant. COCs such as heavy metals currently being discharged from plants also would be substantially reduced. Constituents such as oil and grease and metals in other waste streams will be diverted and managed separately in accordance with appropriate regulations. Additionally all other plant water sources previously contributing to CCR impoundment discharge will be rerouted to appropriate approved permitted outfalls.

This alternative would eliminate any substantial lateral movement (seepage) through berms or groundwater flow and their potential subsequent release to surface waters. Consequently, any pathways for transport of COCs by these mechanisms would be minimized.

Because surface water flow and potential lateral movement (seepage) through berms or groundwater flow to surface waters would be greatly reduced, and because all work will be done in compliance with applicable regulations, permits, and BMPs, potential direct and indirect adverse impacts to surface waters would be negligible and effect on surface water quality should be beneficial. These actions will heighten the protection of water quality standards.

3.7.2.3 Alternative C – Closure-by-Removal

No alteration or modification of surface water resources would occur within the immediate project site or associated laydown areas with utilization of proper BMPs during construction. Water withdrawal and discharge impacts would be essentially the same as those described for Alternative B and will include re-routing of project flows and the drawdown of the free water in the impoundments.

In contrast to Alternative B, this alternative would entail the removal and transport of all CCR material from the project site to an approved landfill. As a result, any pathways for transport of COCs as a result of berm underseepage or groundwater flow to adjacent surface waters would be eliminated over time. Material placed within the receiving landfill is assumed to be fully contained by an approved liner system such that no seepage or discharge of COCs to receiving waters would occur.

The impacts associated with construction activities would be similar to those described above in Alternative B. However, the duration of the construction process has the potential to be much longer than Alternative B. On-site construction impacts are expected to be relatively minor as long as all BMPs and other appropriate mitigation measures are implemented.

EPRI found that the excavate and redispose closure scenario (Closure-by-Removal) provided a positive impact compared to baseline *(*i.e., concentrations of all COCs, with the exception of Arsenic(V), are less than 100 percent of baseline) provided about a 10-fold increase in beneficial impact compared to baseline. Arsenic (V) migrates very slowly, thus, surface water concentrations are the same for all scenarios including baseline (EPRI 2016b).

The impacts due to operational activities associated with the closure of impoundments would be similar to those described above in Alternative B. As long as mitigation measures are utilized as needed, such as water treatment, proper drainage and BMPs, no negative surface water quality impacts are anticipated and water quality will continue to be protected.

Because surface water flow and potential underseepage and groundwater releases to surface waters eventually would be eliminated, and because all work will be done in compliance with applicable regulations, permits and BMPs, potential direct and indirect impacts to surface waters would be negligible. Compared to Alternative B, however, any ongoing surface water impacts would be reduced more slowly because precipitation events would continue to influence flows from the CCR facility until the end of the closure process.

3.8 Floodplains

3.8.1 Affected Environment

A floodplain is the relatively level land area along a stream or river that is subjected to periodic flooding. The area subject to a 1 percent chance of flooding in any given year is normally called the 100-year floodplain. The area subject to a 0.2 percent chance of flooding in any given year is normally called the 500-year floodplain.

The affected environment includes the ash ponds and the streams adjacent to them. The ash impoundments associated with coal-fired power plants in the TVA fleet and the adjacent streams are presented in Table 3-7.

The ash impoundments are currently open to the atmosphere. Based on information from the six plants where site-specific impoundment closures are being analyzed, TVA determined that the low crest elevations of the ponds from five of the six plants specifically analyzed in this review are not only above the 100-year flood elevation, but also above the 500-year flood elevation. The low crest of the ALF West Impoundment is located above the 100-year flood elevation and below the extrapolated 500-year flood elevation of 230.5 ft.

Table 3-7. CCR Impoundments at TVA Coal-Fired Plants

Ash Pond	Stream Name	River Mile*	100-year Flood Elevation	500-year Flood Elevation	Existing Impoundment Crest Elevation (ft)
ALF West Impoundment	Lake McKellar	2.0	225	230.5	226.9
BRF Sluice Channel	Clinch River	47.9	797.3	798.1	809.6
BRF Fly Ash Impoundment	Clinch River	46.7	797.2	797.9	809.1
COF Ash Impoundment 4	Cane Creek (influenced by Tennessee River backwater)	3.2-3.8	423.2	424.4	457.6
COF Laydown Area 9 acres	Cane Creek (influenced by Tennessee River backwater)	3.1	423.1	424.3	~430 (from topographic map)
CUF	Cumberland River	102.8	379.6	385.3	To be determined in site-specific analysis
GAF	Cumberland River	244.4	453.3	457.0	To be determined in site-specific analysis
JSF Bottom Ash Impoundment	Holston River	106.1	1078.0	1082.3	1143.9
JOF	Tennessee River	99.5	375.0	375.0	To be determined in site-specific analysis
KIF Stilling Impoundment	Emory River	2.1	748.1	750.7	764.5
KIF Laydown Area	Emory River	1.8	747.8	750.2	~760 (from topographic map)
KIF Sluice Trench	Emory River	1.8	747.8	750.2	~760 (from topographic map)
PAF	Green River	100.4	402.1	404.9	To be determined in site-specific analysis
SHF Bottom Ash Impoundment	Ohio River	946	336.5	339.5	343
WCF Dredge Cell	Widows Creek (influenced by Tennessee River backwater)	2.2	608.1	610.7	636.9
WCF Ash Impoundment	Widows Creek (influenced by Tennessee River backwater)	3.2	608.1	610.7	635.4

* General river mile of coal-fired plants.

3.8.2 Environmental Consequences

As a federal agency, TVA is subject to the requirements of EO 11988, Floodplain Management. The objective of EO 11988 is "…to avoid to the extent possible the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative" (U.S. Water Resources Council 1978). The EO is not intended to prohibit floodplain development in all cases, but rather to create a consistent government policy against such development under most circumstances. The EO requires that agencies avoid the 100-year floodplain unless there is no practicable alternative. For certain "Critical Actions," the minimum floodplain of concern is the 500-year floodplain.

3.8.2.1 Alternative A – No Action

The No Action Alternative will result in the same impacts to floodplains and floodplain resources as existing conditions. Existing berms will be maintained as part of on-going care and maintenance of the TVA facility. Flood events greater than a 500-year flood could potentially occur at TVA coal-fired plants that could inundate the ash impoundments. Impoundment material could potentially be washed out of the ponds and into the receiving stream. The downstream extent of ash deposition in the receiving stream would be dependent upon the nature of both the flood event and the amount of ash released. Based upon hydraulic modeling done following the release of ash at the Kingston coal-fired plant in 2008, ash deposition in the receiving streams could fill the river bottom such that upstream flood elevations could be increased (TVA 2009). However, TVA has not experienced such flooding during the lives of these CCR impoundments.

3.8.2.2 Alternative B – Closure-in-Place

Under the Closure-in-Place Alternative, flood events greater than the 500-year flood could occur that could inundate the ash impoundments; however, the ash will be covered by a final cover system designed to minimize erosion and infiltration to the ash within. With such a closure system in place, CCRs could still potentially be washed out of the ponds and into the receiving stream. However, the downstream extent of ash deposition in the receiving stream would be expected to be less than existing conditions. The impacts of berm erosion under the Closure-in-Place Alternative would be less than existing conditions.

Structures and facilities such as laydown areas, haul roads, and staging areas will be constructed, and portions of them could be located within 100-year floodplains. These activities would be considered temporary uses of the 100-year floodplain and, therefore, would have no permanent impacts on floodplains or floodplain resources. Also, standard BMPs will be employed in order to minimize adverse impacts during construction activities.

3.8.2.3 Alternative C – Closure-by-Removal

Under Alternative C – Closure-by-Removal, flood events greater than the 500-year flood could occur that could inundate the closed ash ponds; however, the ash will have already been removed and, therefore, no ash would wash out into the receiving stream. In addition, closure of the former ash impoundment site potentially, incrementally increases the overall flood storage. The impacts of berm erosion under the Closure-by-Removal Alternative would be less than both existing conditions and the Closure-in-Place Alternative. Under Closure-by-Removal, ash will be hauled to an approved landfill for final disposal. Because removal of CCR could take years at some locations, floodplain impact risks would remain but would be gradually reduced. TVA will ensure that Closure-by-Removal would not promote unwise use of the floodplain by obtaining documentation from a permitted landfill that the ash would be disposed in an area outside the 100-year floodplain.

Structures and facilities such as laydown areas, haul roads and staging areas will be constructed and portions of them could be located within 100-year floodplains. These activities would be considered temporary uses of the 100-year floodplain and, therefore, would have no permanent impacts on floodplains or floodplain resources. Also, standard best management practices will be employed in order to minimize adverse impacts during construction activities.

3.9 Vegetation

3.9.1 Affected Environment

The TVA region encompasses eight ecoregions (Figure 3-4) which generally correspond with physiographic provinces and sections described in Section 3.5. The terrain and associated plant communities vary from bottomland hardwood and cypress swamps in the floodplains of the Mississippi Alluvial Plain to high elevation balds, spruce-fir and northern hardwood forests in the Blue Ridge. About 3,500 species of herbs, shrubs and trees occur in the TVA region (TVA 2015b). The eight ecoregions in the TVA project area include:

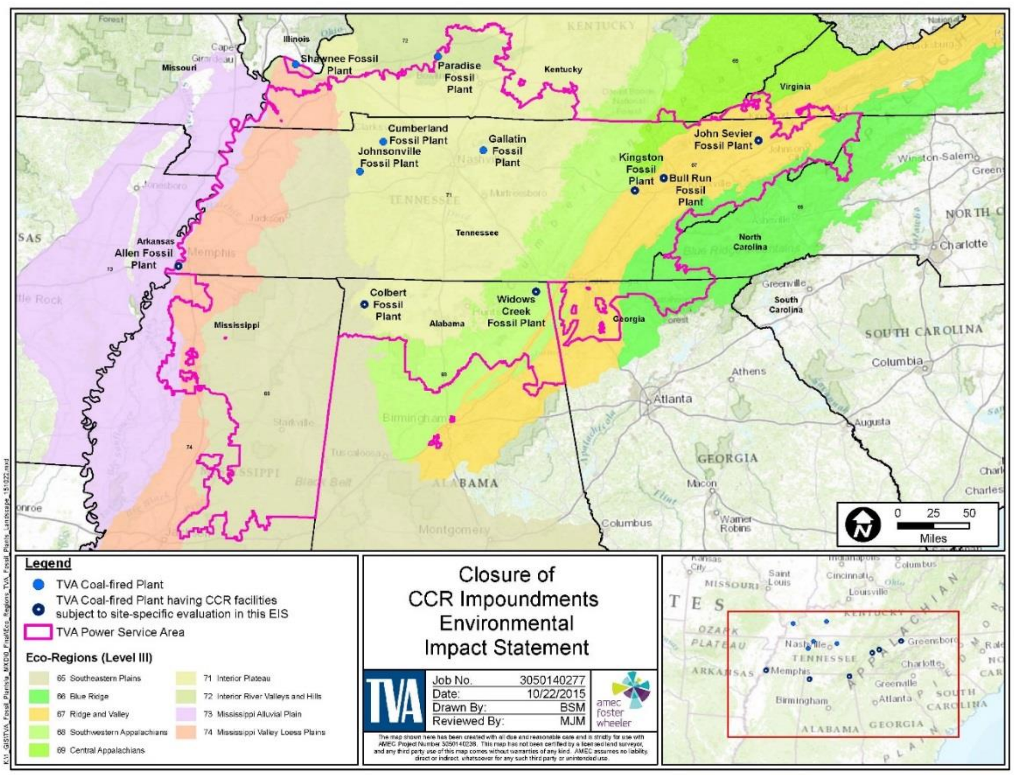


Figure 3-4. Ecoregions within the TVA Valley

- **Southern Blue Ridge Ecoregion**: This ecoregion corresponds to the Blue Ridge physiographic province. It is dominated (80 percent) by the diverse, hardwood-rich mesophytic forest and its Appalachian oak subtype, about 14 percent of the land cover is agricultural and most of the remaining area is developed (6 percent).
- **Ridge and Valley Ecoregion**: This ecoregion corresponds with the Valley and Ridge physiographic province, 56 percent of which is comprised of hardwood-rich mesophytic forest and its Appalachian oak subtype. About 30 percent of the area is agricultural and 9 percent is developed.

- **Central Appalachian Ecoregion**: This ecoregion corresponds with the Cumberland Mountains physiographic section. It is heavily forested (83 percent), primarily with mesophytic forests including large areas of Appalachian oak (TVA 2015b). The remaining land cover is mostly agriculture (7 percent), developed areas (3 percent) and mined areas (3 percent).
- **Southwestern Appalachian Ecoregion**: This ecoregion corresponds with the Cumberland Plateau physiographic section. About 75 percent of the land cover is forest, predominantly mesophytic forest; about 16 percent is agricultural and 3 percent is developed.
- **Interior Plateau Ecoregion**: This ecoregion corresponds with the Highland Rim and Nashville Basin physiographic sections. About 38 percent of the ecoregion is forested, 50 percent is agriculture and 9 percent developed. Forests are predominantly mesophytic, with a higher proportion of American beech, American basswood and sugar maple than in the Appalachian oak subtype.
- **Interior River Valley and Hills Ecoregion**: This ecoregion is relatively flat lowland dominated by agriculture (68 percent) with about 20 percent forested hills, 7 percent developed and 5 percent wetlands.
- **Southeastern Plains and Mississippi Valley Loess Plain Ecoregion**: These two ecoregions correspond, respectively, to eastern and western portions of the East Gulf Coastal Plain physiographic section. These ecoregions are characterized by a mosaic of forests (52 percent of the land area), agriculture (22 percent), wetlands (10 percent) and developed areas (10 percent). Forest cover decreases and agricultural land increases from east to west.
- **Mississippi Alluvial Plain Ecoregion**: This ecoregion is a flat floodplain area originally covered by bottomland deciduous forests. A large portion has been cleared for agriculture and subjected to drainage activities including stream channelization and extensive levee construction. Most of the land cover is agricultural (approximately 80 percent) and the remaining forests are southern floodplain forests dominated by oak, tupelo and bald cypress.

In most cases, TVA coal-fired power plants were developed in close association with large rivers and reservoirs that provide sufficient water supply for condenser cooling. As such, coal-fired plants and their supporting facilities including ash impoundments are predominantly located within floodplain landscapes of major river and reservoir systems of the Valley. Dominant plant communities that are common to floodplains within the Valley across ecoregions include bottomland deciduous forest that support green ash, elm, sugarberry, eastern sycamore and sweetgum; emergent and shrub wetland communities composed of cattail, rushes, buttonbush and willows and agricultural uses (hayland, pasture, cultivated field).

Impoundment closure activities considered by TVA are typically limited in their scope at each coal-fired plant. Activities would be primarily focused within the limits of the ash impoundments subject to closure, associated previously disturbed areas on the project site and roadways serving the facility. As such, plant communities present in the various ash impoundments and related construction laydown areas potentially affected by project operations consist of ruderal/early successional vegetation (often within older, exposed ash in upper portion of impoundments), maintained lawn/turf associated with berms, denuded and unvegetated lands (parking lots, riprapped berms, etc.) and fringing scrub and sapling trees. Dominant land cover types include open water, hay/pasture, cultivated crops, deciduous forest and developed land.

3.9.2 Environmental Consequences

3.9.2.1 Alternative A – No Action

Under the No Action Alternative, TVA will not close ash impoundments at any of the coal-fired plants. Under this alternative, there would be no impacts to vegetation.

3.9.2.2 Alternative B – Closure-in-Place

Ash impoundments are located in landscapes dominated by heavy industrial uses. Impacts to vegetation would result from earthmoving activities related to shaping and filling the ash within the impoundments, inward reconfiguration of berms and grubbing of laydown areas. Because plant communities within the impoundments and most laydown areas of TVA coal-fired sites are often disturbed and of low quality, and potential impacts are very small relative to the abundance of similar cover types within the vicinity, direct impacts from site construction activities would be negligible. Tree removal requirements are expected to be negligible at most facilities.

Sub-alternatives B-1 and B-2 include revegetation as part of the cover system (see Section 2.2). Placement of fill material will also result in a shift in cover from its current condition (typically denuded, exposed ash or herbaceous adventives), to a turf grass community. In contrast, Sub-Alternative B-3 utilizes an engineered turf cover system that would eliminate all vegetation as part of the cover system.

Construction activities associated with the Closure-in-Place Alternative may also result in the introduction and/or spread of invasive plant species from borrow material and heavy equipment. Invasive plants that pose a threat in the TVA region include tree-of-heaven, English ivy, autumn olive, Japanese honeysuckle, Chinese lespedeza and Johnson grass. However, the generalized transformation of existing ash impoundments from highly disturbed environments to stable, controlled and vegetated landscapes provide a net improvement in the overall composition of the plant communities of these sites and their ability to resist establishment by invasive species. Additionally, BMPs consisting of erosion control measures and use of approved, non-invasive seed mixes designed to quickly establish desirable vegetation will further minimize invasive plant impacts.

Impacts to vegetation under this alternative are limited to construction-phase disturbance of largely industrialized environmental settings that lack notable plant communities. Impacts to these plant communities are considered to be small relative to the abundance of similar cover types within the vicinity of each facility. Additionally, the transition of these predominantly denuded ash impoundments to vegetated, stable facilities would result in minor long term beneficial impacts on plant communities.

3.9.2.3 Alternative C – Closure-by-Removal

Impacts to vegetation under this alternative will be associated with ash removal and transport to either approved on-site or off-site permitted landfills. As with Alternative B, any existing vegetation would be entirely removed from the impoundments and from associated laydown areas needed to support construction. Ash impoundment re-use would be determined on a site-specific basis, but much of the former ash impoundment may be expected to revert to naturalized landscapes.

Construction activities associated with the Closure-by-Removal Alternative may also result in the introduction and/or spread of invasive plant species by heavy equipment use, off-site transport of CCR materials and abandonment of the former ash impoundment. However BMPs consisting of erosion control measures and use of approved, non-invasive seed mixes designed to quickly establish desirable vegetation will minimize invasive plant impacts.

Impacts to vegetation under this alternative are limited to construction-phase disturbance of largely industrialized environmental settings that lack notable plant communities. Additionally, the transition of these predominantly denuded ash impoundments to vegetated, naturalized environments is considered minor and beneficial in the long term.

3.10 Wildlife

3.10.1 Affected Environment

The TVA region encompasses nine community ecoregions (Omernik 1987). The terrain, plant communities, and associated wildlife habitats in these ecoregions vary from bottomland hardwood and cypress swamps in the floodplains of the Mississippi Alluvial Plain to high elevation balds and spruce-fir and northern hardwood forests in the Blue Ridge. About 3,500 species of herbs, shrubs and trees, 55 species of reptiles, 72 species of amphibians, 182 species of breeding birds and 76 species of mammals occur in the TVA region (Ricketts et al. 1999, Stein 2002, Tennessee Wildlife Resources Agency 2005, Tennessee Ornithological Society 2014). Although many plants and animals are widespread across the region, others are restricted to one or a few ecoregions. For example, high elevation communities in the Blue Ridge support several plants and animals found nowhere else in the world (Ricketts et al. 1999), as well as isolated populations of species typically found in more northern latitudes.

Many wide-ranging species occur throughout the TVA region; most species that are tolerant to humans continue to thrive in the region. Wildlife populations have been greatly altered by loss and modification of habitats due to agriculture, mining practices, forestry practices, urbanization, and the construction of impoundments. Approximately 48 percent of grassland breeding birds are of conservation concern and 23 species are significantly declining in number. Approximately 22 percent of area-dependent woodland birds are of conservation concern. These numbers have declined by 10 percent through 1980 but have shown some increases in recent years (North American Bird Conservation Initiative 2009). Habitats used by these species have been modified largely by urban development and agricultural practices.

In general, gulls, wading birds, waterfowl, raptors, game birds, game mammals and nongame wildlife (reptiles, amphibians and small mammals) exhibit stable or increasing numbers throughout the TVA region. Populations of white-tailed deer, wild turkey, coyote, and beaver have shown significant population increases. Species associated with river corridors such as osprey, herons and Canada geese have also shown notable recoveries, largely since the ban of dichlorodiphenyltrichloroethane (DDT). This trend is quite noticeable on the Tennessee River, as breeding populations of these species had been relatively scarce in portions of northwest Alabama or northeast Tennessee up to the late 1990s. However, in recent years, breeding populations of these species have expanded into these areas and have become more evenly distributed throughout the Valley. Recent surveys show that shorebirds and waterfowl communities are quite diverse in portions of the Valley, especially during autumn and spring migrations. However, numbers of several species of songbirds continue to decline in the region, especially those typically found in grassland or unfragmented forests (TVA 2011).

3.10.1.1 TVA Lands

While TVA manages lands across the region, most TVA lands are concentrated around its reservoirs. Habitats on TVA lands are just as complex as other lands found throughout the TVA region, supporting diverse communities of wildlife. Wildlife habitat on TVA lands ranges from low quality maintained lawns and disturbed forest fragments around power generating facilities, moderate quality early successional rights-of-way along power lines bordered by forest edges, as well as high quality contiguous blocks of forest along reservoir shorelines. Important habitats found in the Valley include riparian corridors, bluffs, swamps, grasslands, rivers, reservoirs, islands, large unfragmented forested landscapes and karst habitats (TVA 2011).

The construction of the reservoir systems by TVA and USACE created large areas of habitat for waterfowl, herons and egrets, ospreys, gulls and shorebirds, especially in the central and eastern portions of the TVA region where this habitat was limited. Ash and gypsum settling and storage ponds at TVA fossil plants also provide local habitat for these birds and other wetland species. These increases in habitat, as well as the ban on the use of the pesticide DDT, have resulted in large increases in the local populations of several bird species. Both long-term and short-term changes in the operation of the reservoir system affect the quality of habitat for these species, as do impoundment management practices at fossil plants (TVA 2015b).

Riparian habitats associated with the Tennessee River and its tributaries provide important habitats for wildlife. Coupled with unique features such as vernal pools, oxbows, bluffs and islands, these areas provide a diverse array of nesting and foraging habitats for wildlife (TVA 2011).

Open lands are comprised of old-field, pasture, agricultural and other early successional habitats, as well as maintained vegetative areas within industrial areas. Most of these areas have been greatly modified by facility infrastructure, intensive row cropping and timber harvesting. Yet, these habitats also provide needed environment for species favoring early successional habitats (TVA 2011).

Birds commonly observed in these type of disturbed habitats, woodland and/or early successional habitat interspersed with human infrastructure include Carolina wren, tufted titmouse, northern mockingbird, northern cardinal, eastern towhee, eastern bluebird, brown thrasher, field sparrow and eastern meadowlark. Red-tailed hawk and American kestrel also forage along road right of ways (Sibley 2000, LeGrand 2005). Mammals routinely observed in this type of landscape include Virginia opossum, raccoon, eastern cottontail, striped skunk, white-tailed deer, eastern mole, woodchuck and rodents such as white-footed mouse and hispid cotton rat (Whitaker and Hamilton 1998). Common reptiles include black racer, black rat snake and eastern garter snake (LeGrand 2005, Conant and Collins 1998; Niemiller et al. 2013).

Forested habitat in these industrial areas may be too fragmented and isolated to support most common forest animal species. However, birds in small forested areas typically include American crow, Carolina chickadee, tufted titmouse, American goldfinch, blue-gray gnatcatcher, red-bellied woodpecker and downy woodpecker (LeGrand et al. 2007, Sibley 2000). Mammals such as eastern chipmunk and eastern gray squirrel tend to occur in urban woodlands (Whitaker and Hamilton 1998). Amphibian and reptile species that may be found in this habitat include ring-necked snake, gray rat snake, five-line skink, copperhead snake, spring peeper and upland chorus frog (LeGrand 2005, Conant and Collins 1998, Niemiller et al 2013).

Caves are abundant features throughout much of the region, especially in north Alabama, northwest Georgia and the eastern half of Tennessee. These sites provide a unique mixture of microhabitats used by a diverse array of cave-dependent species, some endemic to single cave systems.

3.10.1.2 TVA Coal-Fired Plant Sites
The area evaluated for wildlife impacts from ash impoundment closure is more limited than those represented on a regional basis. Habitats potentially affected by closure activities generally include the existing ash impoundments at each facility, associated water bodies and shoreline habitats, maintained grassed and rip-rapped berms, roads, facility infrastructure and limited areas of old field and forested habitat. Generally, wildlife habitat associated with the ash impoundments and their associated environs is of low quality, as construction, maintenance and continual disturbance from facility operations has impacted most habitat within the industrial facility.

The ash impoundments may periodically support variable numbers of waterfowl, wading birds, shorebirds, gulls and other wildlife. Species that may use maintained impoundment areas and grassed berms include a variety of amphibians, reptiles and mammals that may include water snakes, tree frogs, rodents, eastern chipmunk, eastern gray squirrel, raccoons, opossum, coyotes and deer.

Cave systems, while present within the region, are not present within habitats potentially affected by closure activities.

3.10.2 Environmental Consequences

3.10.2.1 Alternative A – No Action
Under the No Action Alternative, wildlife and wildlife habitats would not be directly or indirectly affected by any project-related actions. No construction activities would be undertaken by TVA that would potentially disturb terrestrial wildlife. Local wildlife populations have become acclimated to plant operations. Therefore, there would be no impacts to wildlife under the No Action Alternative.

3.10.2.2 Alternative B – Closure-in-Place
Under Alternative B, proposed ash impoundment closure would result in some disturbance to potential wildlife habitat of predominantly previously disturbed low quality habitats. Impoundments are generally located within a highly fragmented and disturbed industrial landscape that offers minimal habitat for wildlife. Under this alternative, the resident, common and habituated wildlife found in the project area would continue to opportunistically use available habitats within the project area. During construction, most wildlife present within the project site would likely disperse to adjacent and/or similar habitat. However, the wildlife that can use the early successional habitat used to cover the closed impoundments is expected to return upon completion of the proposed actions. The actions associated with Alternative B are unlikely to affect populations of wildlife species common to the disturbed habitats of coal-fired power plant sites.

Periodic nesting of osprey and other water dependent birds (herons) has historically been observed at a number of TVA coal-fired power plant sites. However, in accordance with TVA wildlife management practices and USFWS requirements, nests have previously been removed from areas potentially affected by closure activities when necessary. As such, no impacts to osprey or other water dependent birds is expected to occur with closure-in-place activities.

Closure activities could result in a loss of marginally suitable waterfowl and wading bird habitat associated with existing ash impoundments. However, other higher quality waterfowl habitat is located elsewhere in the vicinity of the fossil plants as they are generally located on large rivers or reservoirs. Work activities will be designed so as not to affect heron rookeries or other aggregations of migratory waterfowl and wading birds. Thus, this loss of on-site waterfowl and wading bird habitat would be minor.

Following the construction period, some limited wildlife use of closed impoundments may be expected. Impoundments closed by using either the standard soil cover system or the geosynthetic-protective soil cover system will both be vegetated (grassed cover) and may be expected to provide limited foraging and nesting habitat for grassland species. By comparison, however, the engineered synthetic turf cover system would not provide long term habitat for resident wildlife species. Regardless of the cover system sub-alternative selected however, the actions are not expected to result in a significant change to available suitable habitat for any species common to the project area. Proposed actions are not expected to have significant direct or indirect impacts to the local population of any wildlife species. Impoundments with vegetated covers may have minor and slightly beneficial impacts to wildlife in the long term.

3.10.2.3 Alternative C – Closure-by-Removal

Under Alternative C, TVA will excavate and relocate the CCRs from ash impoundments to either on-site or existing off-site facilities.

Similar to Alternative B, the proposed ash impoundment closure would result in some disturbance to potential wildlife habitat of predominantly previously disturbed low quality habitats. During construction, most wildlife present within the project site would likely disperse to adjacent and/or similar habitat in surrounding areas.

As with Alternative B, closure activities under Alternative C could result in a loss of marginally suitable waterfowl and wading bird habitat associated with existing ash impoundments. However, other higher quality waterfowl and wading bird habitat is located elsewhere in the vicinity of the fossil plants as they are generally located on large rivers or lakes. Work activities will be designed so as not to affect heron rookeries or other aggregations of migratory birds. Thus, this loss of on-site waterfowl and wading bird habitat would be minor.

Periodic nesting of osprey and other water dependent birds (herons) has historically been observed at a number of TVA coal-fired plant sites. However, in accordance with TVA wildlife management practices and USFWS requirements, nests have previously been removed from areas potentially affected by closure activities when necessary. As such, no impacts to osprey or other water dependent birds is expected to occur with closure-in-place activities.

After construction, the potential for forested regrowth within the project area could improve wildlife habitat in the area. Because there would be no maintained cover system in the former impoundment area, following construction these lands may be expected to undergo succession to naturalized habitats that may offer somewhat improved habitat quality as compared to Alternative B.

The actions are not likely to affect populations of wildlife species common to the area under Alternative C. The project is not expected to result in a significant change to available suitable habitat for any species common to the area. Proposed actions are not expected to have significant direct or indirect impacts to the local population of any wildlife species.

3.11 Aquatic Ecology

3.11.1 Affected Environment

Most of the major rivers and tributaries in the United States east of the Mississippi originate in the mountains of the Appalachian region. First- through twelfth-order streams (Vannote et al. 1980), ephemeral streams and intermittent streams occur in this region to form major river systems. The TVA region encompasses portions of several of these major river systems including all of the Tennessee River drainage and portions of drainages of the Cumberland, Mobile (primarily the Coosa and Tombigbee rivers) and the Mississippi rivers. These river systems support a large variety of freshwater fishes and invertebrates (including freshwater mussels, snails, crayfish and insects). Due to the presence of several major river systems, the region's high geologic diversity and the lack of glaciation, the region is recognized as a globally important area for freshwater biodiversity (Stein et al. 2000; TVA 2015b).

Generally, reservoirs in the southeastern United States have an ecological structure and function of biological communities that are linked to water residence time. As with other smaller impoundment types, phytoplankton, periphyton and macrophytes supply most of the organic matter to the food web. Due to fluctuating water levels, phytoplankton production dominates most impoundments; however, rooted and floating macrophytes can dominate where water levels are stable in a reservoir (Wallace et al. 1992). Fish, amphibians, reptiles, birds and mammals are the main groups of vertebrates found in and associated with reservoirs in the southeast during a portion of their life cycle (Wallace et al. 1992). Fish populations are mainly comprised of forage fishes including shads and silversides in reservoirs and sunfishes in impoundments (Noble 1981), while the dominant predators in reservoirs are typically basses (Wallace et al.1992).

Common invertebrate species found in southeastern reservoirs include rotifers, protozoans and crustaceans. Within the benthos of most reservoirs in the southeast, larvae of true midges and oligochaete worms are the dominant macroinvertebrates (Diggins and Thorp 1985). Most of the freshwater mussel species known to occur in the United States are distributed in the southeast, with approximately 182 species in Alabama, 130 species in Tennessee, and 126 species Georgia (Neves et al. 1997). However, many benthic organisms have narrow habitat requirements that are not always met in reservoirs or tailwaters below dams. Farther downstream from dams, the number of benthic species increases as natural reaeration occurs and dissolved oxygen and temperatures rise.

3.11.1.1 The Tennessee River Basin

The Tennessee River drainage basin is the dominant aquatic system within the TVA region, and most TVA coal-fired power plants are within the watershed, including BRF, COF, JSF, KIF and WCF. The construction of the TVA dam and reservoir system has promoted navigation, flood control, power generation and recreation, but has also fundamentally altered both the water quality and physical environment of the Tennessee River and its tributaries. Damming of most of the rivers was done at a time when there was little regard for aquatic resources (Voigtlander and Poppe 1989). Beyond changes in water quality, flood control activities and hydropower generation have purposefully altered the flow regime (the main variable in aquatic systems) to suit human demands (Cushman 1985, TVA 2015a).

TVA has undertaken several major efforts (e.g., TVA's Lake Improvement Plan, Reservoir Release Improvements Plan, and Reservoir Operations Study [TVA 2004]) to mitigate impacts on aquatic habitats and organisms. While these actions have resulted in improvements to water quality and habitat conditions in the Tennessee River basin, the Tennessee River and its tributaries remain substantially altered by human activity.

3.11.1.1.1 Mainstem Reservoirs

The nine mainstem reservoirs on the Tennessee River differ from TVA's tributary reservoirs primarily in that they are shallower, have greater flows and retain the water in the reservoir for a shorter period of time. Facilities located on mainstem reservoirs include COF, KIF, JOF and WCF. Although dissolved oxygen in the lower lake levels is often reduced, it is seldom depleted. Winter drawdowns on mainstem reservoirs are much less severe than tributaries, so bottom habitats generally remain wetted all year. This benefits benthic organisms, but promotes the growth of aquatic plants in the extensive shallow overbank areas of some reservoirs. Tennessee River mainstem reservoirs generally support healthy fish communities, ranging from approximately 50 to 90 species per reservoir. "Good" to excellent sport fisheries exist, primarily for black bass, crappie, sauger, white bass, striped bass, sunfish and catfish. The primary commercial species are channel catfish, blue catfish and buffalo (TVA 2015a).

3.11.1.1.2 Tributary Reservoirs and Tailwaters

Tributary reservoirs are typically deep and retain water for long periods of time. Facilities on tributary reservoirs include BRF (Clinch River) and JSF (Holston River). The results from retention time and water depth include thermal stratification, the formation of an upper layer that is warmer and well oxygenated, an intermediate layer of variable thickness and a lower layer that is colder and poorly oxygenated. These aquatic habitats are simplified compared to undammed streams and fewer species are found. Aquatic habitats in the tailwater can also be impaired due to a lack of minimum flows and low dissolved oxygen levels which may restrict movement, migration, reproduction and the available food supply for fish and other aquatic organisms. Dams on tributary rivers affect the habitat of benthic invertebrates (benthos), which are a vital part of the food chain of aquatic ecosystems. Benthic life includes worms, snails, crayfish, aquatic insects, mussels and clams. However, as mentioned previously, many benthic organisms have narrow habitat requirements that are not always met in reservoirs or tailwaters below dams.

3.11.1.2 Other Drainages in the TVA Region
The other major drainages within the TVA region (the Cumberland, Mobile and Mississippi river drainages) share a diversity of aquatic life equal to or greater than the Tennessee River drainage. As with the Tennessee River, these river systems have seen extensive human alteration including construction of reservoirs, navigation channels and locks. Despite these changes, as with the Tennessee River drainage, remarkably diverse aquatic communities are present in each of these river systems.

Facilities located in these watersheds include ALF on the Mississippi River, CUF and GAF on the Cumberland River, PAF on the Green River/Ohio River and SHF on the Ohio River (TVA 2015a).

3.11.1.3 Site-Specific Information
TVA ash impoundments are utilized as retention basins and in many cases do not provide suitable or stable habitat for aquatic species. As such, this PEIS addresses aquatic ecology in the streams and reservoirs at TVA facilities that are adjacent to ash impoundments, or in the immediate vicinity of the impoundments. TVA began a program to monitor the ecological conditions of its reservoirs systematically in 1990. Reservoir (and stream) monitoring programs were combined with TVA's fish tissue and bacteriological studies to form an integrated Vital Signs Monitoring Program (VSMP) (TVA 2009). VSMP activities focus on (1) physical/chemical characteristics of waters; (2) physical/chemical characteristics of sediments; (3) benthic macroinvertebrate community sampling; and (4) fish assemblage sampling (Dycus and Baker 2001). Additional site-specific aquatic ecology information is provided in Part II of this PEIS for selected facilities. TVA's decades' worth of monitoring data show no impacts on aquatic species and ecosystems resulting from regular CCR management activities at TVA's plants.

3.11.2 Environmental Consequences

3.11.2.1 Alternative A – No Action
Under the No Action Alternative, TVA will continue to operate ash impoundments at all facilities. Currently, permitted NPDES discharges will remain operational, and discharge characteristics will continue to meet required permit limits. Accordingly, project-related environmental conditions for aquatic resources in the project area would not change under the No Action Alternative.

3.11.2.2 Alternative B – Closure-in-Place
Under Alternative B, ash impoundments will be closed in place using one of two acceptable closure options (see Section 2.2). Primary construction activities will be located within the footprint of the existing impoundments. Dewatering the ash impoundment prior to construction, followed by the installation of an approved cover system would effectively reduce water inputs to the impoundment, thereby eliminating the NPDES permitted discharge. The wastewater discharges during dewatering will meet existing permit limits, and compliance sampling will continue to be performed at the approved outfall structure in accordance with the NPDES permit to demonstrate compliance. Additional monitoring will be undertaken as appropriate to better track discharge constituents.

Because ash impoundments are considered treatment systems and not aquatic habitat, and because laydown areas would avoid encroachment or alteration of streams and water-bodies to the extent practicable, direct impacts to aquatic habitat would primarily be avoided with closure activities. Should minor alterations of surface waters be required to support construction activities (e.g., culverted crossing of stream for construction access road), any activities within areas containing aquatic resources will be appropriately permitted and will utilize approved BMPs.

Indirect impacts to adjacent streams and reservoirs may be associated with storm water runoff due to temporary construction activities associated with site preparation and capping. Any construction activities will adhere to permit limit requirements and will utilize BMPs to minimize indirect effects on aquatic resources during the construction phase. Following the construction phase, care and maintenance of the approved closure system and site-wide management of storm water using appropriate BMPs would minimize indirect impacts to the aquatic community of receiving waters.

3.11.2.3 Alternative C – Closure-by-Removal

Under the Alternative C, TVA proposes to close ash impoundments by removing CCR materials to an off-site landfill. Primary construction activities will be located within the footprint of the existing impoundments. Dewatering the ash impoundment will occur prior to any impoundment construction activities, followed by the excavation and removal of CCR to an approved disposal facility. The wastewater discharges during dewatering will meet existing permit limits, and compliance sampling will continue to be performed at the approved outfall structure in accordance with the NPDES permit to demonstrate compliance. The disposal location of CCR may vary by facility; however, landfills will be appropriately permitted and maintained and would utilize BMPs and adhere to permit limit requirements.

Because ash impoundments are considered treatment systems and not aquatic habitat, and because laydown areas will avoid encroachment or alteration of streams and waterbodies to the extent practicable, direct impacts to aquatic habitat would primarily be avoided with closure activities. Should minor alterations of surface waters be required to support construction activities (e.g., culverted crossing of stream for construction access road), any activities within areas containing aquatic resources will be appropriately permitted and will utilize approved BMPs. Consequently, no direct impacts to aquatic ecosystems are expected from the closure of ash impoundments by the removal of materials.

Indirect impacts to adjacent streams and reservoirs may be associated with storm water runoff due to temporary construction activities associated with removal activities. Any construction activities will adhere to permit limit requirements and will utilize BMPs to minimize indirect effects on aquatic resources during the construction phase. Following the construction phase, care and maintenance of the former impoundment area coupled with site-wide management of storm water using appropriate BMPs would minimize indirect impacts to the aquatic community of receiving waters.

3.12 Threatened and Endangered Species

3.12.1 Affected Environment

The ESA of 1973 (ESA 16 USC §§ 1531-1543) was passed to conserve the ecosystems upon which endangered and threatened species depend and to conserve and recover those species. An endangered species is defined by the ESA as any species in danger of extinction throughout all or a significant portion of its range. A threatened species is likely to become endangered within the foreseeable future throughout all or a significant part of its range. Critical habitats, essential to the conservation of listed species, also can be designated under the ESA. The ESA establishes programs to conserve and recover endangered and threatened species and makes their conservation a priority for federal agencies. Under Section 7 of the ESA, federal agencies are required to consider the potential effects of their proposed action on endangered and threatened species and critical habitats. If the proposed action may affect these resources, the Federal agency is required to consult with the USFWS.

All seven states in the TVA region have enacted laws protecting endangered and threatened species. In a few states, only species listed under the federal ESA receive legal protection under these laws. In other states, the legal protections also apply to additional species designated by the state. As a federal agency, TVA is not subject to these state laws, but it considers them in its environmental reviews as appropriate.

Thirty-one species of plants, one lichen and 124 species of animals in the TVA region are listed under the ESA as endangered or threatened or formally proposed for such listing by the USFWS. An additional 11 species in the TVA region have been identified by the USFWS as candidates for listing under the ESA. These candidate species receive no statutory protection under the ESA but by definition may warrant future protection. Several areas across the TVA region are also designated as critical habitat essential to the conservation of listed species. In addition to the species listed under the ESA, about 1,600 plant and animal species are formally listed as protected species by one or more of the states or otherwise identified as species of conservation concern (TVA 2015b).

The highest concentrations of terrestrial and aquatic species listed under the ESA occur in the Blue Ridge, Appalachian Plateaus and Interior Low Plateau regions. Relatively few listed species occur in the Coastal Plain and Mississippi Alluvial Plain regions. The taxonomic groups with the highest proportion of species listed under the ESA are fish and mollusks. Factors contributing to the high proportions of vulnerable species in these groups include the high number of endemic species in the TVA region and habitat degradation. River systems in the TVA region with the highest numbers of listed aquatic species include the Tennessee, Cumberland and Coosa rivers (TVA 2015b).

At least 16 species listed or proposed for listing under the ESA occur on or very near TVA generating facility reservations (TVA 2015b). These include the following:

- Large-flowered skullcap (*Scutellaria montana*) – Threatened
- Ruth's golden aster (*Pityopsis ruthii*) – Endangered
- Gray bat (*Myotis grisescens*) – Endangered
- Northern long-eared bat (*Myotis septentrionalis*) – Threatened
- Indiana bat *(Myotis sodalis)* – Endangered
- Dromedary pearlymussel (*Dromus dromas*) – Endangered
- Fanshell (*Cyprogenia stegaria*) – Endangered
- Pink mucket (*Lampsilis abrupta*) – Endangered
- Ring pink (*Obovaria retusa*) – Endangered
- Rough pigtoe (*Pleurobema plenum*) – Endangered
- White wartyback (*Plethobasis cicatricosus*) – Endangered
- Fluted Kidneyshell (*Ptychobranchus subtentum*) – Endangered
- Rabbitsfoot (*Quadrula cylindrica* – Threatened
- Slabside pearlymussel (*Lexingtonia dolabelloides* – Endangered
- Spectaclecase (*Cumberlandia monodonta*) – Endangered
- Anthony's river snail (*Athernia anthonyi*) – Endangered

3.12.2 Environmental Consequences

3.12.2.1 Alternative A – No Action

Under the No Action Alternative, TVA will not close ash impoundments at any of the coal-fired plants, but TVA eventually will cease using them as it changes from wet CCR management systems to dry systems. Threatened and endangered species would not be impacted under this alternative.

3.12.2.2 Alternative B – Closure-in-Place

Closure-in-Place impacts would be limited to the ash impoundments (permanent impacts) and construction laydown areas (temporary impacts). With this alternative, ash impoundments will be dewatered, filled/graded, covered, and restored with herbaceous cover or engineered turf. Laydown areas will be temporarily used for material/equipment staging during construction and subsequently restored to existing conditions. Ash impoundments are located in areas currently used for industrial purposes, and necessary borrow material would be obtained from previously permitted sites. Because the areas of permanent and temporary use impacted by this action are already highly disturbed, impacts to threatened and endangered species are not anticipated. If trees are removed as part of this action, the site will be evaluated for potential bat roost suitability followed by consultation with the USFWS if appropriate. Using this approach, trees will be removed in accordance with established USFWS guidelines thus avoiding or minimizing impacts to listed bat species. For sites that require limited tree removal, potential impacts to threatened and endangered species would be minor.

3.12.2.3 Alternative C – Closure-by-Removal

In this closure alternative, CCR material will be entirely removed and the impoundment dewatered, filled/graded with earthen material prior to restoration with native plants. Because the areas of permanent and temporary use impacted by this action are already highly disturbed, impacts to threatened and endangered species are not anticipated. If trees are removed as part of this action, the site will be evaluated for potential bat roost suitability followed by consultation with the USFWS if appropriate. Using this approach, trees will be removed in accordance with established USFWS guidelines thus avoiding or minimizing impacts to listed bat species. For sites that require limited tree removal potential impacts to threatened and endangered species would be minor.

3.13 Wetlands

3.13.1 Affected Environment

The USACE regulates the discharge of fill material into waters of the United States, including wetlands pursuant to Section 404 of the CWA (33 USC 1344). Additionally, EO 11990 (Protection of Wetlands) requires federal agencies to avoid, to the extent possible, adverse impact to wetlands and to preserve and enhance their natural and beneficial values. Under the CCR Rule EPA recognized the sensitivity of wetland environments and adopted a prohibition on locating CCR surface impoundments and new CCR landfills, as well as lateral expansions of existing CCR units, in wetlands (EPA 2015).

As defined in the Section 404 of the CWA, wetlands are those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas.

Wetlands and wetland fringe areas can also be found along the edges of many watercourses and impounded waters (both natural and man-made). Wetland habitat provides valuable public benefits including flood storage, erosion control, water quality improvement, wildlife habitat and recreation opportunities.

Wetlands occur across the TVA region and are most extensive in the south and west where they comprise 5 percent or more of the landscape (TVA 2015a). Wetlands in the TVA region consist of two main systems: palustrine wetlands such as marshes, swamps and bottomland forests dominated by trees, shrubs and persistent emergent vegetation; and lacustrine wetlands that are associated with lakes and reservoirs such as aquatic bed wetlands (Cowardin et al. 1979). Riverine wetlands associated with moving water within a stream channel are also present. The TVA reservoir system includes almost 200,000 ac of wetlands, which are more prevalent on mainstem reservoirs and tailwaters rather than tributary reservoirs and tailwaters (TVA 2015a). The most abundant type of wetland in this area is forested, while other types include aquatic beds and flats, ponds, scrub/shrub wetlands and emergent wetlands.

Emergent wetland habitat may occur on TVA generating facility sites, often in association with ash disposal and water treatment impoundments. The recently issued Clean Water Rule (80 Federal Register 37053) confirmed that waste treatment systems are excluded from the definition of waters of the United States under Section 404 of the CWA. While excluded from regulation under CWA Section 404, these impoundments can have ecological value such as providing wildlife habitat.

3.13.2 Environmental Consequences

3.13.2.1 Alternative A – No Action

Under the No Action Alternative, TVA will not close ash impoundments at any of the coal-fired power plants. There would be no direct impact to wetland resources as no alterations or construction activities would occur to or near wetlands. Regular maintenance of berms at the ash impoundments would not generally affect emergent wetlands along the fringe of an impoundment as maintenance includes mowing, filling in animal burrows and other similar activities.

3.13.2.2 Alternative B – Closure-in-Place

Ash impoundments are located in areas currently used for industrial purposes and necessary borrow material would be obtained from previously permitted sites. At a given TVA site, an ash impoundment may include an open water area with surrounding wetland fringe habitat. Closure of the impoundment in-place will include draining impounded water, filling the impoundment with material and restoring the site with native herbaceous vegetation or an engineered turf system. While the impoundment may provide wetland habitat, the ash impoundments are not under the jurisdiction of the USACE and are not considered “jurisdictional waters” subject to regulation under the CWA. Therefore, there would be no direct impacts to regulated wetlands associated with construction activities within ash impoundments. Associated impacts to vegetation and wildlife within these impoundments are discussed in Sections 3.9 and 3.10, respectively. Temporary laydown areas will not be located in wetland areas but in previously disturbed upland areas (e.g., cleared and graded). Borrow material will be obtained from existing permitted areas and wetland impacts, if any, would have been evaluated and addressed during the borrow area permitting process.

Potential temporary indirect impacts resulting from construction activities could include erosion and sedimentation from storm water runoff into adjacent receiving wetland areas. In order to minimize potential indirect impacts to wetlands, TVA will follow standard construction BMPs to reduce the potential for construction related sedimentation. Upon completion of construction activities, the area will be restored to as close to the original state as possible and in accordance with applicable permits.

In some instances, adjacent narrow wetland fringe communities may occur as a result of lateral movement of water (seepage) through the impoundment berms. Other wetlands downstream of the impoundments may receive water from the ash impoundment outlets. In such cases, indirect impacts to adjacent wetlands may occur from closure of the impoundments themselves as this would likely interrupt the source of wetland hydrology. However, based on a review of aerial photography, water released from the impoundment outlets typically flows directly to a stream or larger waterbody such that, if wetlands did exist downstream of the impoundments, their primary source of hydrology is not likely the ash impoundments. Substantial changes in wetland hydrology or hydroperiod are therefore, not expected. Based on the results of site-specific wetland delineation efforts, TVA design and construction teams will avoid wetland resources and where not feasible, will mitigate for any project-related wetland loss as necessary.

Direct impacts to wetlands are not anticipated under the Closure-in-Place Alternative. Minor indirect impacts may occur during the construction phase, but those impacts would be minimized through the implementation of BMPs.

3.13.2.3 Alternative C – Closure-by-Removal

As with Alternative B, closure activities under this alternative will result in the elimination of ash impoundments. However, because ash impoundments are not regulated under Section 404 of the CWA, no direct impacts to waters of the United States are anticipated from impoundment closure activities with this alternative. Associated impacts to wildlife and vegetation within these impoundments are discussed in Sections 3.9 and 3.10. All CCR material will be removed and transported to a permitted landfill (either off-site or on-site), thus additional direct impacts to wetland resources would not be incurred. Impacts to wetlands from construction of the temporary laydown areas and/or borrow areas are not expected.

As with Alternative B, indirect construction activities associated with impoundment closure could result in temporary impacts, including sedimentation from storm water runoff during the construction period as well as indirect impacts to adjacent wetlands from ash impoundment dewatering. Temporary indirect impacts would be minimized through implementation of construction-phase BMPs. Based on the results of site-specific wetland delineation efforts, TVA design and construction teams will avoid wetland resources and where not feasible, will then mitigate for any project-related wetland loss as necessary.

Direct impacts to wetlands are not anticipated under the Closure-by-Removal Alternative. Minor indirect impacts may occur during the construction phase, but those impacts will be minimized through the implementation of BMPs.

3.14 Socioeconomics and Environmental Justice

The proposed action involves closure of existing ash impoundments at TVA's coal-fired power plants. Following the completion of construction activities, there will be no operational activities. Some routine periodic maintenance activities are expected but these will be minor. Therefore, the assessment of socioeconomic impacts will be limited to construction activities.

Construction activities may result in positive or negative effects on the local or regional economies as well as positive or negative effects on various socioeconomic groups. The purpose of the socioeconomics analysis is to identify the potential effects of the alternatives on the economy and socioeconomic groups, and to identify any potential measures that would be taken to avoid, minimize, or mitigate negative impacts. In addition, an environmental justice analysis was performed consistent with EO 12989. The purpose of the environmental justice analysis is to determine whether ash impoundment closure activities would result in disproportionate negative environmental impacts on low-income households or minorities.

The data used in this analysis is a combination of US Census Bureau (USCB) Census 2010 and the USCB 2013 and 2014 estimated populations. Regional population, economic and employment, income, and minority data for the affected environment were taken from the Integrated Resource Plan (TVA 2015b).

Impacts to community services and facilities such as cemeteries, churches, primary and secondary education facilities, electricity, fire and emergency medical services, hospitals and police, are normally analyzed in the environmental review of large projects or for major modifications to existing facilities.

3.14.1 Affected Environment

TVA provides electric power or has large generating facilities in a service area that encompasses 202 counties in a seven-state region (Figure 3-5). The estimated population of the TVA PSA was 9.74 million in 2013 (TVA 2015b). This represents a 16 percent increase over the 2000 population (approximately 8.40 million) and a 1.9 percent increase over the 2010 population (approximately 9.56 million). The rate of increase from 2000 to 2013 is greater than the 13.4 percent increase for the United States as a whole and the 14.3 percent increase for the Southern United States. The 2010-2013 rate of increase for the TVA region is lower than both the national rate of 2.5 percent and the rate for the Southern United States of 3.3 percent. The annual rate of population growth in the TVA region is expected to continue to decline to about 0.5 percent by 2043 (TVA 2015b).

Population varies greatly among the counties in the service area (see Figure 3-5). The larger population concentrations tend to be located along major river corridors: the Tennessee River and its tributaries from northeast Tennessee through Knoxville and Chattanooga into north Alabama; the Nashville area around the Cumberland River; and the Memphis area on the Mississippi River. Low population counties are scattered around the region, but most are in Mississippi, the Cumberland Plateau of Tennessee, and the Highland Rim of Tennessee and Kentucky.

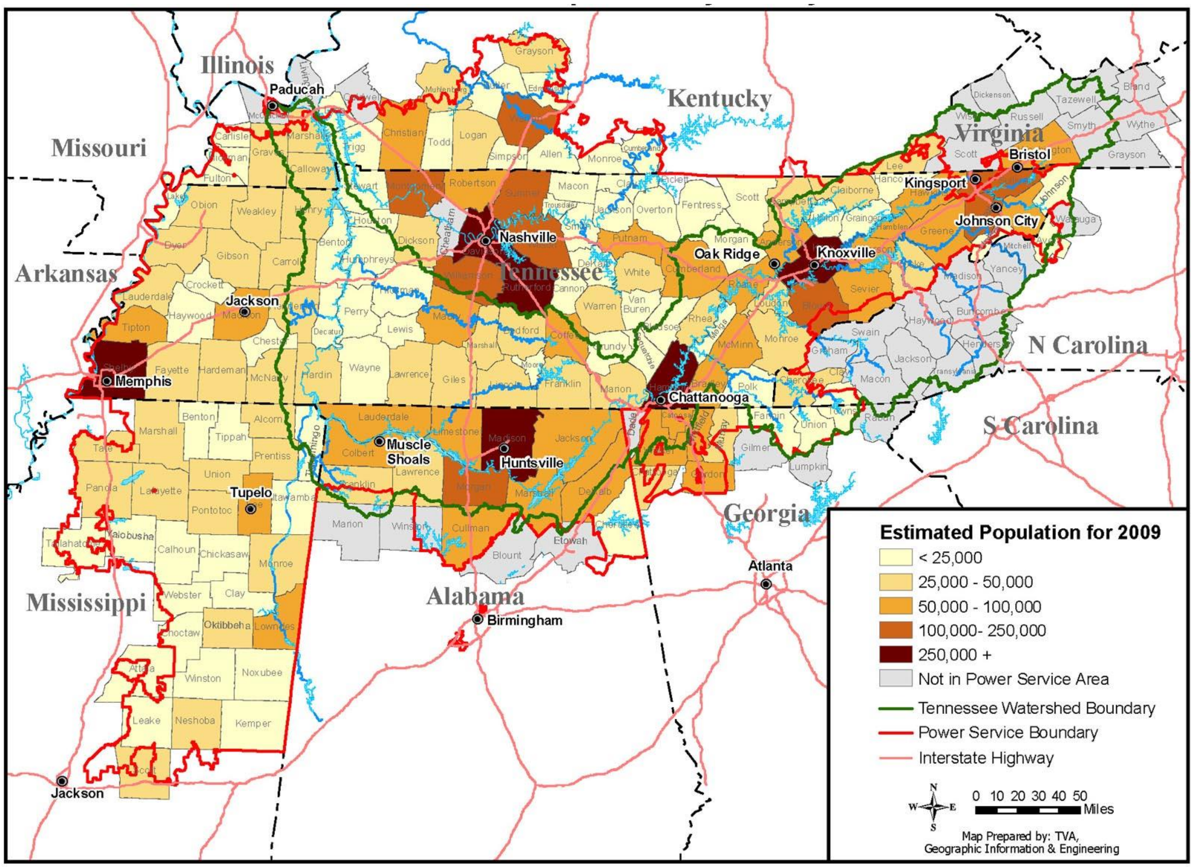


Figure 3-5. TVA Region Estimated 2009 Population by County (TVA 2015b)

TVA has operated coal-fired plants in 11 counties within the TVA service area. Given the scale of the closure activities, it is likely that any socioeconomic impacts would occur on a local rather than regional scale. Therefore, where applicable, the affected environment for socioeconomics is the geographic areas specific to the locations of TVA coal-fired power plants as this scale provides a more effective definition for socioeconomic factors that may be affected by the proposed action. Socioeconomic characteristics of the 11 counties and cities near the location of TVA coal-fired power plants is summarized in Tables 3-8 through 3-10.

Table 3-8. Summary of Demographic Data for Counties in Alabama and Kentucky Near TVA Coal-Fired Plants

Demographic Characteristic	Alabama Colbert County	Alabama Jackson County	Alabama State Totals	Kentucky McCracken County	Kentucky Muhlenberg County	Kentucky State Totals
Population						
Population, 2014 Estimate	54,543	52,665	4,849,377	65,316	31,207	4,413,457
Population, 2013 Estimate	54,499	52,944	4,833,996	65,380	31,244	4,399,583
Population (2010)	54,428	53,227	4,779,736	65,565	31,499	4,339,367
Percent Change (2010-2014)	0.2%	-1.1%	1.4%	-0.4%	-0.9%	1.7%
Percent Change (2010-2013)	0.1%	-0.5%	1.1%	-0.3%	-0.8%	1.4%
Persons Under 5 Years (2013)	5.7%	5.4%	6.1%	5.8%	5.1%	6.3%
Persons Under 18 years (2013)	21.7%	22.0%	23.0%	21.8%	21.1%	23.1%
Persons 65 Years Over (2013)	18.1%	18.1%	14.9%	17.8%	17.5%	14.4%
Racial Characteristics						
White Alone (2013)*	80.8%	91.8%	69.8%	85.7%	93.5%	88.5%
Black or African American Alone (2013)*	16.4%	3.4%	26.6%	11.0%	5.0%	8.2%
American Indian and Alaska Native Alone (2013)*	0.6%	1.6%	0.7%	0.3%	0.2%	0.3%
Asian Alone (2013)*	0.5%	0.5%	1.3%	0.9%	0.2%	1.3%
Native Hawaiian and Other Pacific Islander Alone (2013)*	0.0%	0.1%	0.1%	0.0%	0.0%	0.1%
Two or More Races (2013)	1.6%	2.6%	1.5%	2.1%	1.1%	1.7%
Hispanic or Latino (2013)†	2.5%	2.8%	4.1%	2.3%	1.4%	3.3%
Economic Characteristics						
Per Capita Income in Past 12 months (2013 dollars)	$21,572	$20,486	$23,680	$25,957	$20,008	$23,462
Median Household Income (2009-2013)	$39,077	$37,634	$43,253	$44,898	$38,105	$43,036
Persons Below Poverty Level (2009-2013)	17.9%	16.0%	18.6%	16.2%	20.4%	18.8%
Housing						
Housing Units (2013)	25,957	24,599	2,189,938	31,218	13,585	1,936,565
Homeownership Rate (2009-2013)	72.1%	75.2%	69.7%	68.1%	79.1%	68.4%
Median Value of Owner-Occupied Housing Units (2009-2013)	$99,300	$93,400	$122,500	$117,200	$79,500	$120,400
Households, 2009-2013	22,260	20,765	1,838,683	27,037	11,869	1,694,996
Persons per Household, 2009-2013	2.4	2.5	2. 5	2.4	2.5	2.5

Source: USCB State and County QuickFacts 2014

* Includes persons reporting only one race

† Hispanics may be of any race, so also are included in applicable race categories.

Table 3-9. Summary of Demographic Data for Counties in Tennessee Near TVA Coal-Fired Plants

Demographic Characteristics	Tennessee Anderson County	Hawkins County	Houston County	Humphreys County	Roane County	Shelby County	Sumner County	State Totals
Population, 2014 Estimate	75,528	56,735	8,267	18,135	52,748	938,803	172,706	6,549,352
Population, 2013 Estimate	75,494	56,831	8,295	18,245	52,971	939,365	169,114	6,497,269
Population, 2010	75,129	56,833	8,426	18,538	54,181	927,644	160,645	6,346,105
Percent Change (2010-2014)	0.5%	-0.2%	-1.9%	-2.2%	-2.6%	1.2%	7.5%	3.2%
Percent Change (2010-2013)	0.5%	0%	-1.6%	-1.6%	-2.2%	1.3%	5.3%	2.4%
Persons Under 5 years (2013)	5.3%	5.1%	5.2%	5.6%	4.6%	7.2%	6.0%	6.2%
Persons Under 18 years (2013)	21.1%	21.3%	22.0%	22.0%	20.0%	25.7%	24.5%	23.0%
Persons 65 Years Over (2013)	18.5%	18.7%	19.2%	18.6%	20.6%	11.2%	14.2%	14.7%
White Alone (2013)*	92.2%	96.6%	94.4%	94.9%	94.6%	42.6%	89.8%	79.1%
Black or African American Alone (2013)*	4.2%	1.5%	3.0%	2.8%	2.7%	53.1%	6.9%	17.0%
American Indian and Alaska Native Alone (2013)*	0.4%	0.3%	0.3%	0.6%	0.4%	0.3%	0.3%	0.4%
Asian Alone (2013)*	1.2%	0.5%	0.4%	0.4%	0.6%	2.5%	1.3%	1.6%
Native Hawaiian and Other Pacific Islander Alone (2013)*	0.0%	0	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%
Two or More Races (2013)	1.9%	1.1%	1.9%	1.3%	1.7%	1.4%	1.6%	1.7%
Hispanic or Latino (2013)†	2.4%	1.3%	2.2%	2.0%	1.6%	5.9%	4.2%	4.9%
Per Capita Income in Past 12 Months (2013 Dollars)	$24,561	$20,662	$18,539	$22,183	$23,936	$25,549	$27,795	$24,409
Median household income (2009-2013)	$43,620	37357	$35,271	$42,846	$42,223	$46,250	$55,509	$44,298
Persons below poverty level (2009-2013)	18.2%	16.2%	23.5%	13.9%	15.0%	20.8%	10.4%	17.6%
Housing Units (2013)	34,591	26,673	4,146	8,833	25,496	401,149	67,143	2,840,914
Homeownership Rate (2009-2013)	68.5%	76.9%	70.1%	77.8%	74.4%	59.2%	72.9%	67.8%
Median Value of Owner-Occupied Housing Units (2009-2013)	$127,000	$108,900	$87,300	$108,000	$120,300	$132,700	$176,600	$139,200
Households, 2009-2013	30,548	23,348	3,423	7,396	22,117	343,517	60,835	2,475,195
Persons per Household, 2009-2013	2.4	2.4	2.4	2.5	2.4	2.7	2.7	2.5

Source: USCB State and County QuickFacts 2014

* Includes persons reporting only one race

† Hispanics may be of any race, so also are included in applicable race categories.

Table 3-10. Demographic Characteristics of Cities with TVA Coal-Fired Plants (Alabama, Kentucky, Tennessee)

	Alabama		Kentucky		Tennessee						
Demographic	**Tuscumbia**	**Stevenson**	**Paducah**	**Drakeboro**	**Clinton**	**Rogersville**	**Cumberland City**	**New Johnsonville**	**Harriman**	**Memphis**	**Gallatin**
Population Data											
Population, 2014 estimate	8,529	2,002	24,978	509	9,889	4,406	304	1894	6,219	656,861	33,347
Population, 2013 estimate	8,558	2,018	24,987	509	9,882	4,419	307	1909	6,243	658,508	32,354
Population, 2010	8,423	2,046	25,024	515	9,841	4,427	311	1960	6,350	646,889	30,278
Percent change 2010-2014	1.2%	-2.2%	-0.2%	-1.2%	0.5%	-0.5%	-2.3%	-3.5%	-2.1%	1.5%	9.2%
Percent change 2010-2013	1.6%	-1.4%	-0.1%	-1.2%	0.4%	-0.2%	-1.3%	-2.77%	-1.7%	1.8%	6.4%
Persons under 5 years, 2009-2013	5.1%	3.2%	7.0%	6.0%	4.2%	4.4%	12.1%	6.0%	8.3%	7.5%	7.5%
Persons under 18 years, 2009-2013	21.90%	24.6%	13.6%	28.7%	19.6%	19.3%	29.2%	25.1%	22.9%	25.6%	24.2%
Persons 65 years and over, 2009-2013	21.4%	10.3%	18.6%	12.8%	20.8%	21.9%	9.3%	11.5%	21.4%	10.5%	13.6%
Racial Characteristics											
White alone[1]	76.5%	80.6%	73.3%	90.7%	95.3%	95.4%	59.2%	94.8%	89.7%	30.4%	82.3%
Black or African American alone[1]	19.5%	14.6%	21.2%	8.9%	2.0%	2.6%	26.6%	0.9%	4.9%	63.0%	14.5%
American Indian and Alaska Native alone[1]	0.7%	0.0%	0.5%	0.0%	0.0%	1.3%	0.4%	0.4%	0.0%	0.2%	0.1%
Asian alone[1]	0.0%	0.4%	0.5%	0.0%	0.7%	0.0%	0.0%	0.5%	0.7%	1.7%	0.7%
Native Hawaiian and Other Pacific Islander alone[1]	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Two or More Races	3.3%	4.0%	4.2%	0.4%	1.7%	0.7%	13.8%	1.8%	4.0%	1.7%	0.6%
Hispanic or Latino[2]	1.0%	1.9%	2.2%	1.0%	1.4%	0.2%	0.9%	2.1%	3.1%	6.4%	8.2%
Economic Characteristics											
Per capita money income in past 12 months (2013 dollars)	$21,016	$18,795	$22,984	$17,004	$21,829	$16,913	$12,920	$26,208	$16,405	$21,454	$26,596
Median household income	$35,545	$34,601	$34,679	$31,458	$40,156	$23,444	$30,000	$55,000	$26,152	$36,912	$46,102
Persons below poverty level	17.5%	21.8%	22.4%	21.9%	12.3%	25.7%	25.6%	9.0%	24.3%	26.9%	14.4%
Housing											
Housing units	4,163	1,059	13,067	259	4,550	2,356	233	806	3,515	294,641	13,353
Homeownership rate	63.7%	63.2%	49.3%	89.6%	59.8%	48.4%	60.1%	81.7%	59.0%	51.1%	57.9%
Median value of owner-occupied housing units	$92,600	$79,300	$100,900	$55,000	$128,100	$103,500	$68,300	$100,800	$85,400	$95,900	$159,000
Households	3,709	935	11,186	201	4,322	2,356	178	726	2,586	245,182	12,083
Persons per household	2.2	2.5	2.1	2.7	2.2	2.2	3.5	2.7	2.3	2.6	2.5

[1] Includes persons reporting only one race

[2] Hispanics may be of any race, so also are included in applicable race categories.

Source: USCB State and County QuickFacts 2014 and USCB American Community Survey 2009-2013

3.14.1.1 Demographics

An increasing proportion of the region's total population (66.1 percent in 2000, 68.1 percent in 2010 and 68.6 percent in 2013) live in metropolitan areas. Five of the counties with TVA coal-fired power plants are located in metropolitan areas.

- ALF is located in the Memphis, Tennessee metropolitan area.
- COF is located in the Florence-Muscle Shoals, Alabama metropolitan area.
- JSF is located in the Kingsport-Bristol, Bristol, Tennessee-VA metropolitan area.
- KIF is located in the Knoxville, Tennessee metropolitan area.
- GAF is located in the Nashville, Davidson, Murfreesboro, Franklin metropolitan area.

Although some plants are included within the boundaries of the metropolitan areas, the coal-fired power plants are generally located in the more remote, less populated regions of these metropolitan areas.

Current estimates of population within counties outside of the metropolitan areas range from a high of 75,528 in Anderson County, Tennessee to a low of 8,267 in Houston County, Tennessee. As with the coal-fired power plants located in the metropolitan areas, plants outside of metropolitan areas are generally located in less populated areas of the county.

In general, population growth in the 11 counties with coal-fired power plants has remained relatively steady. Between 2010 and 2014, population increases in the counties ranged from 0.2 percent in Colbert County, Alabama to 7.0 percent in Sumner County, Tennessee. During this same period, population increases in nearby cities ranged from 0.5 percent in Clinton, Kentucky to 9.2 percent in Gallatin, Tennessee. Population losses during this period ranged from a low 0.2 percent in Hawkins County, Tennessee to a 2.7 percent loss in Roane County, Tennessee. Population losses in the nearby cities ranged from a low of 0.2 percent in Paducah, Kentucky to a loss of 3.5 percent in New Johnsonville, Tennessee. These numbers are comparable to overall population growth in Tennessee, Alabama and Kentucky; each of which experienced modest population growth during that time period. In contrast, there was a notable increase in population from 2010 to 2014 in the area around GAF. The population of Sumner County increased by 7.5 percent during this period and the population of Gallatin, Tennessee, located within 5 mi northwest of GAF increased by 9.25 percent.

A household includes all the persons who occupy a housing unit as their usual place of residence (USCB 2015). A household may consist of a person living alone or multiple unrelated individuals or families living together. The number of households in the 11-county area ranges from 3,423 in the county with the lowest population (Houston County, Tennessee) to 343,517 in the county with the highest population (Shelby County, Tennessee) (see Tables 3-8 and 3-9). The average household size in the 11-county area is 2.5 persons. These trends are also reflected in the data for cites near the coal-fired power plants (see Table 3-10).

The minority population (i.e., all non-white racial groups combined and Hispanic or Latino) of the region, as of 2013, is estimated to be about 2.4 million or 24.5 percent of the region's total population of about 9.7 million (TVA 2015b). This is well below the national average minority population of 37.4 percent. About 4.5 percent of minorities in the region are white Hispanic and the rest are nonwhite. Minority populations are largely concentrated in the metropolitan areas in the western half of the region and in rural counties in Mississippi and western Tennessee.

Racial characteristics in the 11 counties which include coal-fired plants are primarily white which is similar to the state-wide values for Alabama, Kentucky and Tennessee (see Tables 3-8 and 3-9), except for Shelby County, Tennessee where minority populations (specifically black or African American) represent 53 percent of the population. This statistic is also reflected in the data for the cities near the coal-fired plants (see Table 3-10). These populations are primarily white except for the city of Memphis, where black or African Americans comprise 63 percent of the population. Other minority racial and ethnic groups present in the 11-county area and selected cities are generally at or below comparative rates for corresponding counties and states.

The estimated poverty level for the TVA region, as of 2013, is 18.5 percent, an increase from 15.8 percent in 2008 and higher than the 2013 national poverty level of 15.8 percent (TVA 2015b). Poverty rates in the 11-county area range from a low of 13.9 percent in Humphreys County, Tennessee to 23.5 percent in Houston County, Tennessee (see Tables 3-8 and 3-9). For cities near the fossil-fuel plants, poverty rates range from 9 percent in New Johnsonville, Tennessee to almost 27 percent in Memphis, Tennessee. Poverty rates for Alabama, Kentucky and Tennessee are 18.6 percent, 18.8 percent and 17.6 percent, respectively (see Table 3-10).

There are over 330,000 housing units in cites proximate to the TVA coal-fired power plants (see Table 3-10). Over half of the housing units are owner-occupied, except in Paducah, Kentucky and Rogersville, Tennessee where the homeownership rate is slightly below 50 percent. Median household values range from a high of $159,000 in the Gallatin, Tennessee to a low of $55,000 in Drakeboro, Kentucky. The average median housing value in the cities near the coal-fired plants is $94,317, which is lower than the corresponding median value for Alabama, Kentucky and Tennessee ($127,367) (Tables 3-8 and 3-9).

It is anticipated that the local workforce would be utilized to complete ash impoundment closure and perform maintenance activities so there would be no need for transient housing. Considering the relative size of the anticipated workforce, if some short-term accommodations are needed, existing hotels and motels would be available.

3.14.1.2 Economic Conditions

Manufacturing employment comprises about 11 percent of employment in the TVA region. The service sector is also a significant share of the regional economy. The service sector and other non-farming, non-manufacturing sectors of the regional economy have continued to grow, increasing by about 21 percent and 9 percent, respectively, in the region since 2000. Farm employment comprises about 3 percent of regional employment (TVA 2015b).

The total labor force within the 11 counties that contain TVA coal-fired power plants is 719,275 (Table 3-11). Occupations providing the greatest employment include those that involve production and transportation and office and administrative services. Occupations employing the least number of people in the selected counties include protective services, personal services and computer, engineering and science related occupations.

Table 3-11. Occupational Characteristics

	Management and Business	Computer, Engineering and Science	Education, Legal, Arts and Social	Healthcare and Healthcare Support	Protective Services	Food preparation and Service	Construction and Maintenance	Personal care Services	Sales	Office and Administrative Support	Natural Resources	Production and Transportation	Total Employed Population
Alabama													
Colbert County													
Employees	2,095	554	1,680	2,067	395	1,184	880	420	2,277	2,976	2,399	4,543	**21,470**
Percent	9.8%	2.6%	7.8%	9.6%	1.8%	5.5%	4.1%	2.0%	10.6%	13.9%	11.2%	21.2%	100.0%
Jackson County													
Employees	1,712	669	1,776	1,793	552	1,015	754	543	1,732	2,569	2,968	5,163	**21,246**
Percent	8.1%	3.1%	8.4%	8.4%	2.6%	4.8%	3.5%	2.6%	8.2%	12.1%	14.0%	24.3%	100.0%
Kentucky													
McCracken County													
Employees	3,260	1,180	2,679	2,919	591	2,097	1,051	806	3,480	4,000	2,566	3,890	**28,519**
Percent	11.4%	4.1%	9.4%	10.2%	2.1%	7.4%	3.7%	2.8%	12.2%	14.0%	9.0%	13.6%	100.0%
Muhlenberg													
Employees	777	261	1,436	1,141	491	498	337	295	887	1,197	1,658	2,601	**11,579**
Percent	6.7%	2.3%	12.4%	9.9%	4.2%	4.3%	2.9%	2.5%	7.7%	10.3%	14.3%	22.5%	100.0%
Tennessee													
Anderson County													
Employees	3,556	2,684	2,678	2,663	594	1,739	1,361	813	3,602	4,553	2,853	4,044	**31,140**
Percent	11.4%	8.6%	8.6%	8.6%	1.9%	5.6%	4.4%	2.6%	11.6%	14.6%	9.2%	13.0%	100.0%
Hawkins County													
Employees	1,739	903	1,630	2,741	392	955	714	659	2,076	2,627	2,658	5,201	**22,295**
Percent	7.8%	4.1%	7.3%	12.3%	1.8%	4.3%	3.2%	3.0%	9.3%	11.8%	11.9%	23.3%	100.0%

Table 3-11. Occupational Characteristics

	Management and Business	Computer, Engineering and Science	Education, Legal, Arts and Social	Healthcare and Healthcare Support	Protective Services	Food preparation and Service	Construction and Maintenance	Personal care Services	Sales	Office and Administrative Support	Natural Resources	Production and Transportation	Total Employed Population
Houston County													
Employees	275	24	128	299	43	139	110	63	201	402	746	652	**3,082**
Percent	8.9%	0.8%	4.2%	9.7%	1.4%	4.5%	3.6%	2.0%	6.5%	13.0%	24.2%	21.2%	100.0%
Humphreys County													
Employees	780	109	542	713	171	485	248	221	499	857	1,226	1,632	**7,483**
Percent	10.4%	1.5%	7.2%	9.5%	2.3%	6.5%	3.3%	3.0%	6.7%	11.5%	16.4%	21.8%	100.0%
Roane County													
	2,128	1,438	1,643	1,982	661	988	819	691	2,120	3,079	2,784	3,161	**21,494**
	9.9%	6.7%	7.6%	9.2%	3.1%	4.6%	3.8%	3.2%	9.9%	14.3%	13.0%	14.7%	100.0%
Shelby County													
	59,087	16,529	44,786	31,552	12,054	22,439	18,020	13,209	47,816	64,252	28,570	59,348	**417,662**
	14.1%	4.0%	10.7%	7.6%	2.9%	5.4%	4.3%	3.2%	11.4%	15.4%	6.8%	14.2%	**100.0%**
Sumner County													
	11,681	2,813	8,269	5,767	1,737	4,353	2,291	2,066	9,483	12,540	6,849	9,738	**77,587**
	15.1%	3.6%	10.7%	7.4%	2.2%	5.6%	3.0%	2.7%	12.2%	16.2%	8.8%	12.6%	100.0%

Source: USCB State and County American Community Survey 2013

In November 2014, the average unemployment rate for counties in the TVA region was 6.9 percent. The counties with the highest unemployment rates in the TVA region are somewhat concentrated in east-central Mississippi, in non-urban counties near the Mississippi River, and in the northern Cumberland Plateau in Tennessee. The metropolitan areas generally had lower unemployment rates (TVA 2015).

Unemployment rates for the 11 counties that contain TVA coal-fired power plants are generally lower than the average for the region as a whole. Unemployment rates range from a low of 4.2 percent in Muhlenberg County, Kentucky to a high of 7.6 percent in Shelby County, Tennessee. Unemployment rates in the 11 counties that contain TVA coal-fired plants are summarized in Table 3-12.

Table 3-12. Summary of Employment and Unemployment Data for Counties with TVA Fossil Fuel Plants

County/State	Population >Age 16	Civilian Labor Force	Employed	Unemployed	Percent of Total Population	Percent of Civilian Labor Force
Alabama						
Colbert County	44,170	23,852	21,470	2,382	5.4%	10.0%
Jackson County	42,919	23,648	21,246	2,402	5.6%	10.2%
State Total	3,806,434	2,261,022	2,002,163	258,859	6.8%	11.4%
Kentucky						
McCracken	52,566	31,119	28,519	2,600	4.9%	8.4%
Muhlenberg	25,514	12,655	11,579	1,076	4.2%	8.5%
State Total	3,454,107	2,075,918	1,857,767	218,151	6.3%	10.5%
Tennessee						
Anderson	60,940	34,248	31,140	3,108	5.1%	9.1%
Hawkins	45,721	25,055	22,295	2,760	6.0%	11.0%
Houston	6,611	3,424	3,082	342	5.2%	10.0%
Humphrey	14,714	8,546	7,483	1,081	7.3%	12.6%
Roane	44,088	24,072	21,494	2,578	5.8%	10.7%
Shelby	718,581	472,108	417,662	54,446	7.6%	11.5%
Sumner	127,542	84,178	77,587	6,591	5.2%	7.8%
State Total	5,078,433	3,138,472	2,806,948	331,524	6.5%	10.6%

Source: USCB American Community Survey 2013

Per capita personal income in the TVA region in 2013 averaged $37,463, about 84 percent of the national average of $44,765. While income levels in the region have increased relative to the nation over the past several decades, average income is still below the national level.

Incomes in the TVA region are included on Tables 3-8, 3-9 and 3-10. Average per capita income in the 11-county area is below the regional statistic, $22,841 ($20,193 for the cities near the coal-fired plants). The average median household income is $42,072 ($35,823 for the cities near the coal-fired plants).

3.14.1.3 Environmental Justice

On February 11, 1994, President Clinton signed EO 12898 Federal Actions to Address Environmental Justice in minority and low-income populations. This EO mandates some federal agencies to consider Environmental Justice (EJ) when identifying and addressing disproportionately high and adverse human health or environmental effects of its programs, policies and activities on minority populations and low-income populations. While TVA is not subject to this EO, TVA applies it as a matter of policy.

The analysis of the impacts of ash impoundment closure activities on EJ issues follows guidelines described in the CEQs EJ Guidance under the NEPA (CEQ 1997). The affected area for EJ encompasses the area where potential impacts could occur. The analysis of EJ impacts has three parts:

- Identification of the geographic distribution of low-income and minority populations in the affected area;
- An assessment of whether the impacts of closure activities would produce impacts that are high and adverse;
- If impacts are high and adverse, a determination is made as to whether these impacts disproportionately affect minority and low-income populations.

In the event that impacts are significant, disproportionality will be determined by comparing the proximity of any high and adverse impacts to the locations of low-income and minority populations. If the analysis determines that health and environmental impacts are not significant, there can be no disproportionate impacts on minority and low-income populations.

The CEQ defines minority as any race and ethnicity, as classified by the USCB, as: Black or African American; American Indian or Alaska Native; Asian; Native Hawaiian and Other Pacific Islander; some other race (not mentioned above); two or more races; or a race whose ethnicity is Hispanic or Latino (CEQ 1997). Low-income populations are based on annual statistical poverty thresholds also defined by the USCB.

Identification of minority populations requires analysis of individual race and ethnicity classifications as well as comparisons of all minority populations in the region. Minority populations exist if either of the following conditions is met:

- The minority population of the impacted area exceeds 50 percent of the total population.
- The ratio of minority population is meaningfully greater (i.e., greater than or equal to 20 percent) than the minority population percentage in the general population or other appropriate unit of geographic analysis (CEQ 1997).

The minority population of the region, as of 2013, is estimated to be about 2.4 million; 24.5 percent of the region’s total population of about 9.7 million (USCB 2014). This is well below the national average minority population share of 37.4 percent. About 4.5 percent of minorities in the region are white Hispanic and the rest are nonwhite. Minority populations are largely concentrated in the metropolitan areas in the western half of the region and in rural counties in Mississippi and western Tennessee (Figure 3-6).

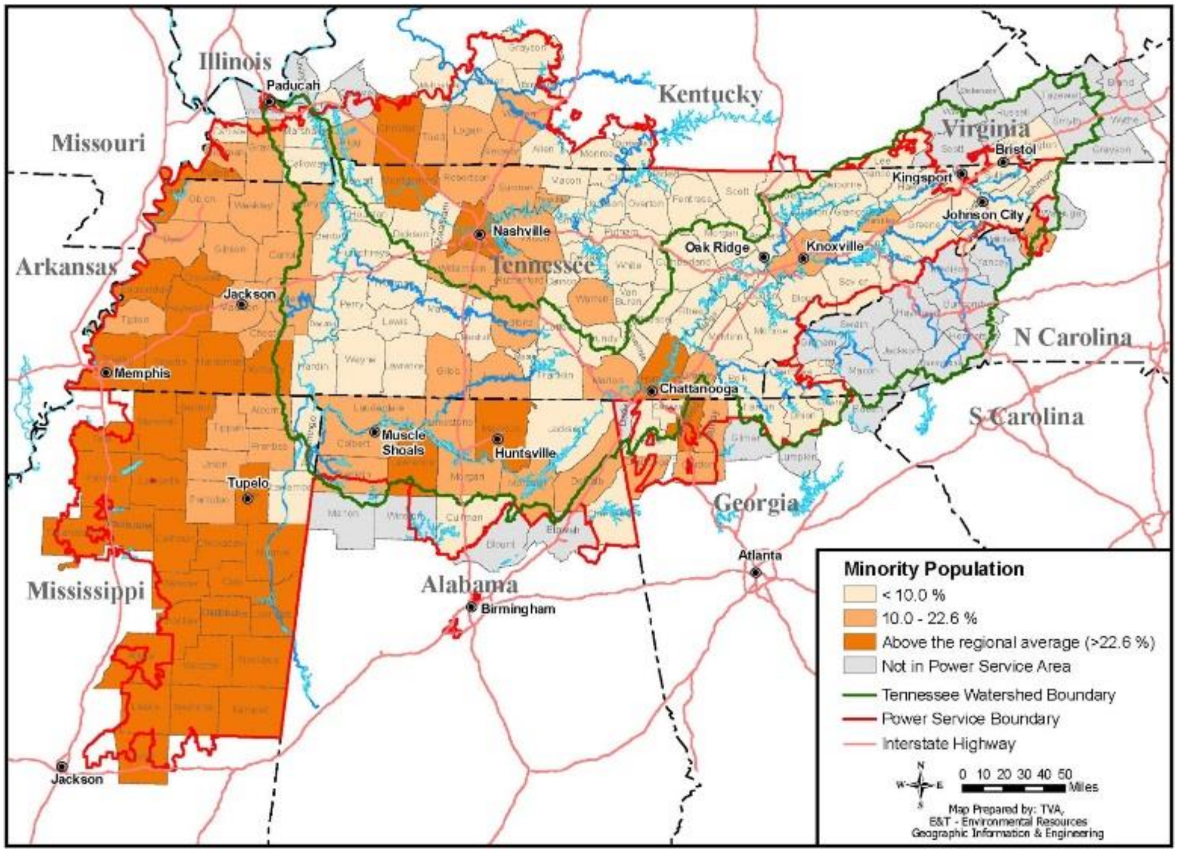


Figure 3-6. Minority Populations within Counties in the TVA Region (TVA 2015b)

Low-income populations are those with incomes that are less than the poverty threshold (CEQ 1997). The poverty threshold takes into account family size and the age of individuals in a family. In 2014, the poverty threshold for a family of four with two children below the age of 18 was $24,008 (USCB 2015). A low-income population is identified if either of the following two conditions are met:

- The low-income population exceeds 50 percent of the total number of households.
- The ratio of low-income population significantly exceeds (i.e., greater than or equal to 20 percent) the appropriate geographic area of analysis.

The estimated poverty level for TVA region counties, as of 2013, is 18.5 percent, an increase from the 15.8 percent in 2008 and higher than the 2013 national poverty level of 15.8 percent (USCB 2015). Counties with the higher poverty levels are generally outside the metropolitan areas and most concentrated in Mississippi (Figure 3-7).

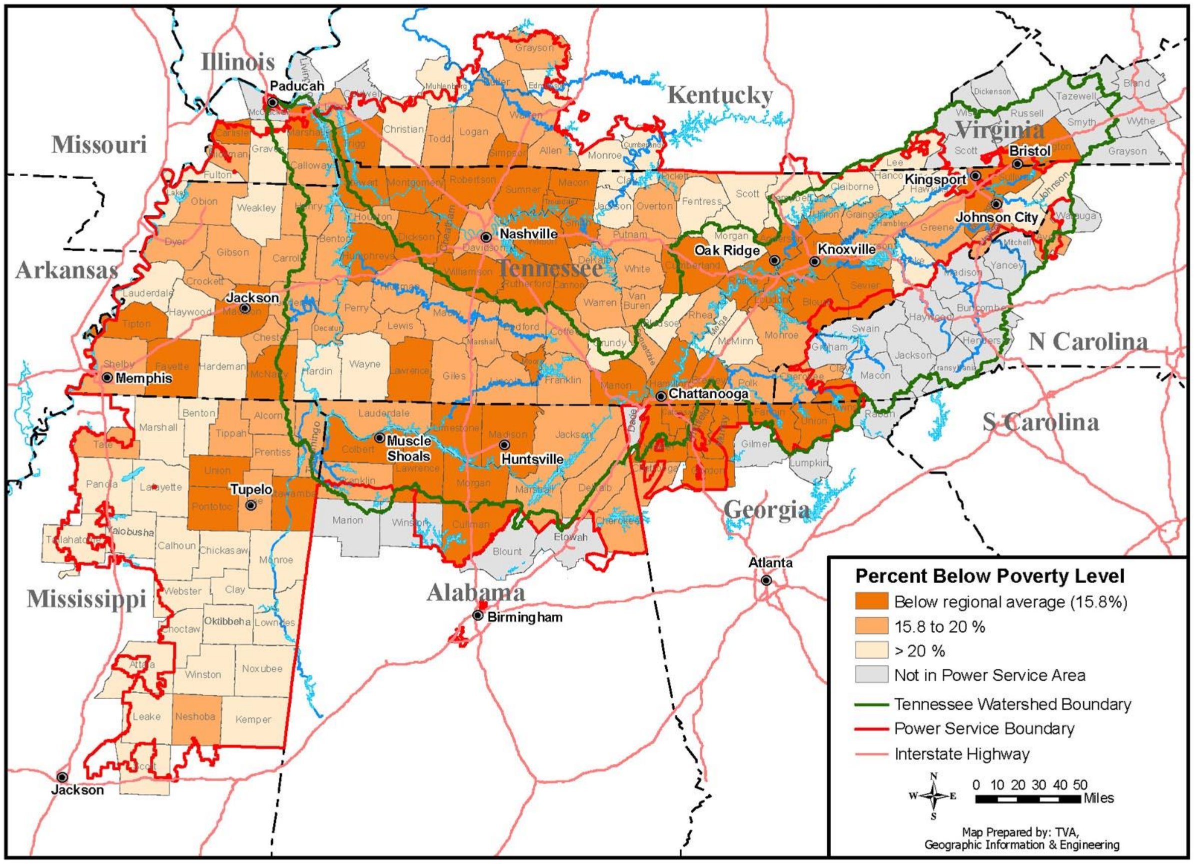


Figure 3-7. Low Income Populations within Counties in the TVA Region (TVA 2015b)

3.14.2 Environmental Consequences

3.14.2.1 Alternative A – No Action

Alternative A will involve no changes to the current conditions, and generated CCR would continue to be stored in the existing ash impoundments. No additional or new socioeconomic impacts would be associated with this alternative.

3.14.2.2 Alternative B – Closure-in-Place

Demographic characteristics are not expected to change in the areas surrounding ash impoundments. Adverse impacts generally occur when a project displaces residents or businesses or when a large workforce relocates to low population areas with limited labor workforces, community facilities and services and housing. Such adverse impacts are not expected because workforces associated with ash impoundment closure are relatively small and no relocations are anticipated since the required work can be accomplished with the local workforce. In addition, no residences or businesses would be displaced. Therefore, adverse impacts to community facilities and services, housing, local workforces and loss of income are not expected.

Closure activities under this alternative will involve several steps that include lowering the water level in the ash impoundment, site preparation, transport of borrow material and installation of an approved closure cover system. For purposes of this programmatic analysis, the range of known construction activities (proposed for the impoundments analyzed in the site-specific sections) was used to provide the bounding condition.

The primary socioeconomic impacts are expected to be beneficial in the form of temporary increase in jobs, income, purchases of local goods and services and employment-related tax revenues. Relevant construction data is summarized on Table 2-1. Because ash impoundment sizes vary, the amount of estimated fill material required to cover these impoundments is also expected to be variable. The total estimated closure costs for this alternative range from $3.5 to $150 million, with most of the closures costing less than $50 million. The associated construction work forces required for the closures varies but can include up to 100 workers.

Construction activity related to the Closure-in-Place Alternative would require a relatively small number of workers for a short time. This would have a small positive, but temporary, impact on income and employment in the local area.

3.14.2.3 Alternative C – Closure-by-Removal

This alternative will entail lowering the water level in the ash impoundment, removal of CCR, filling-in and contouring and planting of vegetation. Depending on the volume of CCR, these activities may require long periods of time to transport materials to receiving landfills as discussed in Section 2.2. Relevant construction data is summarized on Table 2-3.

Under this alternative, the amount of material that will have to be dewatered, excavated and hauled to permitted landfills is very large ranging from 145,500 to 25 million yd^3. The cost of projects ranges from an estimated $15 million to as high as $2.7 billion. The associated construction workforce varies but can include up to 100 workers.

Similar to Alternative B, Alternative C will temporarily create additional jobs, income, purchases of goods and services and tax revenues. Because of the longer construction times that may be required for large ash impoundments for this alternative, the benefits will last for a longer period of time.

Although this alternative is not expected to have any significant adverse impacts on population, community facilities and services, or housing, the potential for adverse impacts to the economy, workforce and equipment resources is potentially much higher than for Alternative B. Depending on the volume of CCR materials to be removed, larger amounts of equipment (especially haul trucks) would be required along with the associated work force needed to operate this equipment. For impoundments with large volumes of CCR, this impact may be long term, rather than short term. Strategies to shorten the duration of the removal effort may be accomplished by increasing the number of trucks. Because space is needed to dry CCR sufficiently to transport it, there is a practical limitation on the ability to shorten removal durations. Such strategies would also place a high demand upon the equipment and workforce availability within the trucking industry which may result in the influx of equipment and operators from a wider area. Due to the increase in the number of workers, this alternative would have a relatively greater positive impact on income and employment. However, as with Alternative B, this impact would be small and temporary for sites having a low CCR volume, but greater and long term for sites having a large CCR volume.

Although significantly adverse human health or environmental impacts as a result of ash impoundment closures are not anticipated, the identification of low-income and minority populations that may be subject to EJ considerations requires an analysis of specific geographies proximate to the ash impoundment closure site as well as the routes used to haul borrow material and CCR to and from the impoundment site.

As closure activities will occur on previously developed industrial sites, borrow material will be obtained from a permitted site, and CCR will be disposed in an existing permitted landfill designed to handle waste of this type, direct human health and environmental impacts are not anticipated. Potential environmental justice impacts associated with either closure method would primarily be indirect impacts related to the transport of borrow material and CCR. These activities would result in construction-related noise, increased transportation safety risks, exposure to fugitive dust and exhaust emissions to identified EJ communities. For sites with large volumes of CCR, the magnitude of impact would be greater and longer lasting due to increased duration and frequency of off-site truck and rail transport.

Further evaluation of the potential impacts to EJ communities requires consideration of site-specific information.

3.15 Natural Areas, Parks and Recreation

3.15.1 Affected Environment

Natural Areas, parks and recreation areas include sites typically managed and/or used for one or more of the following objectives:

- Recreation – Examples include national, state and local parks and recreation areas; reservoirs (TVA and others); picnic and camping areas; birdwatching, trails and greenways; and TVA small wild areas, day use areas and stream access sites.
- Species/Habitat Protection – Places with endangered or threatened plants or animals, unique natural habitats, or habitats for valued fish or wildlife populations. Examples include national and state wildlife refuges, mussel sanctuaries, TVA habitat protection areas and nature preserves.
- Resource Production/Harvest – Lands managed for production of forest products, hunting and fishing. Examples include national and state forests, state game lands and wildlife management areas, and national and state fish hatcheries.
- Scientific/Educational Resources – Lands protected for scientific research and education. Examples include biosphere reserves, research natural areas, environmental education areas, TVA ecological study areas and federal research parks.
- Scenic Resources – Areas with exceptional scenic qualities or views. Examples include national and state scenic trails, scenic areas, wild and scenic rivers and wilderness areas.

Numerous natural areas, parks and recreational facilities occur throughout the seven state TVA region in all physiographic areas. Many managed areas cross state boundaries or are managed cooperatively by several agencies (TVA 2015b). They are most concentrated in the Blue Ridge physiographic area overlapping the western edge of Tennessee and Mississippi Alluvial Plain physiographic area on the eastern edge of Tennessee. Most managed areas and ecologically significant sites have multiple management objectives and if management objectives cannot be met, the integrity of the area may be lost or compromised. Natural areas, parks and recreation sites can vary in size from less than an acre for a boat launching ramp site to thousands of acres for a designated wildlife management area. Several of these areas are located in the vicinity of TVA coal-fired power plants.

Recreational facilities are also found on some coal-ash plants within the TVA system. These facilities include boat launching ramps, bank fishing areas and walking trails. In addition, the ash impoundments in the TVA system typically contain a large, shallow expanse of water and ash/mud flats which attract a variety of shorebirds, waterfowl and other wading birds. Although the ash impoundments are closed to the public, TVA allows birders to view these sites from the surrounding roads.

3.15.2 Environmental Consequences

3.15.2.1 Alternative A – No Action

Under the No Action Alternative, TVA will not close ash impoundments at any of the coal-fired plants. There would be no direct impact to natural areas, parks or recreation.

3.15.2.2 Alternative B – Closure-in-Place

Ash impoundments are located in areas currently used for industrial purposes and necessary borrow material will be obtained from previously permitted sites. Therefore, there would be no direct impact to natural areas, parks or recreation areas. However, recreational facilities such as boat launching ramps and bank fishing areas are found on several of the TVA facilities. Users of recreational facilities on TVA sites could be directly impacted if these facilities would be closed as a result of closure activities. In many cases, this impact would be temporary as facilities would likely re-open once the impoundments are closed. However, if the facilities remain closed, this impact would be considered a direct long-term impact associated with this alternative. Closure of the ash impoundments will require dewatering and these impoundments will no longer attract shorebirds or other waterfowl. This would result in a long-term impact to birders who frequent the area around the impoundments to view shorebirds, waterfowl and other water birds.

There is a potential for indirect impacts associated with construction activities related to closure of the impoundment itself and the transport of borrow material from an off-site location to the construction site. Fugitive dust, noise and traffic generated as a result of these activities could have an indirect impact on users of natural areas, parks and recreational areas located in the vicinity of the construction site. In addition, fugitive dust, noise and traffic generated as a result of transport of borrow material from an off-site location to the impoundment closure site could indirectly impact users of natural areas, parks and recreational facilities located adjacent to the transport route. However, BMPs designed to minimize fugitive dust emissions will be employed which would reduce potential impacts. Therefore, because this impact would be temporary and limited to the construction period and BMPs will be used to minimize the effects from fugitive dust, the effects of this alternative would be minor and would not impair use or enjoyment of these resources.

3.15.2.3 Alternative C – Closure-by-Removal

As with Alternative B, there would be no direct impact to natural areas, parks or recreation as a result of closure activities under this alternative as all ash impoundments are located in industrial areas. All CCR material will be transported to a permitted landfill (either off-site or on-site) and, therefore, there would be no direct impact to natural areas, parks or recreational areas. Users of recreational facilities on TVA properties could be directly impacted if these facilities would be closed as a result of closure activities. In many cases, this impact would be temporary as facilities likely would reopen once the impoundments are closed. However, if the facilities remain closed, this impact would be considered a direct long-term impact associated with this alternative. If an ash impoundment attracts shorebirds or other waterfowl, closure of the ash impoundment under this alternative would have a long term impact to recreational birders as these areas will no longer be available.

As with Alternative B, construction activities associated with impoundment closure and the transport of CCR to an off-site landfill could indirectly impact natural areas, parks and recreation sites as a result of increased traffic volumes, noise and fugitive dust generated by construction activities. Transporting CCR to a permitted landfill could also result in an increase in noise, fugitive dust and increased traffic along the haul routes that may impact adjacent receptors. Additionally, because the volume of CCR material within ash impoundments is typically much greater than the volume of borrow material required for Alternative B, the duration of these potential off-site impacts would be substantially greater. Implementation of BMPs will minimize potential fugitive dust impacts. Closure under this alternative may cause minor disturbances during the construction phase for sites having small volumes of CCR, but could result in larger disturbances for sites having large volumes of CCR that may affect use or enjoyment of these resources.

3.16 Transportation

3.16.1 Affected Environment

This section describes the transportation infrastructure that could be affected by the project alternatives. The approach taken in this programmatic section focuses on a regional scale rather than a site-specific scale.

TVA's coal-fired power plants are served by public roadway, railway and/or waterway modes of transportation. Road access to these power plants varies from two-lane roads to four-lane divided highways and is via at-grade intersections, with some of them controlled by traffic signals. Public road managers for this system include state departments of transportation, county highway departments and municipal road departments. Rail lines are managed by large railroad operators such as Union Pacific Railroad and Burlington Northern and Santa Fe Railway) in the western part of the PSA, Norfolk Southern Railway in the eastern part and CSX Transportation, Inc. throughout the PSA. Several short-line and local railroads exist in the PSA as well. Barge operation is present on the Mississippi River, Ohio River, Tennessee River and the Tennessee-Tombigbee Waterway.

3.16.2 Environmental Consequences

3.16.2.1 Alternative A – No Action

Under the No Action Alternative, TVA will not close ash impoundments at any of the coal fired plants. The impoundments will continue to receive storm water and some process water, and TVA will conduct regular maintenance on the berms to ensure stability. There would be no direct impact and no change to transportation in the TVA PSA.

3.16.2.2 Alternative B – Closure-in-Place

Under Alternative B, CCR impoundments will be closed in place using an approved closure system (see Section 2.2). Borrow material used in the closure system will be obtained from a previously permitted site either on-site or off-site. Impacts to the transportation system would be associated with the following:

- Equipment/materials mobilization
- Construction workforce
- Transport of suitable borrow material to the site.

All of these actions would be temporary but would extend through the duration of the closure activities.

3.16.2.2.1 Equipment Mobilization and Construction Workforce

The construction workforce traveling to and from a plant site would contribute to the traffic on the local transportation network. A construction workforce of 75 to 100 could be expected to support most ash closure activities under this alternative. This workforce volume would occur at the beginning and end of the work day. Additional construction-related vehicles (dozers, backhoes, graders, loaders, etc.) would be delivered to or removed from each CCR impoundment site on flatbed trailers under both the mobilization and demobilization stages of the project. Overall, the traffic volume generated by the construction workforce and the construction-related vehicles would be relatively minor. It is assumed that these motorists would use interstate highways or major arterial roadways as much as possible, but would likely have to use lower functioning roadways (such as collectors and local roads) closer to TVA plants.

3.16.2.2.2 Transport of Borrow Material

As described in Section 2.2, roadway transport of borrow material likely will be the most reasonable and economically viable mode for transport of borrow at all sites. Trucking has the advantage of using the established roadway network and does not require the design, permitting and construction of additional rail loading facilities.

The impacts to transportation would result from increased traffic volumes on roadways between the borrow sites and the impoundment to be closed. It is expected that suitable borrow material would be available within a 30-mi radius of each site.

The amount of borrow material needed at each site will vary, but it is possible that as much as 4,300,000 yd^3 of material would be needed to supply sufficient cover under the Closure-in-Place Alternative. Typical borrow material requirements are likely to be between 80,000 and 200,000 yd^3.

Using the estimated largest volume of borrow, it is estimated that up to175 truckloads per day (tandem dump truck) (traffic count of 350 trips passing a single location on a daily basis) would be required to haul borrow material. This is a conservative approach and does not represent the typical range of borrow needed at a site. Table 3-13 presents the relationship between the number of truckloads and the amount of borrow material that can be hauled given a 48-month construction schedule. While the CCR ruling specifies a 5-year closure window, it is anticipated that up-front permitting/approvals and planning will take approximately 6 months and post-closure site restoration and permit close-out will take approximately 6 months. Thus, a 4-year window is used for the timeframe for the actual hauling of borrow to the site. It is not likely that the hauling of borrow would occur over long distances (i.e., 30 mi or more) because as the haul distance gets longer, it would become more cost prohibitive as more trucks would be required to satisfy the truckload requirement. Under shorter haul distances, the same truck could make several trips (truckloads) over the course of a workday. Additionally, a longer haul route would result in an increased risk of traffic crashes and safety issues.

Table 3-13. Borrow Material Transport Capacity for Closure-In-Place Alternative

Number of Truckloads Per Day[1]	Borrow Material (yd^3) (Thousands) [2]
30	270
40	360
50	450
60	540
90	810
120	1,080
175	1,580
240	2,160
300	2,700
400	3,600
478	4,300

[1]Each truckload results in a truck passing a given location two times (one trip loaded and the return trip unloaded).
[2]Assumes a work duration of 48 months and 15 yd^3 per tandem dump truckload.

As described above, as the haul distance from a borrow site to the project site increases, it would result in the need for more trucks to meet the total truckload demand and required closures schedule.

The volume generated by the trucks hauling borrow material from a borrow site to the ash impoundment site would create a steady traffic stream over the course of an entire work day. For impoundments having a large borrow volume requirement and a short closure schedule (4,300,000 yd^3 in 48 months) this would equate to a traffic count of approximately 106 trips per hour (between 8:00 a.m. and 5:00 p.m.) or two trucks passing a given point approximately every minute. This volume of truck traffic could be expected to result in a deterioration of local traffic operations (the level of service could degrade), and it would have the potential to result in notable deterioration of roadways (particularly less improved local roads). Such impacts may include wear and tear of the pavement, pavement rutting, formation of potholes and destruction of soft (grass or loose gravel) shoulders. Other potential adverse effects may also result from high volumes of haul trucks on public roads such as noise and vibration and visual impacts as described in Sections 3.17 and 3-19.

Typical borrow material requirements are likely to be between 80,000 and 200,000 yd^3. As illustrated in Table 3-13, a volume of 270,000 yd^3 is expected to result in approximately 30 truckloads per day over a 48-month (or longer) period. Traffic counts along the haul routes would be expected to be up to 60 vehicles per day for such borrow volumes. It is expected that this would equate to approximately seven trucks passing by a given location each hour (0.1 truck per minute). Based on this level of use, impacts to traffic operations are expected to be relatively minor. In addition, the impact on the condition of less improved local roads and receptors along the route would be substantially less.

Therefore, given a more typical volume of borrow material need, this alternative may cause minor disturbances to the roadway network, localized roadway degradation and minor potential effects to adjacent environmental receptors from traffic noise, emissions and vibration during the construction phase. However, it would not impair use of these roads by the public. Alternatively, for sites requiring more substantial borrow volumes, the transport-tation impacts resulting from the implementation of Alternative B would be more notable.
As discussed earlier in Chapter 2, there is an increased risk of traffic crashes involving

trucks on local roadways. For sites that require larger borrow volumes, the risk of crashes would increase due to the increased number of trucks traveling along the haul route.

However, as the number of truck movement miles increase, both for Alternative B and Alternative C, the risk of traffic crashes, including personal injuries and fatalities increase. A September 2013 investigation of heavy truck crashes in Kentucky by the University of Kentucky analyzed crash data for 2008-2012. Annually, crashes involving trucks ranged from 7,442 to 9,092 with annual fatalities of 85 to 102. For the five-year period studied, truck crashes represented 6.4 percent of all crashes, 5.5 percent of injury crashes and 12.2 percent of fatal crashes. The statewide crash rate per 100 MVM ranged from 163 to 226. On rural roadways, statewide crash rates range from 183 to 217 per 100 MVM on two-lane roadways. Therefore, there is a potential for increased crash rates on roadways being used by heavy trucks to haul borrow.

3.16.2.3 Alternative C – Closure-by-Removal

Under Alternative C, CCR material will be removed from the impoundments and transported to a previously permitted landfill (either off-site or on-site). The former impoundment will be filled/graded and covered with borrow material obtained from a previously permitted site.

The determination of the mode of transport (truck or rail) will be made on a case by case basis. Transport by rail is expected to result in lower impacts to transportation as compared to truck transport. However, as described in Section 2.2, rail transportation may not be feasible in light of the five-year closure period and the loading and unloading infrastructure that may have to be permitted and constructed.

For this programmatic analysis, a 30-mi radius is used as the boundary for transportation impacts. Impacts to the transportation system would be associated with the following:

- Design and permitting of rail load-out facilities;
- Equipment/materials mobilization;
- Construction workforce;
- Transport of suitable borrow material to the site; and
- Truck transport of CCR off-site to a previously permitted landfill.

The impacts to transportation associated with the construction workforce and the transport of borrow would be similar to those described above for Alternative B in proportion to the required volume of borrow. Borrow activities under this alternative are expected to be sequenced after most CCR removal activities. While this would avoid compounding the transportation impacts of moving borrow and CCR during the same or overlapping periods, sequential movements of borrow material would extend closure schedules probably beyond the five-year closure period.

Unlike Alternative B, the Closure-by-Removal Alternative could have a substantially greater volume of truck traffic hauling CCR to a permitted landfill. The amount of CCR at the various TVA plants varies and this variability would affect the number of truckloads from the TVA plant. Two factors would affect the number of trucks needed to satisfy the truckload demand: (1) the haul distance to the landfill; and (2) the timeframe for the hauling. Longer distances or shorter timeframes would generally require more trucks to meet the CCR truckload demand.

The amount of CCR to be hauled off-site varies by ash impoundment. The CCR volumes could range from approximately 250,000 yd^3 to 25 million yd^3 or more. Truck transport of CCR is more cumbersome than hauling borrow material. The CCR material transported off-site will be dried to a reasonable degree to support transport. As a result, the volume of CCR material within a given truck is expected to be notably lower (approximately 10 yd^3 for CCR as compared to 15 yd^3 for borrow material). TVA determined that loading operations are highly dependent on the rate at which CCR can be safely excavated, dried and moved to truck loading facilities. TVA carefully considered these factors and determined that the rate of truck loading is 100 trucks per day. Prior to leaving a given TVA site, all trucks would be required to pass through a truck washing station.

Additional logistical problems associated with hauling large volumes of CCR to off-site landfills include the following:

1. If it is assumed that removal activities include the use of 100 truckloads per day, approximately 600,000 yd^3 of CCR would be removed within a 5-year closure period (allowing time for design, permitting and close-out activities, which is assumed to absorb one of the five years) (Table 3-14). It is unlikely that off-site transport of CCR from ash impoundments with larger volumes of CCR could be accomplished within four years.
2. The distance to the receiving landfill is an important factor in evaluating feasibility of the haul-off. Landfills at greater distances from the site would require longer travel times and would require more trucks to satisfy the number of truckloads per day (shorter haul routes mean one truck could make several truckload trips per day).
3. The hauling of CCR off-site creates safety concerns with respect to a higher risk of crashes and spills along the haul route.
4. Sufficient resources (drivers, trucks, loaders, equipment) may not exist for a site with larger CCR haul-off volumes.

Table 3-14. CCR Material Transport Capacity for Closure-By-Removal Alternative

Number of Truckloads Per Day	CCR Material (yd^3) (Thousands)[1]
20	120
30	190
40	240
50	300
60	360
100	600
120	720
175	1,050

[1]Assumes a work duration of 5-years, allowing time for design/permitting and mobilization (6 months) and close-out activities (6 months). Assumes 10 yd^3 per tandem dump truckload.

For sites having a lower volume of CCR (<600,000 yd^3), the hauling off of CCR would be completed prior to the hauling of borrow material to a respective site. It is assumed that there will be 100 truckloads of CCR per day from a site, and there will be 175 truckloads of borrow per day to a site. Therefore, the amount of truckloads of borrow establishes the upper limit of haul trips for a site at a given time. This 175 truckloads per day under the Closure-by-Removal Alternative would result in approximately 39 trucks passing by a given location each hour (approximately one truck every minute and a half – this includes return trips to the site). However, even on smaller roads (such as a rural two-lane road with no shoulders), this volume of trucks would not have a substantive impact on traffic operations unless traffic volumes on that two-lane roadway were already causing reduced operational efficiency. The addition of the truck traffic has the potential to lower traffic efficiency if an existing roadway or intersection is at or near capacity. However, most of the TVA service area is rural and the existing traffic volumes are relatively low and these additional truck volumes are not such that they are likely to affect the level of traffic operations.

For sites having large volumes of CCR (>600,000 yd^3), the combined use of trucks hauling off CCR and hauling of borrow material on-site could extend for prolonged periods of time (see Figure 2-6) and/or result in much greater truck volumes. Figure 3-8 identifies the relationship between CCR volume and the resulting intensity of trucking operations assuming closure within the five-year timeframe. For example, closure of a site having a CCR volume of 3,500,000 yd^3 in four years would result in 350,000 truckloads of CCR (583 truckloads per day) to a landfill. It is expected that this would equate to approximately 130 trucks passing by a given location each hour (2.2 trucks per minute). For much larger sites having a CCR volume of 25,000,000 yd^3 closure within four years would result in 2,500,000 truckloads of CCR (4,167 truckloads per day, Figure 3-8). It is expected that this would equate to approximately 926 trucks passing by a given location each hour. This would increase roadway deterioration substantially compared to Alternative B. Such deterioration would include wear and tear of the pavement, pavement rutting, formation of potholes and destruction of soft (grass or loose gravel) shoulders. This will require maintenance of these roadways over the duration of the hauling operation. As discussed earlier, increased numbers of truck movements also have the potential to result in an increased number of truck-related crashes that is proportional to the number of trips. Other potential adverse effects are associated with higher numbers of haul trucks on public roads such as air quality, noise and ground vibration as described in Sections 3.17 and 3.19.

Therefore, transportation impacts resulting from the implementation of Alternative C are variable and dependent upon both CCR volume to be removed and schedule for impoundment closure.

Rail transport of CCR may also be a viable mode of transportation at some sites. As initially addressed in Section 2.2.4.2, the use of rail would require loading and unloading infrastructure, and a rail transportation service in the form of a rail carrier. Additionally the rate of CCR removal by rail is expected to be similar to that of truck transport because rail loading operations are highly dependent on the rate at which CCR can be safely excavated, dried and moved to rail loading facilities. TVA carefully considered these factors and determined that the rate of rail loading is 11.1 rail cars per day (1,000 yd^3 per day), a volume that is similar to the rate determined for truck transport.

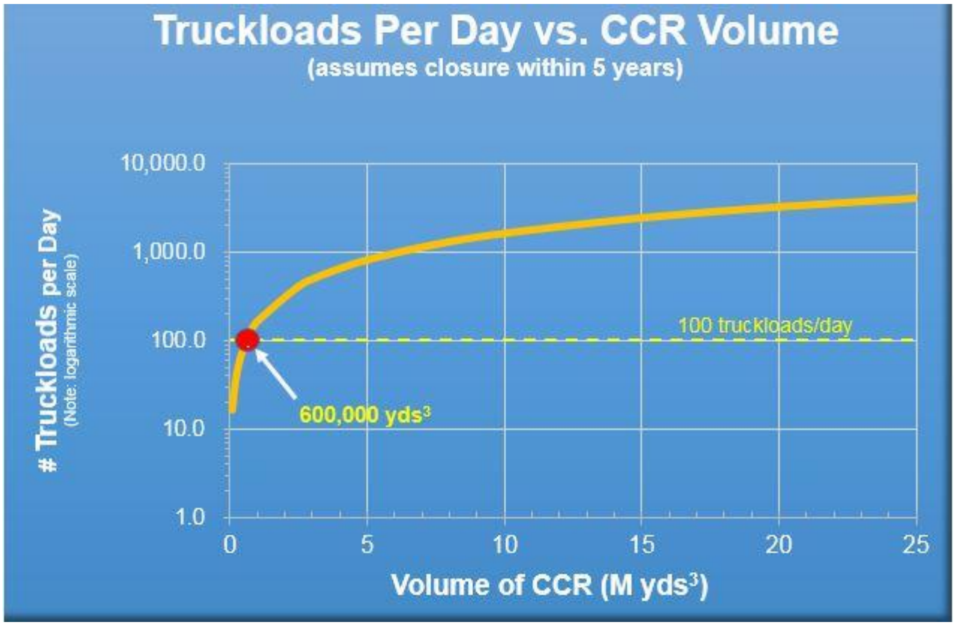


Figure 3-8. Trucking Intensity vs. CCR Removal Volume

Rail cars dedicated for use as CCR transport would also have to be acquired and provided to support CCR removal operations. An assessment of permitted Subtitle D landfills in Tennessee, Kentucky and Alabama shows that there is a very low percentage (5 to10 percent) of landfills that can accept waste directly by rail. It may be necessary to consider disposal sites at more distant locations. Even if a landfill is near a rail line, additional infrastructure would likely need to be developed to support the unloading operations in the vicinity of the receiving landfill. Because the CCR is not likely to be off-loaded directly from rail to a permitted landfill (unless a rail spur is designed with these capabilities), some amount of over-the-road trucking will still be needed in most cases to haul the CCR to a landfill. Impacts associated with trucking would be similar to those described above (i.e., air and noise emissions, traffic impacts, roadway deterioration, safety), but more localized in their extent. Transporting CCR to a landfill located elsewhere also could give rise to environmental justice concerns.

Impoundments that are closed-by-removal that have large volumes of CCR feasibly may use either trucking or rail operations. Trucking over prolonged periods for such sites may be expected to result in impacts that are pronounced and more widespread, whereas removal by rail may be a less impactful and more cost effective alternative relative to trucking.

3.17 Visual Resources

3.17.1 Affected Environment

This assessment provides a review and classification of the visual attributes of existing scenery, along with the anticipated attributes resulting from the proposed action. The classification criteria used in this analysis are adapted from a scenic management system developed by the U.S. Forest Service (USFS) and integrated with planning methods used by TVA. The classification process is also based on fundamental methodology and descriptions adapted from Landscape Aesthetics, A Handbook for Scenery Management, Agriculture Handbook Number 701 (USFS 1995).

The visual landscape of an area is formed by physical, biological and man-made features that combine to influence both landscape identifiability and uniqueness. Scenic resources within a landscape are evaluated based on a number of factors that include scenic attractiveness, integrity and visibility. Scenic attractiveness is a measure of scenic quality based on human perceptions of intrinsic beauty as expressed in the forms, colors, textures and visual composition of each landscape. Scenic integrity is a measure of scenic importance based on the degree of visual unity and wholeness of the natural landscape character. The varied combinations of natural features and human alterations both shape landscape character and help define their scenic importance. The subjective perceptions of a landscape's aesthetic quality and sense of place is dependent on where and how it is viewed.

Scenic visibility of a landscape may be described in terms of three distance contexts: (1) foreground, (2) middleground and (3) background. In the foreground, an area within 0.5 mi of the observer, individual details of specific objects are important and easily distinguished. In the middleground, from 0.5 to 4 mi from the observer, object characteristics are distinguishable but their details are weak and tend to merge into larger patterns. In the distant part of the landscape, the background, details and colors of objects are not normally discernible unless they are especially large, standing alone, or have a substantial color contrast. In this assessment, the background is measured as 4 to 10 mi from the observer. Visual and aesthetic impacts associated with a particular action may occur as a result of the introduction of a feature that is not consistent with the existing viewshed. Consequently, the character of an existing site is an important factor in evaluating potential visual impacts.

For this analysis, the affected environment is considered to include the project area within a TVA CCR facility, which encompasses both permanent and temporary impact areas, any off-site borrow areas, as well as the physical and natural features of the landscape. Any part of the project area located within the TVA facility would be located on previously disturbed lands and within existing industrial infrastructure. Principal features in the foreground include plant structures such as the powerhouse, coal handling system, emissions stacks, switch yard and major transmission corridors. Most of the TVA facilities have limited amounts of any vegetation, although there may be some small patches of grassed areas and/or small trees within the facility grounds. Therefore, scenic attractiveness of the affected environment is considered to be minimal to common, whereas the scenic integrity is considered to be low.

Since fossil fuel facilities are located in mostly remote areas, groups that would likely have direct views of the project area include authorized employees, contactors and visitors to the plant site near the project area. Views of the project area are generally restricted to the foreground (i.e., within a half mile) in all directions, however that may be buffered by nearby vegetation and the local topography.

3.17.2 Environmental Consequences

The potential impacts to the visual environment from a given action are assessed by evaluating the potential for changes in the scenic value class ratings based upon landscape scenic attractiveness, integrity and visibility. Sensitivity of viewing points available to the general public, their viewing distances and visibility of the proposed action are also considered during the analysis. These measures help identify changes in visual character based on commonly held perceptions of landscape beauty and the aesthetic sense of place. The extent and magnitude of visual changes that could result from the proposed action were evaluated based on the process and criteria outlined in the scenic management system.

3.17.2.1 Alternative A – No Action

Under Alternative A, TVA will not close ash impoundments at any of the coal fired plants, resulting in no changes to the existing environment. The landscape character and integrity would remain in its current state; therefore, and there would be no new impacts to aesthetics and visual resources.

3.17.2.2 Alternative B – Closure-in-Place

Under Alternative B, the ash impoundments will be closed in place and will be filled/graded and covered using borrow material from a previously permitted site. During the construction phase, there would be slight visual discord from the existing conditions due to an increase in personnel and equipment in the area. Visual impacts from additional vehicular traffic associated with the transport of borrow materials and construction-related traffic to the work site are expected to be insignificant as the roads in the vicinity of plants are already predominately used for industrial activity. This small increase in visual discord would be temporary and only last until all activities have been completed by TVA.

Permanent impacts would include minor discernible alterations that would be viewed in the foreground of plant operations. In the foreground, the closure of the ash impoundment and cover with natural vegetation may enhance the landscape character compared to the current condition. In more distant views, the closure of the impoundment would likely merge with the overall industrial components of the facility. The proposed activity would have minimal public visibility and would primarily be seen by employees and visitors to the TVA facility. Therefore, the closed impoundment would generally be absorbed by existing TVA plant components and would become visually subordinate to the overall landscape character associated with the plant site.

Overall, the proposed action is not expected to be discernible from the existing scenery nor would it contrast with the overall landscape. There may be some minor visual discord during the construction and subsequent post-construction maintenance period due to an increase in personnel and equipment and the use of laydown and materials storage areas. These minor visual obtrusions would be temporary until all areas have been restored using standard construction and restoration BMPs. Based upon the improved visual characteristics of a vegetated closure system under this alternative, the scenic attractiveness and scenic quality of the project area may be expected to improve to some degree relative to the existing condition. Therefore, visual impacts resulting from implementation of Alternative B would be minor and beneficial in the long term.

3.17.2.3 Alternative C – Closure-by-Removal

Construction phase visual impacts associated with closure activities under Alternative C would be similar to that identified under Alternative B. As with Alternative B, construction activities associated with impoundment closure and the transport of CCR to an off-site landfill could indirectly impact the landscape character along the haul route. For sites having relatively small volumes of CCR impacts are expected to result in a small and temporary increase in visual discord. By comparison, for sites requiring the removal of large volumes of CCR impacts to the visual environment from trucking would be more long lasting and pronounced. Following construction however, based upon the improved visual characteristics of a vegetated former impoundment under this alternative, the scenic attractiveness and scenic quality of the project area may be expected to improve to some degree relative to both the existing condition and Alternative B. Overall, visual impacts resulting from implementation of Alternative C would be minor and beneficial in the long term.

3.18 Cultural and Historic Resources

3.18.1 Affected Environment

3.18.1.1 Regulatory Framework for Cultural Resources

Cultural resources or historic properties include prehistoric and historic archaeological sites, districts, buildings, structures and objects, as well as locations of important historic events. Federal agencies, including TVA, are required by the NHPA (16 USC 470) and by NEPA to consider the possible effects of their undertakings on historic properties. Undertaking means any project, activity, or program, and any of its elements, which have the potential to have an effect on a historic property and that is under the direct or indirect jurisdiction of a federal agency or is licensed or assisted by a federal agency. An agency may fulfill its statutory obligations under NEPA by following the process outlined in the regulations implementing Section 106 of NHPA at 36 CFR Part 800. Additional cultural resource laws that protect historic resources include the Archaeological and Historic Preservation Act (16 USC 469-469c), Archaeological Resources Protection Act (16 USC 470aa-470mm) and the Native American Graves Protection and Repatriation Act 925 USC 3001-3013).

Section 106 of the NHPA requires that federal agencies consider the potential effects of their actions on historic properties and to allow the Advisory Council on Historic Preservation an opportunity to comment on the action. Section 106 involves four steps: (1) initiate the process; (2) identify historic properties; (3) assess adverse effects; and (4) resolve adverse effects. This process is carried out in consultation with the State Historic Preservation Officer (SHPO) of the state where the undertaking takes place and other interested consulting parties, including federally recognized Indian tribes.

Cultural resources are considered historic properties if they are listed or eligible for listing in the National Register of Historic Places (NRHP). The NRHP eligibility of a resource is based on the Secretary of the Interior’s criteria for evaluation (36 CFR 60.4), which state that significant cultural resources possess integrity of location, design, setting, materials, workmanship, feeling, association and

1. Are associated with events that have made a significant contribution to the broad patterns of our history; or
2. Are associated with the lives of persons significant in our past; or

3. Embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic value, or
4. Have yielded, or may yield, information (data) important in prehistory or history.

A project may have effects on a historic property that are not adverse, if those effects do not diminish the qualities of the property that identify it as eligible for listing on the National Register. However, if the agency determines (in consultation) that the undertaking's effect on a historic property within the area of potential effect (APE) would diminish any of the qualities that make the property eligible for the NRHP (based on the criteria for evaluation at 36 CFR Part 60.4), the effect is said to be adverse. Examples of adverse effects would be ground disturbing activity in an archaeological site, or erecting structures within the viewshed of a historic building in such a way as to diminish the structure's integrity of feeling or setting.

Agencies must resolve the adverse effects of their undertakings on historic properties. Resolution may consist of avoidance (such as choosing a project alternative that does not result in adverse effects), minimization (such as redesign to lessen the effects), or mitigation. Adverse effects to archaeological sites are typically mitigated by means of excavation to recover the important scientific information contained within the site. Mitigation of adverse effects to historic structures sometimes involves thorough documentation of the structure by compiling historic records, studies and photographs. Agencies are required to consult with SHPOs, tribes and others throughout the Section 106 process and to document adverse effects to historic properties resulting from agency undertakings.

3.18.1.2 Archaeological Resources

3.18.1.2.1 Background

The earliest known human occupation on TVA owned lands occurred during the Paleoindian period. Artifacts typically associated with this period include lanceolate fluted and unfluted basally ground projectile points and later, the Dalton projectile point and adze. The Archaic Period, which immediately followed the Paleoindian period, is divided into the Early (8000-6000 BC), Middle (6000-3000 BC) and Late (3000-1000 BC) subperiods.

The Early Archaic is characterized by a shift from the nomadic bands of the Paleoindian period to a more sedentary social structure with an increased reliance on wild plant foods, small game and aquatic resources (Chapman 1985, Steponaitis 1986). Typical lithic technology consists of Kirk, Big Sandy, LeCroy, during the Early Archaic and Kirk, Morrow Mountain, White Springs, Benton and Stanley cluster projectile points/knives (PPKs) during the Middle Archaic period. The Late Archaic is characterized by an increase in the number and size of sites with diagnostic stone tools that included the Savannah River, Appalachian Stemmed and Iddins PPKs, steatite bowls and grooved axes (Chapman 1985).

In the southeast, the Woodland period is divided into three subperiods: Early (1000 BC-AD 100), Middle (AD 100-600) and Late (AD 600-900) (Steponaitis 1986). The bow and arrow were introduced during the Woodland period, and extensive trade networks were established. The Early and Middle Woodland period is characterized by large base camps in major river valleys with an increase in the reliance on cultivated plants. The Late Woodland period witnessed the continued reliance on domesticated plants, particularly maize, while hunting small game and gathering wild plant foods was still necessary. Increased ceremonialism and religious activity are noted in the construction of conical burial mounds, as well as an increase in the stratification of the social structure (Steponaitis 1986).

The Mississippian period, which is divided into Early (AD 900-1000), Middle (AD 1000-1300) and Late (AD 1300-1600) subperiods, is characterized by major changes in the social structure, subsistence patterns and settlement patterns of the prehistoric people. Large permanent settlements ruled by elite chief and a strong reliance on maize agriculture are typical of the Mississippian period (Bense 1994).

The historic period began with the arrival of de Soto in the southeast. Europeans soon migrated into the southeast encountering the Cherokee in North Carolina, Kentucky, Alabama and Georgia and the Chickasaw in western Tennessee and northern Mississippi. During the 17th and 18th centuries. Native American communities in the southeast had to deal with several European powers including France, Spain and Britain. During this time period, there were constant struggles between the English, French and Spanish, which had a long-term deleterious effect on the Chickasaw and other local Native American tribes. During the American Revolution, the Chickasaw fought on the side of the British, with the Chickasaw Nation becoming the last British stronghold (Gibson 1971). Following the American Revolution, cultural developments in the southeast loosely followed geographical areas.

Archaeological resources are identified through Phase I archaeological surveys conducted for compliance with Section 106. Numerous surveys have been conducted along reservoir shorelines, within reservoirs and on power plant reservations. Some TVA transmission line corridors and roadways have also been surveyed. Outside of TVA reservoirs and plant reservations, little is known about the presence or density of archaeological resources in these areas. Archaeological surveys outside of coal-fired plants vary state by state with most surveys conducted on a project-by-project basis.

3.18.1.2.2 Previously Identified Sites at TVA Coal-Fired Power Plants

Archaeological sites can occur throughout the TVA-owned lands in a variety of environmental contexts. Archaeological sites are rarely found in areas of extreme slope, wet areas and areas that have been heavily disturbed by modern construction activities. Table 3-15 provides a summary of previously recorded NRHP-eligible sites at TVA coal-fired power plants.

Within the boundaries of TVA's coal-fired power plant sites, ash impoundments are typically located near the coal-fired plant and in or near floodplains. Laydown areas will be located in the vicinity of the impoundments being closed. Because ash impoundments and laydown areas are located on heavily disturbed industrial lands where construction required surface grading and the excavation, there is a very low potential for significant cultural resources to be present within the ash impoundment footprints or proposed laydown areas.

Table 3-15. Summary of Previously Identified Cultural Resources at TVA Coal-Fired Plants

Plant Name	Location	NRHP Eligibility of Coal-Fired Plant	Number of NRHP-Eligible Archaeological Sites	Impoundments Considered Eligible for NRHP
ALF	TN	No	0	None
BRF	TN	No	4	None
COF	AL	No		None
CUF	TN	No	4	None
GAF	TN	No	1	None
JSF	KY	Potentially Eligible	4	None
JOF	TN	No	1	None
KIF	TN	No		None
PAF	KY	No		None
SHF	KY	Potentially Eligible	17	None
WCF	AK	Eligible	8	None

3.18.1.3 Historic Resources

Historic architectural resources are standing structures (e.g., houses, barns, dams, power plants) that are usually at least 50 years of age and are considered eligible for listing on NRHP as defined by the Secretary of the Interior criteria for evaluation (36 CFR 60.4). Approximately 5,000 structures, buildings, power plants and infrastructure have been identified and recorded on TVA-owned lands. TVA, in consultation with the various state SHPOs, have evaluated individual fossil plants for their NRHP eligibility (see Table 3-15). TVA, in consultation with the Tennessee SHPO, has determined that the ALF, CUF, GAF, KIF and PAF are not eligible for listing in the NRHP but JSF is potentially eligible. SHF in Kentucky and WCF in Alabama have been recommended as potentially eligible for listing in the NRHP.

3.18.2 Environmental Consequences

3.18.2.1 Alternative A – No Action Alternative

Under the No Action Alternative, TVA will not close ash impoundments at any of the coal-fired plants and therefore, no closure construction activities would be undertaken. No direct, indirect, or cumulative impacts to cultural resources would occur under Alternative A.

3.18.2.2 Alternative B – Closure-in-Place

For Alternative B, the APE will be the existing ash impoundments and laydown areas. The ash impoundment themselves have not been considered individually eligible for listing on the NRHP as less than 50 years in age or as contributing elements for those plants considered eligible for listing on the NRHP. The laydown areas have been identified as areas previously surveyed for cultural resources and/or previously disturbed from other activities. If a laydown area has not been previously surveyed or determined disturbed in a manner to preclude the potential for cultural resources, TVA will survey the laydown parcel. If an archaeological site is identified, TVA will select a different laydown area. TVA will use existing borrow areas and haul roads that have been previously surveyed and permitted where feasible. Areas that would be used for temporary laydown areas will be used for temporary parking and equipment and material storage.

A potential exists for indirect impacts associated with construction activities related to closure and the transport of borrow materials from an off-site location to the impoundment area. Borrow will be obtained from an existing authorized site, but noise and vibration associated with the transport of borrow material could have an indirect impact to historic resources in the vicinity of the construction site or adjacent to the transportation route. It is expected, however, that construction-related traffic from more distant borrow sites (i.e., 10 to 30 mi) will utilize interstate or major arterial roadways where possible to minimize impacts. Therefore, any indirect impacts would be temporary and limited to the construction period. Indirect impacts would be minor and would not impair or have an adverse effect on historic properties.

Therefore, TVA anticipates that no historic properties would be affected by closure activities associated with Alternative B. Should undisturbed lands be required for laydown areas, TVA will comply with Section 106 requirements prior to closure activities affecting these areas.

3.18.2.3 Alternative C – Closure-by-Removal

Similar to Alternative B, no direct impact to historic properties will occur from Alternative C. No historic properties have been identified at the ash impoundment locations.

All CCR removed from the ash impoundment will be transported to a permitted landfill (either on-site or off-site). Indirect impacts from transporting CCR to a permitted landfill would have similar impacts as those discussed under Alternative B, but likely be for longer durations. Indirect impacts would be minor and would not impair or have an adverse effect on historic properties. As volumes of CCR transported increase, noise and vibration impacts could occur for longer periods of time and could have greater effects.

TVA finds that no historic properties would be affected by closure activities associated with Alternative C. Should undisturbed lands be required for additional laydown areas, TVA will comply with Section 106 requirements prior to closure activities affecting these areas.

3.19 Noise

3.19.1 Affected Environment

Noise is unwanted or unwelcome sound usually caused by human activity and added to the natural acoustic setting of a locale. It is further defined as sound that disrupts normal activities diminishes the quality of the environment. Community response to noise is dependent on the intensity of the sound source, its duration, the proximity of noise-sensitive land uses and the time of day the noise occurs (i.e., higher sensitivities would be expected during the quieter overnight periods).

Sound is measured in units of decibels (dB) on a logarithmic scale. The “pitch” (high or low) of the sound is a description of frequency, which is measured in Hertz (Hz). Most common environmental sounds are a composite of sound energy at various frequencies. A normal human ear can usually detect sounds that fall within the frequencies from 20 Hz to 20,000 Hz. However, humans are most sensitive to frequencies between 500 Hz to 4,000 Hz.

Given that the human ear cannot perceive all pitches or frequencies in the sound range, sound level measurements are typically weighted to correspond to the limits of human hearing. This adjusted unit of measure is known as the A-weighted decibel (dBA). A noise change of 3 dBA or less are not normally detectable by the average human ear. An increase of 5 dBA is generally readily noticeable by anyone, and a 10 dBA increase is usually felt to be "twice as loud" as before.

To account for sound fluctuations, environmental noise is commonly described in terms of the equivalent sound level or Leq. The Leq value, expressed in dBA, is the energy-averaged, A-weighted sound level for the time period of interest. The day-night sound level (Ldn), is the 24-hr equivalent sound level, which incorporates a 10-dBA correction penalty for the hours between 10 p.m. and 7 a.m., to account for the increased sensitivity of people to sounds that occur at night.

Common indoor and outdoor sound levels are listed in Table 3-16.

3.19.1.1 Noise Regulations

The Noise Control Act of 1972, along with its subsequent amendments (Quiet Communities Act of 1978, USC 42 4901-4918), delegates authority to the states to regulate environmental noise and directs government agencies to comply with local community noise statutes and regulations. Many local noise ordinances are qualitative, such as prohibiting excessive noise or noise that results in a public nuisance. Because of the subjective nature of such ordinances, they are often difficult to enforce. Only one of the counties in which TVA fossil-fuel power plants are located (Anderson County, Tennessee) has established quantitative sound-level regulations specifying environmental sound level limits based on the land use of the property receiving the noise.

There is considerable variation in individual response to noise. Noise that one person would consider mildly annoying, another person may consider highly annoying or not annoying at all. The EPA noise guideline recommends an L_{dn} of 55 dBA, which is sufficient to protect the public from the effect of broadband environmental noise in typical outdoor and residential areas. These levels are not regulatory goals but are “intentionally conservative to protect the most sensitive portion of the American population” with “an additional margin of safety” (EPA 1974). The U.S. Department of Housing and Urban Development (HUD) considers an Ldn of 65 dBA or less to be compatible with residential areas (HUD 1985).

Table 3-16. Common Indoor and Outdoor Noise Levels

Common Outdoor Noises	Sound Pressure Levels (dB)	Common Indoor Noises
	110	Rock Band (15 ft)
Jet Fly-Over (1000 ft)		
	100	
Gas Lawn Mower (3 ft)		
	90	Food Blender (3 ft)
Diesel Truck (50 ft)		
	80	Garbage Disposal (3 ft)
Gas Lawn Mower (100 ft)	70	
		Vacuum Cleaner (10 ft)
		Normal Speech (3 ft)
Heavy Traffic (300 ft)	60	
	50	Dishwasher Next Room
Typical Urban Daytime		
	40	
Urban Nighttime		Library
	30	Bedroom at Night
Rural Nighttime		
	20	Whisper
	10	
	0	Threshold of Hearing

Source: Arizona DOT 2008

3.19.1.2 Background Noise Levels

Noise levels continuously vary with location and time. In general, noise levels are high around major transportation corridors along highways, railways, airports, industrial facilities and construction activities. Sound from a source spreads out as it travels from the source, and the sound pressure level diminishes with distance. In addition to distance attenuation, the air absorbs sound energy; atmospheric effects (wind, temperature, precipitation) and terrain/vegetation effects also influence sound propagation and attenuation over distance from the source. An individual's sound exposure is determined by measurement of the noise that the individual experiences over a specified time interval.

Community noise refers to outdoor noise near a community. A continuous source of noise is rare for long periods and is typically not a characteristic of community noise. Typical background day/night noise levels for rural areas range between 35 and 50 dB whereas higher-density residential and urban areas background noise levels range from 43 dB to

72 dB (EPA 1974). Background noise levels greater than 65 dBA can interfere with normal conversation, watching television, using a telephone, listening to the radio and sleeping.

3.19.1.3 Sources of Noise
Coal-fired power plant operations and ancillary activities are expected to be the primary source of background noise at most operational TVA facilities. Ambient noise at those coal-fired power plants that are no longer operational would be characterized by adjacent roadway traffic and general environmental background noise which would be relatively low as most coal-fired power plants are located in rural settings. Noise sources common to activities evaluated in this EIS include noise from operating industrial and utility facilities, transportation noise and construction noise.

Operations at operating coal-fired power plants generate varying amounts of environmental noise and can include noise generating activities associated with barge operations, coal unloading activities and heavy equipment operations associated with coal pile management, truck operations and occasional rail operations. Existing noise emission levels associated with these activities typically range from 59 to 87 dBA (TVA 2014).

Transportation noise related to activities evaluated in the EIS primarily includes noise from highway traffic. However some of TVAs coal-fired power plants support rail traffic which would also generate noise. Three primary factors influence highway noise generation; traffic volume, traffic speed and vehicle type. Generally, heavier traffic volumes, higher speeds and greater numbers of trucks increase the loudness of highway traffic noise. Other factors that affect the loudness of traffic noise include a change in engine speed and power, such as at traffic lights, hills and intersecting roads and pavement type. Highway traffic noise is not usually a serious problem for people who live more than 500 ft from heavily traveled freeways or more than 100 to 200 ft from lightly traveled roads. (Federal Highway Administration [FHWA] 2011). Due to the nature of the decibel scale and the attenuating effects of noise with distance, a doubling of traffic will result in a 3 dBA increase in noise levels, which in and of itself would not normally be a perceivable noise increase. Railway noise depends primarily on the speed of the train but variations are present depending upon the type of engine, wagons and rails (Berglund and Lindvall 1995).

The level of construction noise is dependent upon the nature and duration of the project. Construction activities for most large-scale projects would be expected to result in increased noise levels as a result of the operation of construction equipment on-site and the movement of construction-related vehicles (i.e., worker trips, and material and equipment trips) on the surrounding roadways. Noise levels associated with construction activities will increase ambient noise levels adjacent to the construction site and along roadways used by construction-related vehicles. Construction noise is generally temporary and intermittent in nature as it generally only occurs on weekdays during daylight hours which minimizes the impact to sensitive receptors.

3.19.2 Environmental Consequences

3.19.2.1 Alternative A – No Action
Under the No Action Alternative TVA will not close ash impoundments at any of the coal-fired plants. Although no additional CCR will be managed in the impoundments, TVA will continue to perform care and maintenance activities as needed that may include inspections, cutting and maintaining vegetation on interior and exterior slopes, repair of eroded and rutted areas and repair/regrade animal paths and burrows and seeding and mulching bare areas. Therefore, there would be no change in the existing noise environment.

3.19.2.2 Alternative B – Closure-in-Place

Under Alternative B, CCR impoundments will be closed in place. Noise impacts would be associated with on-site closure activities and transport of borrow materials and other construction-related traffic to and from the work site. Closure activities would be temporary and most of the work would occur during the day on weekdays. However, construction activities could occur at night or weekends if necessary.

Heavy construction equipment used for closure activities will include (but may not be limited to) stationary equipment (generators and compressors), excavators, compactors, dump trucks graders, loaders, compactors, haul trucks, bulldozer, water trucks, cranes, forklifts, utility vehicles and boats. Noise from heavy equipment is primarily contained within the construction site. As illustrated by Table 3-17, typical noise levels from construction equipment used for closure are expected to be 85 dBA or less when measured at 50 ft. These types of noise levels would diminish with distance from the project area at a rate of approximately 6 dBA per each doubling of distance and therefore would be expected to attenuate to the recommended EPA noise guideline of 55 dBA at 1,500 ft. However, this distance would be shorter in the field as objects and topography would cause further noise attenuation. The ash impoundments at TVA's coal-fired power plants are generally located in remote areas currently used for industrial purposes and therefore most construction noise levels at the closest noise-sensitive receptor (i.e. residences, parks and recreation areas and schools) would be attenuated over distance and would be similar to noise from plant operations. For nonoperational plants, the existing noise levels are lower and therefore, construction-related noise would be a primary source of noise. However, due to the temporary and intermittent nature of construction and the attenuating effects of noise levels over distance, construction phase impacts to sensitive noise receptors are expected to be minimal. Examples of sensitive noise receptors include residences, parkland and churches.

Table 3-17. Typical Construction Equipment Noise Levels

Equipment	Noise Level (dBA) at 50 ft
Dump Truck	84
Bulldozer	85
Scraper	85
Grader	85
Excavator	85
Compactor	80
Concrete Truck	85
Boring-Jack Power Unit	80
Backhoe (trench)	80
Flatbed Truck	84
Crane (mobile)	85
Generator	82
Air Compressor	80
Pneumatic Tools	85
Welder/Torch	73

Source: FHWA 2015

Indirect noise impacts would be associated with the transportation related activities. Depending on the particular size and closure requirements at each site, varying amounts of borrow materials may be required to construct an approved cover system. For sites requiring little borrow material, the duration of transport activities and associated noise impact would be relatively short, whereas for larger sites, borrow transport activities may extend for longer periods of time. Noise impacts from the transport of borrow material are therefore, subject to site-specific analysis and may range from short term and minor to long term and substantial.

Transportation related effects may also occur in conjunction with construction-related traffic (the construction workforce and the shipment of goods and services) to the work site. As identified in Section 3.16, construction-related traffic will utilize interstate highways or major arterial roadways as much as possible and likely would not have a noticeable increase on traffic volume and consequently traffic noise in the vicinity of those major roadways However, construction-related traffic and transport of borrow material may result in an increase in intermittent noise at residences or other sensitive receptors located along any local roads that may be utilized during the construction period. For borrow sites at greater distances from the plant site, trucks are expected to use larger arterial roadways for much of the travel to and from the borrow site. Noise impacts from the additional transport of borrow along these arterial roadways is expected to be minor relative to existing baseline traffic-related noise. However, for receptors along the local roadway system serving each plant, noise related effects may be more pronounced during the construction period.

3.19.2.3 Alternative C – Closure-by-Removal

Direct noise impacts associated with on-site closure activities would be the same as identified under Alternative B and due to the temporary and intermittent nature of construction, and the attenuating effects noise levels over distance, construction phase impacts to sensitive noise receptors are expected to be negligible.

As with Alternative B, construction related traffic associated with impoundment closure and the transport of CCR to an off-site landfill by road or rail and the transport of borrow material by road could indirectly impact noise sensitive receptors located proximate to area roadways or railways. Indirect impacts associated with the transport of borrow material would be similar, as those described for Alternative B.

Noise emissions associated with the transport of CCR materials differs from Alternative B. Depending on the volume of CCR materials to be removed, larger amounts of equipment (especially haul trucks) would be required and the associated work force needed to operate this equipment would be larger. For sites having a lower volume of CCR (<700,000 yd^3) the combined use of trucks hauling off CCR from the site and hauling of borrow material to the site could total over 175 loads per day under the Closure-by-Removal Alternative. Under this scenario there could be a truck passing in front of a residence or other noise sensitive receptor every 1.5 minutes. While the intensity of the truck noise may be lower at receptors more distant from a roadway, frequent truck trips transporting CCR materials would increase the magnitude of the noise impact.

For impoundments with extremely large volumes of CCR, this impact may be long term and more intense. For example, strategies to shorten the duration of the removal effort may be accomplished by increasing the number of trucks. However, this would also increase the noise intensity due to the higher volume and increase the frequency of the disturbance. Under this alternative, noise impact magnitude and significance would vary and depend upon volume and duration of CCR removal.

Rail transport of CCR may also be a viable mode of transportation at some sites as addressed in Subsection 2.2.4.2. The rate of CCR removal by rail is expected to be similar to that of truck transport because rail loading operations are highly dependent on the rate at which CCR can be safely excavated, dried and moved to rail loading facilities. TVA carefully considered these factors and determined that the average rate of rail loading is 11.1 rail cars per day (1,000 yd^3 per day), a volume that is similar to the rate determined for truck transport. Based on this average, TVA anticipates that approximately one train per week would transport CCR along an existing railway to an off-site landfill. The noise impacts on residents and businesses adjacent to the railway from this additional trainload of CCR is expected to be minor.

Therefore, noise impacts resulting from the implementation of Alternative C are related to the transportation of CCR off-site and are dependent upon CCR volume to be removed, method of transportation and schedule for impoundment closure. For sites having relatively small volumes of CCR, impacts are expected to be minor and localized. By comparison, for sites requiring the removal of large volumes of CCR impacts from truck and rail traffic related noise may be expected to be pronounced and more widespread.

3.20 Solid Waste and Hazardous Waste and Hazardous Materials

3.20.1 Affected Environment

Solid waste consists of a broad range of materials that include refuse, sanitary wastes, contaminated environmental media, scrap metals, nonhazardous wastewater treatment plant sludge, nonhazardous air pollution control wastes, various nonhazardous industrial waste, and other materials (solid, liquid, or contained gaseous substances).

Hazardous materials are defined as any substance or material that has been determined to be capable of posing an unreasonable risk to health, safety and property. Hazardous material includes hazardous substances and hazardous waste. Under the RCRA hazardous waste is listed, or meets the characteristics described in 40 CFR Part 261, including ignitability, corrosivity, reactivity, or toxicity.

Hazardous materials and management of these materials are regulated under a variety of federal laws including the Occupational Safety and Health Administration (OSHA) standards, Emergency Planning and Community Right to Know Act and RCRA subtitle C. TVA adheres to these requirements either because they legally apply to its activities or as a matter of policy.

With the issuance of its CCR Rule on December 19, 2014, EPA decided to continue to regulate CCRs as solid waste. This includes fly ash, bottom ash and FGD solids (i.e., gypsum and calcium sulfite). Coal-fired plants remove these solid wastes through both wet and dry disposal methods. Dry disposal practices typically involve transferring the combustion wastes to a storage silo or outdoor storage pile to either be hauled to a landfill or, depending on the particular residual, sent off-site where it may be used to create beneficial by-products such as drywall or cement. In wet handling systems, bottom ash and fly ash is transported from the boiler and particulate removal units and is typically disposed of in surface impoundments. The properties of these wastes vary with the type of coal plant, the chemical composition of the coal and other factors (TVA 2015). Although CCRs are not considered a hazardous waste, they can contain hazardous substances in varying amounts.

TVA is required to comply with EPA's CCR Rule, which provides specific deadlines for compliance. EPA issued minimum national criteria, including requirements for composite liners, groundwater monitoring, structural stability requirements, corrective action and closure/post-closure care. EPA determined that compliance with these requirements would ensure that CCR management activities would "not pose a reasonable probability of adverse effects on health or the environment." 89 Federal Register 21468 (40 CFR 257.50(a)). Saying this differently, compliance with the CCR Rule is expected to adequately protect human health and the environment.

During 2015, TVA produced approximately 3.9 million tons of CCRs with approximately 2.1 million tons being synthetic gypsum and 1.1 million tons being fly ash (see Table 1-3). Of the 3.9 million tons, 33.6 percent were utilized or marketed, which is an increase from the annual average for 2010-2014 (25.5 percent), mostly due to reduced demand resulting from the recent recession. The main beneficial uses of coal combustion solid wastes are in the manufacture of wallboard, roofing, cement, concrete and other products.

The CCRs that are not sold for reuse are currently managed in landfills and impoundments at or near coal plant sites.

A variety of hazardous materials are used as part of daily operations at TVAs coal-fired power plants. A byproduct of the use of hazardous materials is the generation of hazardous wastes. Consequently, most TVA coal-fired plants are classified as small quantity generators of hazardous waste, generating between 100 and 1,000 kilograms of hazardous waste per month. The proper management of these materials/wastes is performed in accordance with established procedures and applicable regulations.

3.20.2 Environmental Consequences

3.20.2.1 Alternative A – No Action

Under Alternative A, TVA will not close ash impoundments at any of the coal-fired power plants. However, TVA is in the process of converting all wet ash and gypsum storage facilities, to dry storage and disposal facilities and does not plan to use ash impoundments for management of CCRs in the future. Solid and hazardous wastes generated at TVA coal-fired power plants will continue to be managed in accordance with established procedures and applicable regulations. Therefore, no impacts to solid waste and hazardous waste generation are anticipated.

3.20.2.2 Alternative B – Closure-in-Place

The only solid and hazardous wastes generated under this alternative would be from closure activities. Table 3-18 identifies representative solid and hazardous wastes that could be generated as a result of closure activities under this alternative.

Table 3-18. Representative Hazardous and Solid Wastes Generated During Construction

Waste	Origin	Composition or Characteristic	Disposal Method
Solid Waste			
Scrap wood, steel, glass, plastic, paper	Construction activities	Normal refuse	Recycle and/or dispose of in a Class I landfill
Land clearing wastes	Construction activities	Solids	Dispose of in a Class III or IV landfill
Waste oil filters	Construction equipment and vehicles	Solids	Recycle at a permitted TSDF
Oil fuel and solvent rags	Cleanup of small spills, cleaning and degreasing operations	Hydrocarbons	Dispose at a Class I landfill as special wastes
Non-hazardous solvents, paint, adhesives	Construction activities, Equipment cleaning	Solvents paints, adhesives that are not characteristic or listed hazardous waste	Dispose at a Class I landfill as special waste
Sanitary waste	Portable toilet holding tanks	Solids and liquids	Remove by contracted sanitary service
Hazardous Waste			
Used and waste lubricating and hydraulic oils	Construction vehicles and equipment	Hydrocarbons	Recycle at a permitted treatment, storage and disposal facility (TSDF)
Oily rags, oily sorbent	Cleanup of small spills	Hydrocarbons	Dispose at a permitted TSDF
Fuels, absorbents and soils contaminated by gasoline or diesel	Construction equipment	Ignitable, benzene, other hydrocarbons	Dispose at a permitted TSDF or recycle
Solvents, paint, adhesives	Construction activities, equipment cleaning	Ignitable solvents; solvents paints, adhesives containing constituents identified as characteristic hazardous waste (40 CFR 261 Subpart C); Solvents listed under 40 CFR 261 Subpart D	Recycle or dispose at a permitted TSDF
Solvent and fuel contaminated rags	Construction activities, equipment cleaning	See above	Recycle or dispose at a permitted TSDF
Miscellaneous acids and alkalis	Construction activities	Corrosive hazardous wastes	Dispose at a permitted TSDF
Spent lead acid batteries	Construction machinery	Lead, sulfuric acid	Manage as universal wastes
Spent lithium and Ni/Cd batteries	Equipment construction machinery	Heavy metals	Manage as universal waste
Fluorescent, mercury vapor and high intensity (sodium vapor) lamps	Lighting equipment	Mercury and other metals	Recycle or dispose of-site as universal waste
Contaminated environmental media	Site preparation	Varies	Dispose at permitted TSDF or Class I landfill

The primary waste streams resulting from construction would be solid nonhazardous waste. However, some nonhazardous liquid waste would also be generated. During construction, the primary solid nonhazardous wastes generated would be refuse from the contractor personnel, a small volume of construction debris (liner scraps, piping removed, etc.) and soils as briefly summarized below:

- Construction debris consisting primarily of liner scraps, piping removed, miscellaneous construction rubble, wastes from packing materials and empty nonhazardous chemical containers during project construction.
- Land clearing wastes would result from grading operations.
- Soils would result from land clearing, grading and excavation.

In addition to these larger nonhazardous waste streams, limited quantities of nonhazardous solvents, paints and adhesives, spill absorbent, oil and solvent contaminated rags, and empty containers would be generated.

Various hazardous wastes, such as fuels, lubricating oils, solvents, paints, adhesives, compressed gases and other hazardous materials could also be produced during construction. Oily wastes generated during servicing of heavy equipment will not be stored on site, but will be managed by off-site vendors who service on-site equipment using appropriate self-contained used oil reservoirs. Appropriate spill prevention, containment and disposal requirements for hazardous wastes would be implemented to protect construction and plant workers, the public and the environment.

TVA would manage all solid waste and hazardous wastes generated from construction activities in accordance with standard procedures for spill prevention and cleanup and waste management protocols in accordance with pertinent federal, state and local requirements.

Therefore, only minimal direct or indirect effects related to solid or hazardous wastes are anticipated from closure activities.

3.20.2.3 Alternative C – Closure-by-Removal

Similar to Alternative B, the proposed ash impoundment closure would result in the generation of some construction-related solid and hazardous wastes. With implementation of the standard procedures for spill prevention and cleanup and waste management protocols in accordance with pertinent federal, state and local requirements, only minimal direct or indirect adverse effects related to solid or hazardous wastes are anticipated from closure activities.

In addition, under this closure alternative, TVA will excavate and relocate the CCRs from ash impoundments to existing off-site facilities. OSHA requirements for workers engaged in excavation activities will be applied. Transport of CCRs will be managed under the requirements set forth under RCRA Subtitle D and in accordance with pertinent state and local requirements and impacts to solid waste and hazardous waste generation are not significant.

3.21 Public Health and Safety

Workplace health and safety regulations are designed to eliminate personal injuries and illnesses from occurring in the workplace. These laws may comprise both federal and state statutes. U.S. Department of Labor, OSHA is the main statute protecting the health and safety of workers in the workplaces. OSHA regulations are presented in Title 29 CFR Part 1910 (29 CFR 1919), OSHA Standards. A related statute, 29 CFR 1926, contains health and safety regulations specific to the construction industry. The Tennessee Department of Labor and Workforce Development has adopted federal OSHA standards contained in 29 CFR Parts 1910 and 1926 pursuant to Tennessee Code Annotated Section 50-3-201. Additionally, the federal regulations govern workplace health and safety requirements in private sector workplaces in Alabama since no state law governs workplace safety for public sector employers. The Kentucky Occupational Safety and Health Program, under the statutory authority of Kentucky Revised Statutes Chapter 338 has a state plan approved by the OSHA to protect the health and safety of workers in the workplaces.

3.21.1 Affected Environment

The routine operations and maintenance activities at the existing TVA facilities reflect a safety conscious culture. Activities are performed consistent with OSHA and state standards and requirements and specific TVA guidance. Personnel at TVA facilities are conscientious about health and safety having addressed and managed operations to reduce or eliminate occupational hazards through implementation of safety practices, training and control measures.

TVA has a safety program in place to prevent worker injuries and accidents. The various prevention programs include but are not limited to the following:

- Operations and Maintenance Plans
- Hazard Communication
- Housekeeping
- Project Safety Plans
- Competent Person
- Ground Disturbance
- Lifting Operations
- Energy Isolation (Lockout/Tag out)
- Cutting, Burning, Welding and other “Hot Work”
- Incident Reporting and Investigations
- Personal Protective Equipment
- Hearing Conservation
- Employee Training
- Contractor Evaluation and Acceptance
- Emergency Spill/Release Plans
- Emergency Response Plan

The implementation of proper engineering and equipment design, administrative controls such as employee training and compliance with regulatory requirements related to Health and Safety, help ensure that the risks associated with work at TVA facilities remain low.

Health risks are also associated with emissions and discharges from the facilities as well as accidental spills/releases and there are comprehensive environmental regulatory programs in place to manage and reduce such risks to acceptable levels. Coal-fired power plants are among the most heavily regulated industrial facilities in the country in this regard.

3.21.2 Environmental Consequences

3.21.2.1 Alternative A - No Action Alternative

The operations and maintenance activities at the TVA facilities will continue within the safety conscious culture and activities currently performed in accordance with applicable standards or specific TVA guidance. Facilities will continue to address and manage reduction or elimination of occupational hazards through implementation of safety practices, training and control measures. TVA's safety conscious efforts will continue such that potential impacts on worker and public health and safety would be reduced.

3.21.2.2 Alternative B – Closure-in-Place

Construction activities in support of the ash impoundment Closure-in-Place will be performed consistent with standards as established by OSHA and state requirements. These activities include moving and backfilling CCR and borrow (fill) material, placement of geomembranes and transportation of borrow material.

A recent study conducted by EPRI has evaluated the potential impacts of Closure-in-Place and Closure-by-Removal using a hypothetical CCR impoundment in Tennessee. In EPRI's analysis Closure-by-Removal was expected to have more adverse impacts than Closure-in-Place because Closure-by-Removal represents a longer, more intensive construction project than Closure-in-Place. The estimated number of labor hours for Closure-by-Removal is 5-fold greater than the estimated number for Closure-in-Place, and the estimated truck miles for Closure-by-Removal is 30-fold greater than for the estimated number for Closure-in-Place. Consequently, the potential for injuries and fatalities is directly proportional to labor hours and the number of miles driven (EPRI 2016b).

The risk of impacts of the Closure-in-Place Alternative would be temporary and limited to the construction period. During construction, customary industrial safety standards as well as the establishment of appropriate BMPs and job site safety plans would address job safety during the project. This includes the use of personal protective equipment when appropriate; programs for lockout, right-to-know, hearing conservation, heavy equipment operations, excavations, transportation and other activities; the performance of employee safety orientations and regular safety inspections; and the development of a plan of action for the correction of any identified hazards. All these measures would help ensure that job site safety risks are reduced.

Once closed, the TVA ash impoundment areas (all located within TVA plant sites) would be appropriately maintained. Facility health and safety practices would address and manage the reduction or elimination of occupational and public health hazards through implementation of safety practices, training and control measures in accordance with applicable federal, state and local laws and regulations and all applicable permit requirements.

3.21.2.3 Alternative C – Closure-by-Removal

As with Alternative B, construction activities in support of the ash impoundment Alternative C Closure-by-Removal will be performed consistent with standards as established by OSHA and state requirements.

Construction activities associated with impoundment Closure-by-Removal will include the excavation and disposal of CCRs from ash impoundments to existing off-site facilities. Deep excavations into the CCR impoundment required under the Closure-by-Removal Alternative are particularly dangerous as noted by reports of accidents leading to injury or death in the industry. As discussed in *Challenges of Closing Large Fly Ash Ponds* and other reports, accidents, near misses and fatalities have been reported at impoundments during operations and closure activities (Seymour et al. 2013, Johnson 2014, Mitchell 2006). Equipment, such as bulldozers and trucks, can become bogged down, disabled and engulfed. During the CCR recovery activities at KIF, one fatality occurred. TVA does consider worker safety its highest goal and its goal is to minimize risk to work safety. Despite constant attention to safety, accidents still happen. Additionally, extensive off-site trucking of CCR materials would represent an increased risk to worker safety and safety of the traveling public as a result of higher accident rates (especially on less improved secondary and local roadways).

In the analysis of the closure of the hypothetical CCR impoundment in Tennessee, EPRI also evaluated the potential effects of a closure scenario similar to Alternative C. EPRI found that for both injury and fatality incidents, the negative impacts of excavate and redispose were notably greater than the in-place closure (EPRI 2016b). Even greater risks of injury and fatality would occur for sites having especially high volumes of CCR.

Customary industrial safety standards including OSHA requirements for workers engaged in excavation activities would help reduce these risks. In addition, the establishment of appropriate BMPs and job site safety plans would address transportation in describing how job safety will be maintained during the project. These BMPs and site safety plans address the implementation of procedures to ensure that equipment guards, housekeeping and personal protective equipment are in place; the establishment of programs and procedures for lockout, right-to-know, hearing conservation, heavy equipment operations, excavations and other activities; the performance of employee safety orientations and regular safety inspections; and the development of a plan of action for the correction of any identified hazards. All these measures would help ensure that job site safety risks are reduced.

Similar to the closure-in-place alternative, TVA ash impoundment areas (all located within TVA plant sites) will be maintained, and facility health and safety practices would help reduce occupational and public health risks.

Therefore, the risk of adverse impacts to worker and public safety would be reduced. However, because of the volume of material that would be transported (both CCR and borrow material) and the duration of the closure project (years), the risks of impacts under Alternative C is much greater than under Alternative B.

3.22 Unavoidable Adverse Environmental Impacts

Unavoidable adverse impacts are the effects of the proposed action on natural and human resources that would remain after mitigation measures or BMPs have been applied. Mitigation measures and BMPS are typically implemented to reduce a potential impact.

Impacts associated with the closure of impoundments at TVA coal-fired power plants have the potential to cause unavoidable adverse effects to several environmental resources. On the other hand, impoundment closure also would be environmentally beneficial by reducing potential surface and groundwater contamination. The magnitude of adverse impacts and the degree to which they can be successfully avoided, minimized, or mitigated would vary from site to site. However, the impacts from closure under both alternatives would primarily be related to construction activities.

Specifically, activities associated with the use of construction equipment may result in varying amounts of dust, air emissions and noise that may potentially impact both on-site workers and nearby off-site residences and parks. Emissions from on-site construction activities and equipment are minimized through implementation of BMPs including proper maintenance of construction equipment and vehicles. During construction, BMPs to minimize runoff will be implemented but there could still be some uncontrolled runoff that could affect nearby outfalls and water bodies.

The transport of borrow material and CCRs to and from the ash impoundment sites as well as an increase in the construction workforce and construction-related equipment would increase traffic on public roads. This additional construction-related traffic would also increase noise and fugitive dust in areas proximate to these roads. Emissions from construction equipment are minimized through implementation of BMPS including proper maintenance of construction equipment and vehicles.

3.23 Relationship of Short-Term Uses and Long-Term Productivity

NEPA requires a discussion of the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity. This PEIS focuses on the analyses of environmental impacts associated with the closure of ash impoundments at all TVA coal-fired power plants. For the purposes of this section, activities associated with closure of the ash impoundments are considered short-term uses of the environment and the long term is considered to be initiated upon the completion of closure activities. This section includes an evaluation of the extent that the short-term uses preclude any options for future long-term use of the project site.

Closure of ash impoundments would have a negative effect on a limited amount of short-term uses of the environment such as air, noise and transportation resources as described above. Access to the TVA property where ash impoundments are located would be restricted during construction activities. This would primarily impact recreational users such as bank fisherman, birders, etc. In addition, construction activities such as site preparation and noise may displace some wildlife during the construction period. Most environmental impacts during closure activities would be relatively short term and would be addressed by programmatic BMPs and mitigation measures, but the duration of potential impacts would increase substantially depending on the amount of CCR and borrow material that is moved on-site and off-site.

Ash impoundment closure would have a favorable short-term impact to the local economies where TVA coal-fired power plants are located through the creation of construction and support jobs and revenue.

Long-term effects would include the permanent loss of waterfowl and wading bird habitat as ash impoundments are dewatered, and the potential permanent loss of recreational use as a result of implementation safety and security measures which would result in access restrictions to ash impoundments that are closed-in-place. However, other higher quality waterfowl and wading bird habitat is generally located elsewhere in the vicinity of the fossil plants as they are generally located on large rivers or reservoirs.

Ash impoundments that are closed-in-place will remain and safety and security requirements as well as post closure monitoring could limit other future use of these lands. Ash impoundments that are closed-through-removal would not be subject to future restrictions under the CCR Rule and these lands may be available for future industrial or nonindustrial use. However, all of the impoundments are located in areas presently dedicated for industrial uses which would limit future use of these sites.

In the near future, disposal of CCRs at all TVA coal-fired power plants will utilize a dry system. Ash impoundment closure would have a beneficial effect on long-term productivity through the reduction or elimination of potential subsurface discharges of leachate to groundwater that would occur as a result of closure of the ash impoundment.

3.24 Irreversible and Irretrievable Commitments of Resources

A resource commitment is considered irreversible when impacts from its use would limit future use options and the change cannot be reversed, reclaimed, or repaired. Irreversible commitments generally occur to nonrenewable resources such as minerals or cultural resources and to those resources that are renewable only over long time spans, such as soil productivity.

A resource commitment is considered irretrievable when the use or consumption of the resource is neither renewable nor recoverable for use by future generations until reclamation is successfully applied. Irretrievable commitments generally apply to the loss of production, harvest, or natural resources and are not necessarily irreversible.

In relation to ash impoundment closure, resources that construction activities would require, including labor, fossil fuels and construction materials, would be committed for the life of the project. Nonrenewable fossil fuels would be irretrievably lost through the use of gasoline and diesel-powered equipment during construction. In addition, construction materials (such as liners) would be consumed. However, it is unlikely that their limited use in these projects would adversely affect the future availability of these resources generally.

The transfer of borrow material from the borrow site to the ash impoundment could be both an irreversible and irretrievable commitment of resources. The loss of soil (which requires a very long time to generate) would constitute an irreversible and irretrievable resource commitment; however, revegetating the borrow site and ash impoundment would return both sites to productive status. Thus, the loss of vegetation until the areas are successfully revegetated would be an irretrievable commitment, but not irreversible.

The land used for the ash impoundments that are closed-in-place would be irreversibly committed as the CCR material would remain in place for the foreseeable future representing a permanent commitment of the land and precluding future use of the land. However, as these sites would be vegetated they would support some natural resources.

Land used by ash impoundments that are closed through removal is not irreversibly committed because once closure is complete, the land could be returned to other industrial or non-industrial uses at some time in the future.

3.25 Cumulative Effects

The CEQ regulations (40 CFR 1500-1508) implementing the procedural provisions of the NEPA of 1969, as amended (42 USC 4321 et seq.) define cumulative impact as:

> "…the impact on the environment which results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 CFR § 1508.7).

Baseline conditions reflect the impacts of past and present actions. The impact analyses summarized in preceding sections are based on baseline conditions and either explicitly or implicitly consider cumulative impacts.

3.25.1 Geographic Area of Analysis

The appropriate geographic area over which past, present and future actions could reasonably contribute to cumulative effects is variable and dependent on the resource evaluated. Actions related to ash impoundment closure within TVA's system of coal-fired power plants vary with respect to location and timing. However, they are unified under this cumulative effects analysis as "similar" actions. Therefore, for this programmatic level cumulative effects analysis TVA's service area is considered to be the appropriate context for analysis of cumulative effects of TVA ash impoundment closure for most resource areas.

This geographic area includes the Tennessee River Watershed and along the Cumberland, Mississippi, Green and Ohio rivers (where all the TVA operated coal fired plants are located) as identified in Figure 1-1.

3.25.2 Identification of "Other Actions"

TVA recognizes that many types of actions by others within the TVA service area have varying levels of impact on environmental resources. Such actions may include state highway maintenance and improvement projects, airport operations and expansions, rail development projects, industrial and mining operations and other actions. Those actions cannot be identified sufficiently to take them into account in TVA's analyses other than in the broadest sense. For this analysis TVA considered its broader program activities within the service area as being the predominant and appropriate context for analysis against the proposed closure of impoundments across its system of coal-fired power plants.

TVA's operations within the Tennessee Valley form a baseline of actions that influence environmental resources within the service area. Primary operations include those associated with energy, the environmental management and economic development.

3.25.2.1 Energy

TVA operates the nation's largest public power system, including 41 active coal-fired units, six nuclear units, 109 conventional hydroelectric units, four pumped-storage units, 87 simple-cycle combustion turbine units, 11 combined cycle units, five diesel generator units, one digester gas site and 16 solar energy sites. TVA also purchases power from third-party operators under long-term power purchase agreements. TVA's 16,000-mile-long transmission system is one of the largest in North America. For the past 14 years, the system achieved 99.999 percent power reliability. It efficiently delivered more than 161 billion kilowatt-hours of electricity to customers in FY 2014. Research is also ongoing related to emerging technological advances in small modular nuclear reactors (SMRs), grid modernization for transmission and distribution systems, energy utilization technologies and distributed energy resources (TVA 2015b).

3.25.2.2 Environmental Stewardship

TVA manages the Tennessee River system and associated public lands to reduce flood damage, maintain navigation, support power production, enhance recreation, improve water quality and protect shoreline resources. TVA manages its power system to provide reliable and affordable electricity. Since 1977, TVA has spent about $6 billion on air pollution controls and is investing approximately $1 billion in more control equipment at the Gallatin Fossil Plant in middle Tennessee. Emissions of NO_x are 91 percent below peak 1995 levels and emissions of SO_2 are 95 percent below 1977 levels through 2013.

TVA's emissions of CO_2 were reduced 32 percent between 2005 and 2013, and a 40 percent reduction in CO_2 emissions from 2005 levels is predicted by 2020. TVA is also reducing water use and waste production from its operations as it retires coal plants and increases generation from natural gas and renewable sources. Key environmental regulations relevant to TVA operations that contribute or that are expected to contribute to an overall improvement in environmental quality of air and water resources within the region include:

- Coal Combustion Residuals Rule
- Cross-State Air Pollution Rule (emissions related to SO_2 and NO_x)
- Mercury and Air Toxics Standards (Utility MACT) (emission standards for hazardous air pollutants)
- Clean Water Act Section 316(b) Cooling Water Intake Structures (entrainment and impingement reduction)
- Effluent Limitation Guidelines (levels of toxic metals in utility wastewater)

3.25.3 Analysis of Cumulative Effects

To address cumulative impacts, the existing affected environment surrounding the proposed action was considered in conjunction with the environmental impacts presented in Chapter 3. The potential for cumulative effects to each of the identified environmental resources of concern are analyzed below for Alternatives B and C.

3.25.3.1 Alterative B – Closure-in-Place

Under Alternative B, TVA will close ash impoundments in place and decisions to implement this alternative would be made on a site-specific basis. If this alternative were to be implemented programmatically at all of TVA's ash impoundments it would have very limited localized effects and those would primarily be beneficial.

As described for each resource analyzed within Chapter 3.0, resources that are not affected or that have an overall beneficial impact include land use, prime farmland, geology and seismology, floodplains, surface water, groundwater, vegetation, wildlife, aquatic ecology, threatened and endangered species, natural areas, visual and cultural resources. These resources are not included in this analysis as they are either not adversely affected, or the effects are considered to be minimal or beneficial. Overall risk related to groundwater and surface water quality would be improved on a cumulative basis within the Valley and within river systems supporting multiple coal-fired power plants subject to CCR impoundment closures (e.g., BRF and KIF on Clinch River; WCF and COF on Tennessee River; CUF and GAF on Cumberland River; Table 3-5).

This action will involve several activities that would potentially result in air, dust and noise emissions that may potentially be adverse. On-site vehicle/equipment use coupled with off-site trucking operations associated with borrow transport are the primary actions potentially affecting these resources. Construction-related traffic and transport of borrow material may result in an increase in intermittent noise at residences or other sensitive receptors located along any local roads that may be utilized during the construction period. However, emissions from these activities generally would have, a minor, short-term impact and localized effects and would not contribute to cumulative impacts.

3.25.3.2 Alternative C – Closure-by-Removal

As described for Alternative B, the overall risk related to groundwater and surface water quality would be improved under Alternative C on a cumulative basis within the Valley and within river systems supporting multiple coal-fired power plants subject to CCR impoundment closures.

The potential for cumulative effects to resources as a result of closure of ash impoundments by Closure-by-Removal is driven in-part by the need to transport CCR material to receiving landfills. This would not only impact the availability of disposal areas, but also the workforce and transportation demands associated with transporting the material and the associated off-site impacts.

Under this alternative, the amount of CCR that will have to be dewatered, excavated and hauled to permitted landfills ranges from <250,000 to 25,000,000 yd^3 on a site-specific basis. The volume to be transported on a programmatic basis (i.e., assuming all ash impoundments are closed under this alternative) is enormous (more than 67,000,000 yd^3). Under this alternative closure activities will also include the transport of borrow material, similar to the process discussed for Alternative B.

The quantity of dump trucks required to move this amount of material to receiving landfills is correspondingly very large and operations would be expected to result in greater effects on air emissions, GHG contribution, noise, safety and traffic operations (including roadway deterioration). Additionally, because the alternative requires significantly longer durations for impoundment closure (see Figure 3-9) the duration of operations under this alternative are long term, rather than short term. Strategies to shorten the duration of the removal effort such as increasing the number of trucks, may require utilizing resources from a wider area thereby expanding the scope of the cumulative effects. Additional transportation impacts may also result from overlapping haul routes extending from different plant sites to similar/different landfills. In the analysis of the closure of the hypothetical CCR impoundment in Tennessee, EPRI also evaluated the potential effects of a closure scenario similar to Alternative C. EPRI found that this scenario has a more negative impact than the in-place closure scenario when considering both $PM_{2.5}$ and PM_{10} emissions, likely due to the larger number of emission sources and the closer proximity of some emissions sources (roadways) to the residential community. Greater impacts from emissions, GHG contribution, safety and traffic operations may be expected to result in greater cumulative effects on these resources associated with this alternative. Rail movement of CCRs to landfills capable of receiving such movements would substantially reduce these potential impacts.

CHAPTER 4 – LITERATURE CITED

AECOM. 2009. Root Cause Analysis of TVA Kingston Dredge Pond Failure on December 22, 2008 – Kingston Fossil Plant, Harriman, Tennessee – Volume I – RCA Report

American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI). 2010. Minimum Design Loads for Buildings and Other Structures, American Society of Civil Engineers Standard ASCE/SEI 7-10.

Arizona Department of Transportation. 2008. Common Indoor and Outdoor Noise levels. Retrieved from http://azdot.gov/docs/default-source/planning/noise_common_indoor_and_outdoor_noise_levels.pdf?sfvrsn=4 (accessed September 11, 2015).

Atherton, Susan 2016. TVA Draft Ash Impoundment Closure Environmental Impact Statement Part I and II. Freight Insights, LLC. 2016.

Bailey, R. G. 1995. Description of the Ecoregions of the United States. Fort Collins, Colorado. USDA, Forest Service. Retrieved from www.fs.fed.us/land/ecosysmgmt/ecoreg1_home.html.

Bense, J. A. 1994. Archaeology of the Southeastern United States: Paleoindian to World War I. University of Alabama Press, Tuscaloosa.

Benziger, C. P. and J. M. Kellberg. 1951. Preliminary Geological Investigations for Eastern Area Steam Plant, Tennessee Valley Authority.

Berglund, B. and Lindvall, T. (Eds.). 1995. Community noise. Archives of the Center for Sensory Research 2(1), 1-195. Retrieved from http://www.noisesolutions.com/uploads/images/pages/resources/pdfs/WHO%20Community%20Noise.pdf

Bohac and Bowen. 2012. Water Use in the Tennessee Valley for 2010 and Projected Use in 2035. Tennessee Valley Authority, Chattanooga, Tennessee. Available at http://www.tva.com/river/watersupply/water_use.pdf

Bowen, Abigail, Jodie Branum, Corey Chandler, Adam Dattilo, Britta Dimick, Shea Gaither, Casey Henley, Todd Liskey, Joe Melton, Cherie Minghini, Paul Pearman, Kenton Smithson, Joe Turk, Emily Willard, and Robby Wilson. A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Transmission Construction and Maintenance Activities, Revision 2.1 – 2012.

Chapman, U. 1985. Archaeology and the Archaic Period in the Southern Ridge-and-Valley Province. Structure and Process in Southeastern Archaeology. Ed. R. J. Dickens and H. T. Ward. Tuscaloosa, University of Alabama Press, 137-153.

Conant, R. and J. T. Collins. 1998. A Field Guide to Reptiles and Amphibians: Eastern and Central North America. 3rd ed. Boston: Houghton Mifflin, 1998. 616 pp.

Council on Environmental Quality. 1997. Environmental Justice Guidance Under the National Environmental Policy Act, Executive Office of the President, Washington, DC. Retrieved from http://www.epa.gov/environmentaljustice/resources/policy/ej_guidance_nepa_ceq1297.pdf

Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1979. Classification of Wetland and Deepwater Habitats of the United States. Washington, D.C.: U.S. Fish and Wildlife Publication FWS/OBS-79/31.

Cushman, R. M. 1985. Review of Ecological Effects of Rapidly Varying Flows Downstream from Hydroelectric Facilities. N. Amer. J. Fisheries Management 5:330–339.

Diggins, M. R. and J. H. Thorp. 1985. Winter-spring depth distribution of Chironomidae in a southeastern reservoir. Freshwater Invertebrate Biology 4(1):8-21.

Dycus, D. L. and T. F. Baker. 2001. Aquatic Ecological Health Determinations for TVA Reservoirs—2000. An Informal Summary of 2000 Vital Signs Monitoring Results and Ecological Health Determination Methods. Primary authors/editors: Don L. Dycus and Tyler F. Baker. TVA Water Management, Clean Water Initiative, Chattanooga, Tennessee.

Electric Power Research Institute (EPRI). 2009. Potential Impact of Climate Change on Natural Resources in the Tennessee Valley Authority Region. Report 1020420, EPRI, Palo Alto, California, and TVA, Knoxville, Tennessee.

_____. 2016a. Qualitative Application of Relative Impact Framework to Ten Tennessee Valley Authority Surface Impoundments, Technical Report 3002007542, April 2016.

_____. 2016b. Relative Impact Framework Application for a Hypothetical CCR Impoundment. Technical Report 3002007544. May 2016.

_____. 2016c. Relative Impact Framework for Evaluating Coal Combustion Residual (CCR) Surface Impoundment Closure Options. Technical Report 3002007543. May 2016.

Federal Highway Administration. 2015. Construction Noise Handbook. Retrieved from http://www.fhwa.dot.gov/environment/noise/construction_noise/handbook/handbook09.cfm (accessed September 2015).Federal Highway Administration. 2011. Highway Traffic Noise: Analysis and Abatement Guidance. FHWA-HEP-10-025. December 2011

Fenneman, N., 1938. Physiography of Eastern United States. McGraw-Hill, New York.

Gibson, A. 1971. The Chickasaws. Norman: University of Oklahoma.

Green, E. R., K. R. Agent, J. G. Pigman, and Fields, M. A. Analysis of Traffic Crash Data in Kentucky (2003 – 2013). Kentucky Transportation Center, College of Engineering, University of Kentucky in cooperation with Kentucky Transportation Cabinet. Research Report KTC-4-7/KSP2-13-1F.

Griffith, G. E., J. M. Omernik, J. A. Comstock, S. Lawrence, G. Martin, A. Goddard, V.J. Hulcher, and T. Foster. 2001a. Ecoregions of Alabama and Georgia, Reston, Virginia, U.S. Geological Survey.

Griffith, G. E., J. M. Omernik, J. A. Comstock, S. Lawrence, G. Martin, A. Goddard, V. J. Hulcher, and T. Foster. 2001b. Ecoregions of Tennessee, Reston, Virginia, U.S. Geological Survey.

Hallowell, L. and C. McPhedran, Esq. 2015. Environmental Integrity Project, Sierra Club and EarthJustice on First Energy's Application for Minor Modification of Permit No. 300370 for the Hatfield's Ferry Power Station Coal Combustion By-Product Landfill to Dispose of Coal Combustion Waste Generated at the Bruce Mansfield Power Station (June 2015).

Hanson, K. L., K. I. Kelson, M.A. Angell, and W. R. Lettis, 1999, Techniques for identifying faults and determining their origins: NUREG-CR-5503, U.S. Nuclear Regulatory Commission, Washington, D.C.

Insurance Institute for Highway Safety, Highway Loss Data Institute (IIHS-HLDI). 2014. Retrieved from http://www.iihs.org/iihs/topics/t/large-trucks/fatalityfacts/large-trucks (accessed March 2016).

Intergovernmental Panel on Climate Change (IPCC). 2014. Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R. K. Pachauri and L. A. Meyer (eds.)]. IPCC, Switzerland, 151 pp.

Johnson, M. and K. Nilsson. 2014. Construction Considerations Are Key in Closure Planning for Coal Ash Ponds.

Kellberg, J. M. 1962. Foundation Investigations for the Bull Run Steam Plant, Tennessee Valley Authority.

Kentucky Department for Environmental Protection (KDEP), Division of Water. 2013. Final 2012 Integrated Report to Congress on the Condition of Water Resources in Kentucky. Volume II. 303(d) List of Surface Waters.

Kunkel, K. E., L. E. Stevens, S. E. Stevens, L. Sun, E. Janssen, D. Wuebbles, C. E. Konrad II, C. M. Fuhrman, B. D. Keim, M. C. Kruk, A. Billet, H. Needham, M. Schafer, and J. G. Dobson. 2013. Regional Climate Trends and Scenarios for the U.S. National Climate Assessment: Part 2. Climate of the Southeast U.S., NOAA Technical Report 14202, 103 pp., National Oceanic and Atmospheric Administration, National Environmental Satellite, Data, and Information Service, Washington D.C. Retrieved from http://www.nesdis.noaa.gov/technical_reports/NOAA_NESDIS_Tech_Report_142-2-Climate_of_the_Southeast_U.S.pdf]. p 83.

LeGrand, H. G. 2005. Associations of Avian and Herpetofauna Communities with Forest Management at Multiple Spatial Scales. Master's Thesis. Retrieved from http://etd.lsu.edu/docs/available/etd-08192005-145124/

LeGrand, H. G., M. J. Chamberlain, E. B. Moser. 2007. Diversity and Abundance of Breeding Birds in a Managed Loblolly Pine Forest in Louisiana. The American Midland Naturalist 157:2, 329-344.

Melillo, Jerry M., T. C. Richmond and G. W. Yohe, Eds. 2014. Climate Change Impacts in the United States: The Third National Climate Assessment. U.S. Global Change Research Program. Doi: 10,7930/J0Z31WJ2, p iii.

Miller, R.A. 1974. The Geologic History of Tennessee, Bulletin 74, Tennessee Division of Geology.

Mitchell, Wendy. 2015. Braken County man killed in ash pond slide at DP&L. J.M. Stuart Electric Generating Station. The Ledger Independent, July 25, 2006 by staff writer Wendy Mitchell. Retrieved from http://www.maysville-online.com/news/bracken-county-man-killed-in-ash-pond-slide-at-dp/article_12612753-294d-536b-b0b0-7454ef814eae.html (accessed August 2015).

Moore, James L., Finlayson, C. P., and Milici, R. C., 1993, Geologic Map and Mineral Resources Summary of the Harriman Quadrangle, Tennessee. State of Tennessee Department of Environment and Conservation.

National Highway Traffic Safety Administration (NHTSA), 2012, Traffic Safety Facts, 2012 Data, page 2.

Natural Resources Conservation Service (NRCS). 2014. Web Soil Survey. Retrieved from http://soils.usda.gov/survey/ (accessed December 2014).

Neves, R. J., A. E. Bogan, J. D. Williams, S. A. Ahlstedt, and P. W. Hartfield. 1997. Status of aquatic mollusks in the southeastern United States: a downward spiral of diversity. In: Aquatic Fauna in Peril: The Southeastern Perspective. Southeast Aquatic Research Institute.

Niemiller, M. L., R. G. Reynolds, and B. T. Miller (Eds.). 2013. The Reptiles of Tennessee. The University of Tennessee Press, Knoxville. 366 pgs.

Noble, R.L. 1981. Management of Forage Fishes in Impoundments of the Southern United States. Transactions of the American Fisheries Society. 100: 738-750.

North American Bird Conservation Initiative, U.S. Committee. 2009. The State of the Birds, United States of America, 2009. Washington, D.C.: U.S. Department of Interior. Retrieved from http://www.stateofthebirds.org/pdf_files/State_of_the_Birds_2009.pdf.

Omernik, J.M. 1987. Ecoregions of the Conterminous United States. Map (scale 1:7,500,000). Annals of the Association of American Geographers 77(1): 118-125. Retrieved from http://www.epa.gov/wed/pages/ecoregions/level_iii.htm#Ecoregions.

Ricketts, T. H., E. Dinerstein, D. M. Olson, C. J. Loucks, W. Eichbaum, D. DellaSala, K. Kavanagh, P. Hedao, P. T. Hurley, K. M. Carney, R. Abell, and S. Walters. 1999. Terrestrial Ecoregions of North America: A Conservation Assessment. Island Press, Washington, D.C.

Seymour, J., S. Macrowski, P. 2013. Amaya. Challenges of Closing Large Fly Ash Ponds. World of Coal Ash (WOCA) Conference. February 2013.

Sibley, D. A. 2000. The Sibley Guide to Birds. Knopf, New York.

Stantec Consulting Services Inc. 2009a. Report of Phase 1 Facility Assessment, Coal Combustion Product Impoundments and Disposal Facilities, Various Locations, Kentucky.

_____. 2009b. Report of Phase 1 Facility Assessment, Coal Combustion Product Impoundments and Disposal Facilities, Various Locations, Alabama.

_____. 2009c. Report of Phase 1 Facility Assessment, Coal Combustion Product Impoundments and Disposal Facilities, Various Locations, Tennessee.

_____. 2010a. Report of Geotechnical Exploration and Slope Stability Evaluation, Ash Pond 4, Colbert Fossil Plant, Tuscumbia, Alabama.

_____. 2010b. Report of Geotechnical Exploration and Evaluation of Slope Stability, Eastern Perimeter Dike, East Stilling Pond, Allen Fossil Plant, Shelby County, Tennessee.

_____. 2010c. Report of Geotechnical Exploration and Slope Stability Evaluation, Ash Pond, Cumberland Fossil Plant, Stewart County, Tennessee.

_____. 2010d. Report of Geotechnical Exploration and Slope Stability Evaluation, Ash Pond/Stilling Pond Complex, Gallatin Fossil Plant, Gallatin, Tennessee.

_____. 2010e. Report of Geotechnical Exploration and Slope Stability Evaluation, Ash Disposal Areas 2 and 3 (Active Ash Disposal Area), Johnsonville Fossil Plant, New Johnsonville, Tennessee.

Stein, B. A., L. S. Kutner, G. A. Hammerson, L. L. Master, and L. E. Morse. 2000. State of the States: Geographic Patterns of Diversity, Rarity, and Endemism. In B. A. Stein, L. S. Kutner, and J. S. Adams, Eds. Precious Heritage: The Status of Biodiversity in the United States. Oxford University Press, New York, New York.

Steponaitis, V. 1986. Prehistoric Archaeology in the Southeastern United States, 1870-1985. Annual Review of Anthropology 15:363-404.

Tennessee Ornithological Society (TOS). 2014. The Official List of the Birds of Tennessee. Available at http://www.tnbirds.org/TBRC/TBRC_checklist.html.

Tennessee State Parks. 2013. T.O. Fuller State Park. Retrieved from http://tnstateparks.com/parks/about/t-o-fuller (accessed April 2014).

Tennessee Valley Authority (TVA). 1990. Reservoir Operations Study Final Programmatic EIS.

_____. 2003. Colbert Fossil Plant Units 1 through 5 Reduction Systems for Control of Nitrogen Oxides. February 2003.

_____. 2004. Final Programmatic Environmental Impact Statement. Tennessee Valley Authority Reservoir Operations Study. Volume I – Environmental Impact Statement. February 2004.

_____. Tennessee Valley Authority 2008 Environmental Policy. Retrieved from https://jobs.tva.com/environment/policy.htm (accessed August 2015).

_____. 2009. Widows Creek Fossil Plant Gypsum Removal Project: Final Environmental Assessment. Jackson County, AL. July 2009.

_____. 2010. Kingston Dry Fly Ash Conversion, Final Environmental Assessment. June 2010.

_____. 2011. Natural Resource Plan, Final Environmental Assessment – Alabama, Georgia, Kentucky, Mississippi, North Carolina, Tennessee, and Virginia. 321 pp.

_____. 2012. Bottom Ash and Gypsum Mechanical Dewatering Facility, Bull Run Fossil Plant, Final Environmental Assessment. September 2012.

_____. 2013a. Widows Creek Fossil Plant Soil Excavation and Gypsum Stack Closure Environmental Assessment, Jackson County, Alabama, Tennessee Valley Authority, Chattanooga, Tennessee.

_____. 2013b. Alternate Source Demonstration Arsenic Concentrations in Groundwater, Allen Fossil Plant. October 2013.

_____. 2014. Allen Fossil Plant Emission Control Project, Final Environmental Assessment. August 2014.

_____. 2015a. Biological Monitoring of the Clinch River Near Bull Run Fossil Plant Discharge: Autumn 2014. June 2015.

_____. 2015b. Integrated Resource Plan 2015 Final Supplemental Environmental Impact Statement Volume 1- Main Text. July 2015.

_____. 2015c. John Sevier Fossil Plant Deconstruction Final Environmental Assessment, Hawkins County, Tennessee, Tennessee Valley Authority, Chattanooga, TN.

_____. 2015d. Kingston Fossil Plant Bottom Ash Dewatering Facility Draft Environmental Assessment. Roane County, Tennessee. March 2015.

_____. 2015e. Widows Creek Property Disposal Environmental Assessment. March 2015.

Tennessee Wildlife Resources Agency (TWRA). 2005. Tennessee's Comprehensive Wildlife Conservation Strategy. TWRA, Nashville, Tennessee.

USCB. 2015. https://www.census.gov/hhes/www/poverty/data/threshld/index.html accessed September 2015

U.S. Department of Agriculture NRCS (USDA). 2013. Summary Report: 2010 National Resources Inventory. Natural Resources Conservation Service, Washington, DC, and Center for Survey Statistics and Methodology, Iowa State University, Ames, Iowa. Retrieved from http://www.nrcs.usda.gov/Intenet/FSE_DOCUMENTS/stelprdb1167354.pdf.

U.S. Department of Housing and Urban Development. 1985. The Noise Guidebook, HUD-953-CPD Washington, D.C., Superintendent of Documents, U.S. Government Printing Office.

U.S. Environmental Protection Agency (EPA). 1974. Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, EPA-550/9-74-004, Washington, DC. Retrieved from http://www.nonoise.org/library/ levels74/levels74.htm (accessed September 2015).

_____. 2015a. Designated Sole Source Aquifers in EPA Region IV. Retrieved from http://www.epa.gov/safewater/sourcewater/pubs/reg4.pdf (accessed September 2015).

_____. 2015b. Environmental Justice, Retrieved from http://www3.epa.gov/environmentaljustice/ (accessed September 2015).

_____. 2015c. Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals From Electric Utilities; Final Rule Federal Register Vol. 80 No. 74 page 21302, April 17, 2015.

_____. 2015d. Technical Amendments to the Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities, 80 Federal Register 37988. July 2, 2015.

U.S. Forest Service (USFS). 1995. Landscape Aesthetics: A Handbook for Scenery Management (SuDoc A 1.76:701).

_____. 2014. Forest Inventory and Analysis - Forest Inventory Data Online. Available at http://apps.fs.fed.us/fia/fido/index.html (accessed June 2014).

U.S. Geological Survey. 1996. Fields of the Conterminous United States. USGS Open-File Report of 96-92.

U.S. Water Resources Council. 1978. Floodplain Management Guidelines For Implementing E.O. 11988. 43 FR 6030, Second Reprinting.

Vannote, R. L., G. W. Minshall, K. W. Cummins, J. R. Sedell, and C. E. Cushman. 1980. The River Continuum Concept. Canadian Journal of Fisheries and Aquatic Sciences. 37:130-137.

Voigtlander, C. W. and W. L. Poppe. 1989. The Tennessee River. Pages 372-384 in D. P. Dodge, Ed. Proc. International Large River Symposium, Canadian Journal of Fisheries and Aquatic Sciences Special Publication 106.

Wallace, J. B., J. R. Webster, R. L. Lowe. 1992. Biodiversity of the Southeastern United States: Aquatic Communities. C. T. Hackney, S. M. Adams, and W. H. Martin, editors. John Wiley and Sons, New York.

Wear, D. N., D. R. Carter, and J. Prestemon. 2007. The U.S. South's Timber Sector in 2005: A Prospective Analysis of Recent Change. U.S. Forest Service Southern Research Station, Asheville, N.C. Retrieved from http://www.srs.fs.usda.gov/sustain/report/index.htm.

Webbers, Ank. 2003. Public Water-Supply Systems and Associated Water Use in Tennessee. 2000. U.S. Geological Survey Water-Resources Investigations Report 03-4262.

Whitaker, J. O. Jr., and W. J. Hamilton. 1998. Mammals of the Eastern United States. Third edition. Cornell University, New York. 583 pp.

Zurawski, A. 1978. Ground-Water Resources of the United States, Tennessee Region. USGS Professional Paper 813-L. 1978.

CHAPTER 5 – LIST OF PREPARERS

5.1 NEPA Core Team

Name:	**Ashley Farless, PE, AICP (TVA)**
Education:	B.S. Civil Engineering
Project Role:	TVA Project Manager
Experience:	Professional Engineer and Certified Planner, 15 years in NEPA Compliance.

Name:	**Bill Elzinga (Amec Foster Wheeler)**
Education:	M.S. and B.S., Biology
Project Role:	Project Manager, NEPA Coordinator
Experience:	30 years of experience managing and performing NEPA analyses for electric utility industry and state/federal agencies; ESA compliance; CWA evaluations.

Name:	Abigail Bowen (TVA)
Education:	B.S. Environmental Science, Geography
Project Role:	TVA Waste Ash Compliance Program Manager
Experience	12 years of Environmental Compliance Experience

5.2 Other Contributors

Name	**Liz Burton (TVA)**
Education:	M.S., Wildlife and B.S. Biology
Project Role:	Terrestrial Ecology (Animals), Terrestrial Threatened and Endangered Species
Experience:	17 years conducting field biology, 12 years technical writing, 8 years compliance with NEPA and ESA.

Name:	**Cathy Coffey TVA)**
Education:	BA Journalism
Project Role:	Communications Manager
Experience:	Accredited Business Communicator; 30+ years in Environmental/Public Involvement

Name:	**Adam Dattilo (TVA)**
Education:	M.S., Forestry
Project Role:	Vegetation, Threatened and Endangered Plants
Experience:	10 years botany, restoration ecology, threatened and endangered plant monitoring/surveys, invasive species control, as well as NEPA and Endangered Species Act compliance.

Name:	**Kim Pilarski-Hall (TVA)**
Education:	M.S., Geography, Minor Ecology
Project Role:	Wetlands, Natural Areas
Experience:	20 years expertise in wetland assessment, wetland monitoring, watershed assessment, wetland mitigation, restoration as well as NEPA and Clean Water Act compliance.
Name:	**Robert Marker (TVA)**
Education:	B.S., Outdoor Recreation Resources Management
Project Role:	Parks and Recreation
Experience:	40 years in outdoor recreation resources planning and management.
Name:	**Carrie C. Williamson, PE, CFM (TVA)**
Education:	M.S., Civil Engineering; B.S., Civil Engineering; Professional Engineer, Certified Floodplain Manager
Project Role:	Floodplains
Experience:	2 years in Floodplains and Flood Risk; 3 years in River Forecasting; 11 years in Compliance Monitoring
Name:	**Craig Phillips**
Education:	M.S. and B.S. Wildlife and Fisheries Science
Project Role:	Aquatic Ecology and Threatened and Endangered Species
Experience:	7 years sampling and hydrologic determination for streams and wet-weather conveyances; 5 years in environmental reviews
Name	**Karen Utt (TVA)**
Education:	JD and B.A., Biology
Project Role:	Climate Change
Experience:	21 years of experience with environmental compliance, specializes in corporate carbon risk management and climate change adaptation planning for TVA.
Name:	**Tom Waddell (TVA)**
Education:	B.S., Chemical Engineering
Project Role:	Air Quality
Experience:	30 years in air permitting and compliance, regulatory development, and air pollution research
Name:	**A. Chevales Williams (TVA)**
Education:	B.S. Environmental Engineering
Project Role:	Surface Water
Experience:	10 years of experience in water quality monitoring and compliance; 9 years in NEPA planning and environmental services.

Name: **Richard Yarnell (TVA)**
Education: B.S., Environmental Health
Project Role: Cultural and Historic Resources
Experience: 39 years, cultural resource management

Name: **Deborah Barsotti, PhD**
Education: PhD, Pathology and B.A., Biology
Project Role: Solid and Hazardous Waste
Experience: 30 years of experience in human health and ecological risk assessment.

Name: **Jonathan Bourdeau (Amec Foster Wheeler)**
Education: M.S., Mgt. Science and B.S., Forest Resources
Project Role: Terrestrial/Wildlife
Experience: 18 years of experience in natural resources studies (protected species assessments, wetlands and NEPA).

Name: **Karen Boulware (Amec Foster Wheeler)**
Education: M.S., Resource Planning and B.S., Geology
Project Role: Socioeconomics and Environmental Justice, Natural Areas, Parks and Recreation, Noise
Experience: 25 years of professional experience in NEPA.

Name: **J. Emmett Brown, RPA**
Education: M.A., Anthropology and B.A., Anthropology
Project Role: Cultural Resources
Experience: 18 years of experience in development, coordination and implementation of archaeological projects.

Name: **Kelvin Campbell (Amec Foster Wheeler)**
Education: B.S., Geology, Geological Science and Hydrogeology
Project Role: Geology
Experience: 25 years of experience in geology and seismic assessment.

Name: **Steve Coates, PE (Amec Foster Wheeler)**
Education: B.S., Civil Engineering
Project Role: Transportation
Experience: 25 years of experience in conceptual design of urban and rural highway projects, environmental compliance and storm water management and civil site design and NEPA compliance.

Name: **W. Kenneth Derickson (Amec Foster Wheeler)**
Education: PhD, Biology and Ecology, M.S., Marine Biology, B.S., Biology and Natural Sciences
Project Role: Socioeconomics, Air Quality and Climate Change
Experience: More than 30 years of experience preparing Aquatic and Terrestrial Ecology, Land Use, Air Quality, Climate Change, Socioeconomics sections and managing the preparation NEPA documents.

Name:	**James B. Feild, PhD, RG/PG (Amec Foster Wheeler)**
Education:	PhD, Hydrogeology, M.S., Hydrogeology and B.S., Geological Oceanography
Project Role:	Groundwater
Experience:	Over 21 years of experience. Hydrogeological technical support.

Name:	**Linda Hart (Amec Foster Wheeler)**
Education:	B.S. Management/Biology
Project Role:	Technical Editor
Experience:	30 years of experience in production of large environmental documents including formatting, technical editing and assembling.

Name:	**Kenneth Paul Haywood III, FP-C, CE (Amec Foster Wheeler)**
Education:	M.S., Environmental Science and B.S., Environmental Science
Project Role:	Aquatic Ecology
Experience:	8 years of experience in aquatic, marine and terrestrial ecology studies, fisheries

Name	**Wayne Ingram P.E. (Amec Foster Wheeler)**
Education	B.S., Civil Engineering and B.S., Physics
Project Role	Surface Water, floodplains
Experience:	30 years of experience in surface water engineering and analysis including drainage, storm water management, water quality assessment, erosion and sedimentation, sediment transport, wetlands hydrology, stream restoration and storm water detention systems

Name:	**Brad Loomis, PE (Amec Foster Wheeler)**
Education:	M.S. and B.S., Civil Engineering
Project Role:	Transportation
Experience:	10 years of experience in civil engineering design including roadway and highway; storm and sanitary sewer; airport, airport facilities and site design; railroad design; federal and military facilities and permitting

Name:	**Heather Lutz, PG (Amec Foster Wheeler)**
Education:	M.S., Geological Engineering - Hydrogeology and B.S., Geology
Project Role:	Groundwater
Experience:	18 years’ experience in Remediation, Investigation, Compliance, Drilling and Well Installation, Subsurface Hydrogeology, Fractured Rock Hydrogeology, Quality Assurance, Health & Safety, Waste Management and Restoration).

Name:	**Marty Marchaterre (Amec Foster Wheeler)**
Education:	JD, Law
Project Role:	Project Management
Experience:	25 years of experience in NEPA document preparation.
Name:	**Stephanie Miller (Amec Foster Wheeler)**
Education:	M.S., Biology and B.S., Marine Biology
Project Role:	Land Use and Prime Farmland, Visual Resources
Experience:	8 years of experience in visual assessment, land use, aquatic and terrestrial ecology.
Name:	**Brian Mueller (Amec Foster Wheeler)**
Education:	B.S., Fisheries Biologist/Limnologist
Project Role:	Senior GIS Analyst
Experience:	25 years in GIS applications for environmental projects.
Name:	**Lana Smith (Amec Foster Wheeler)**
Education:	M.S., Biology and B.S., Environmental Biology
Project Role:	Public Health and Safety
Experience:	21 years in Health and Safety, Hazard Analysis Assessment and Health and Safety Plan development.
Name:	**Steve Stumne, PWS**
Education:	B.S., Biology
Project Role:	Vegetation, Threatened and Endangered Species
Experience:	Over 20 years of experience providing natural resource investigations, NEPA analysis and documentation, wetland and stream delineation/permitting/mitigation and endangered species investigations
Name:	**Irene Weber (Amec Foster Wheeler)**
Education:	M.S., Biology and B.S., Plant Biology
Project Role:	Vegetation, Threatened and Endangered Species
Experience:	5 years of experience in ecology and plant biology.
Name:	**David Zopff, PE**
Education:	B.S., Chemical Engineering
Project Role:	Noise
Experience:	29 years of experience in acoustic assessments to support NEPA documentation.

CHAPTER 6 – ENVIRONMENTAL IMPACT STATEMENT RECIPIENTS

Following is a list of the agencies, organizations, and persons who have received copies of the EIS or notices of its availability with instructions on how to access the EIS on the Ash Impoundment Closure Project Web page.

6.1 Federal Agencies

Advisory Council on Historic Preservation
United States Army Corps of Engineers, Memphis District
United States Army Corps of Engineers, Mobile District
United States Army Corps of Engineers, Nashville District
United States Army Corps of Engineers, Vicksburg District
United States Department of Agriculture, Forest Service, Region 8
United States Department of Agriculture, Natural Resources Conservation Service, Alabama State Conservationist
United States Department of Agriculture, Natural Resources Conservation Service, Kentucky State Conservationist
United States Department of Agriculture, Natural Resources Conservation Service, Tennessee State Conservationist
United States Fish and Wildlife Service, Alabama, Ecological Services Field Office
United States Fish and Wildlife Service, Kentucky Ecological Services Field Office
United States Fish and Wildlife Service, Tennessee, Ecological Services Field Office

6.2 Federally Recognized Tribes

Absentee Shawnee Tribe of Oklahoma
Alabama-Quassarte Tribal Town of the Creek Nation of Oklahoma
Alabama-Coushatta Tribe of Texas
Cherokee Nation of Oklahoma
Chickasaw Nation
Choctaw Nation of Oklahoma
Coushatta Tribe of Louisiana
Eastern Band of Cherokee Indians
Eastern Shawnee Tribe of Oklahoma
Jena Band of Choctaw Indians
Kialegee Tribal Town
Mississippi Band of Choctaw Indians
Muscogee Creek Nation
Poarch Band of Creek Indians
Seminole Nation of Oklahoma
Shawnee Tribe
Thlopthlocco Tribal Town
United Keetoowah Band of Cherokee Indians in Oklahoma

6.3 State Agencies

Alabama

Alabama Department of Agriculture and Industries
Alabama Department of Conservation and Natural Resources
Alabama Department of Economic and Community Affairs
Alabama Department of Environmental Management

Alabama Department of Transportation
Alabama Historical Commission

Kentucky
Kentucky Department for Energy Development and Independence
Kentucky Department for Local Government
Kentucky Department for Natural Resources
Kentucky Energy and Environment Cabinet
Kentucky Heritage Council
Kentucky State Clearinghouse

Tennessee
Tennessee Department of Environment and Conservation, Office of Policy and Planning
Tennessee Historical Commission
Tennessee Wildlife Resources Agency

6.4 Individuals and Organizations

United States Congressional and state representatives were notified of EIS availability; local officials in our coal plant communities, all TVA local power companies and directly served customers were provided notice of the EIS availability and given briefings as requested.

Alabama
Northwest Alabama Council of Local Governments
Top of Alabama Council of Local Governments

Tennessee
East Tennessee Development District
First Tennessee Development District
Memphis Area Association of Governments
Upper Cumberland Development District

Appendix A – Responses to Comments

APPENDIX A

RESPONSES TO COMMENTS
DRAFT
ASH IMPOUNDMENT CLOSURE PROGRAMMATIC DRAFT PEIS

June 2016

Table of Contents

CHAPTER A.1 – INTRODUCTION 1

CHAPTER A.2 – RESPONSES TO COMMENTS....... 3

2.1 General Comments 3
2.2 Public Involvement 8
2.2.1 Extend the Comment Period 8
2.2.2 Public Meetings 8
2.3 Use of Programmatic EIS for Impoundment Closures 8
2.4 Purpose and Need 9
2.4.1 Artificially Imposes a Short Timeframe (April 2018) 9
2.4.2 Closure Schedule is Voluntary Not Mandatory....... 10
2.5 Range of Alternatives....... 10
2.5.1 The No Action Alternative....... 10
2.5.2 Closure-in-Place 11
2.5.3 Closure-by-Removal....... 12
2.5.4 Preferred Closure Alternative 14
2.5.5 Beneficial Use....... 20
2.6 Need to Comply with Other Federal and State Laws....... 21
2.7 Need for Full Public Disclosure....... 22
2.7.1 EPRI Model and Report....... 22
2.7.2 Freedom of Information Act (FOIA) 23
2.7.3 Costs and Estimated Time for Closure Alternatives....... 23
2.8 Groundwater 25
2.9 Surface Water 31
2.9.1 Treatment Prior to Discharge to Surface Waters 31
2.9.2 Seepage 31
2.9.3 Mitigation Measures 32
2.9.4 Dewatering....... 33
2.9.5 Effluent Limitation Guidelines....... 34
2.10 Wildlife....... 34
2.11 Threatened and Endangered Species 35
2.12 Floodplain....... 37
2.13 Wetlands 37
2.14 Transportation....... 37
2.14.1 Analysis 37
2.14.2 Safety....... 38
2.14.3 Traffic....... 38
2.15 Socioeconomics – Environmental Justice....... 39
2.16 Air Quality....... 40
2.16.1 Greenhouse Gas Emissions....... 40
2.16.2 Life Cycle Analysis 40
2.16.3 Fugitive Dust/Particulate Emissions 40
2.17 Land Use....... 41
2.18 Landfill....... 42
2.19 Waste Management....... 43
2.20 Safety 44
2.21 Native American Consultation....... 45
2.22 Cumulative Impacts....... 45
2.23 Site-Specific Comments....... 45

2.23.1 General Comments 45
2.23.2 Allen Fossil Plant 47
2.23.3 Bull Run Fossil Plant 50
2.23.4 Colbert Fossil Plant 52
2.23.5 John Sevier Fossil Plant 53
2.23.6 Kingston Fossil Plant 54
2.23.7 Widows Creek Fossil Plant 56
2.23.8 Gallatin Fossil Plant 57
2.24 Southern Environmental Law Center Consultant Report Comments 58
2.24.1 Atherton Report 59
2.24.2 Global Environmental, LLC Report (Mark Quarles) 60
2.24.3 RT Environmental Services 61

CHAPTER A.1 – INTRODUCTION

The Draft Programmatic Environmental Impact Statement (Draft PEIS) was released to the public on December 30, 2015 and the notice of its availability was published in the Federal Register on January 8, 2016 (81 FR 936). Publication in the Federal Register initiated the public comment period that was originally scheduled to close on February 14, 2016 but was then extended until March 9, 2016 in response to several requests.

The Draft PEIS was posted on the project Web site. Printed copies and/or DVDs containing electronic files of the documents were mailed to certain federal agencies and to others upon request.

TVA accepted comments submitted through an electronic comment form on the project Web site and by mail and email. During the comment period, TVA held ten public meetings (Table 1-1) to describe the proposed actions and to accept comments on the Draft PEIS.

TVA chose the open forum meeting format to allow members of the public to drop in at their convenience and meet with TVA staff. At these meetings, TVA provided members of the public the opportunity to look at displays, view a presentation, discuss the proposed actions with our subject matter experts and submit comments.

Table 1-1. Public Meetings

Date	Location
1/12/16	Paducah, KY
1/13/16	Paradise, KY
1/19/16	Stevenson, AL
1/20/16	Tuscumbia, AL
1/21/16	Memphis, TN
2/02/16	Rogersville, TN
2/03/16	Oak Ridge, TN
2/04/16	Kingston, TN
2/23/16	Clarksville, TN
2/24/16	Waverly, TN

TVA published notices of the public meetings in the following newspapers: Central City Leader News; Central City Times Argus; Paducah Sun; Paducah West KY News; Colbert County Reporter; North Jackson Progress; Commercial Appeal; Oak Ridge; Roane County News; The Rogersville Review; The Leaf-Chronicle; and The News Democrat.

TVA received approximately 70 comment submissions which included letters, e-mails, petition-style submissions, comment forms, and submissions through the project Web site. The comment submissions were signed by more than 650 individuals. The comment submissions were carefully reviewed and synthesized into comment statements. These comment statements and TVA's responses to them are provided in Chapter 2 of this appendix. The comments and responses are categorized into broad topics. Most of these topics are further categorized into more specific issues.

Approximately 583 individuals and groups submitted comments as part of organized campaigns. These comments were received as part of e-mails, form letters and submissions consisting of the text and a list of names and addresses of those who supported the comments. Each of these sets of identical comments was treated as a single comment.

The two organized commenting campaigns were those submitted by:

- Sierra Club (411 individuals signed a form letter)
- Southern Alliance for Clean Energy (164 individuals signed a petition)

In addition, the Southern Environmental Law Center (SELC) and nine other environmental advocacy groups submitted an 89-page letter with hundreds of pages of attachments commenting on the Draft PEIS. The other groups were: Environmental Integrity Project, Southern Alliance for Clean Energy, Earthjustice, SOCM E3, Tennessee Clean Water Network, Shoals Environmental Alliance, Sierra Club, Alabama Rivers Association and the Tennessee Riverkeeper. Unless otherwise indicated, these commenters are collectively referred to as SELC or Southern Environmental Law Center.

The most frequently mentioned topics included comments regarding the public involvement process, project purpose and need, range of closure alternatives, identification of the preferred alternative, need to comply with other federal and state requirements, need for full public disclosure, beneficial use of CCR and a range of environmental resource issues such as, groundwater, surface water, transportation, wildlife, floodplains, wetlands, air quality, socioeconomics/environmental justice, land use, safety, and waste management. Additional comments regarding Part II, the site-specific reviews were also received.

CHAPTER A.2 – RESPONSES TO COMMENTS

2.1 General Comments

1. Comment: NEPA requires TVA to analyze fully, fairly and publicly the environmental impacts associated with a reasonable range of alternatives before choosing a course of action. *(Commenter: Southern Environmental Law Center)*

Response: Comment noted. TVA utilized a thorough process to identify and evaluate reasonable alternatives for closure of CCR impoundments. This process included:

- a public scoping phase in which initial input from the agencies (federal, state), public, nationally recognized tribes, and other interested parties was sought on the alternatives that should be considered; and
- careful consideration of the purpose and need for TVA's proposed actions that inform the alternatives to be considered.

This process included evaluation of the No Action Alternative, consistent with TVA's procedures and regulations promulgated by the Council on Environmental Quality (CEQ) that implement the National Environmental Policy Act (NEPA). We think the alternatives evaluated in the Draft PEIS are reasonable.

Under Section 309 of the Clean Air Act, the U.S. Environmental Protection Agency (EPA) reviews and rates draft EISs issued by other agencies. In its March 7, 2016 letter reviewing the Draft PEIS, EPA said: "EPA has rated this Draft PEIS as "LO" – or Lack of Objections. The EPA has not identified any significant environmental impacts to the proposed action that would require substantive changes to the Draft PEIS or require the TVA's consideration of different alternatives for the site-specific closure plans."

2. Comment: Draft PEIS references the CCR Rule in numerous places. The CCR Rule constitutes a self-implementing program enforceable through the Resource Conservation and Recovery Act (RCRA) citizen suit provision and by States using their independent regulatory authority. EPA recommends including a link to additional information that can be used as a quick reference for citizens, stakeholders, and other interested parties. TVA may wish to consider inclusion of an appendix that summarizes the key provisions of 40 CFR Part 257 regulations as it pertains to future TVA NEPA documents (*Commenter: U.S. Environmental Protection Agency*)

Response: TVA has included this link in the Final PEIS: https://www.epa.gov/coalash

3. Comment: The Draft PEIS is fundamentally deficient in several ways. First, the public's ability to comment meaningfully on the Draft PEIS has been thwarted by TVA's refusal to disclose key analyses of environmental impacts. Second, TVA's programmatic approach to closure of coal ash ponds improperly obscures the extent of site-specific environmental impacts. Third, the statement of purpose and need in the Draft PEIS artificially constrains TVA's timeline for closing the ponds and ignores the full extent of TVA's legal obligation to protect human health and the environment. Fourth, the "no action" alternative analyzed in the Draft PEIS is manifestly contrary to TVA's existing legal obligations. Its analysis of impacts must therefore reflect the consequences of enforcement that must be undertaken by EPA, the State or citizens. Fifth, neither the programmatic Draft PEIS nor the site-specific analyses consider a reasonable range of clean closure alternatives, including closure that uses on-site lined landfills or transportation off-site by rail, barge, or other trucking options. Finally, the Draft PEIS fails to establish the proper baseline for analysis of key impacts, particularly impacts to groundwater and surface water. *(Commenter: Southern Environmental Law Center)*

Response: TVA disagrees with the conclusion that the Draft PEIS is fundamentally deficient. TVA conducted a thorough and complete analysis of all reasonable alternatives in both the programmatic and site-specific reviews of impoundment closures considered in the Draft PEIS. The sound basis of TVA's NEPA analysis in this document is mirrored by the letter from EPA dated March 07, 2016, in which the EPA did not identify any impacts that would require substantive changes to the document.

Responses to specific comments as they relate to the general conclusions of this comment are provided in the responses below.

4. Comment: It seems like the process is being rushed and not all factors and possibilities are being considered in the Draft PEIS. *(Commenter: Kaela Odell)*

Response: TVA has followed the NEPA process and employed a public involvement process that has involved multiple opportunities for public comment, including public scoping and comment periods and held ten public meetings near locations where it is proposing to close CCR impoundments. This process complies with and goes beyond applicable NEPA requirements in CEQ's and TVA's regulations and procedures. TVA considers it important that the NEPA process be conducted and completed in time for TVA and the public to consider the potential environmental impacts of proposed closure methods and to support impoundment closure decisions that TVA needs to make.

5. Comment: Make a public apology for the 2008 TVA Kingston disaster and the coal ash spill around Perry County, Alabama. Take executive pay cut at home and give to the environment. *(Commenter: Ajeet Khalsa)*

Response: This comment is out of scope. The 2008 ash spill at Kingston has been successfully remediated with no apparent long-term environmental or health consequences. TVA is unaware of any ash spill at Perry County, Alabama.

6. Comment: I appreciate the opportunity to comment. *(Commenter: Peter Scheffler)*

Response: TVA acknowledges the comment.

7. Comment: I have no comments about your EA, because you already know the option you will choose and are just holding your 'public meetings' so you can check the box and say you have done as required. *(Commenter: Patricia Hart)*

Response: TVA held ten public meetings to provide information about the actions it is proposing to take and facilitate the public providing comments. The fact that TVA has proposed actions that it is considering taking does not denote that it has reached final decisions regarding those actions.

8. Comment: Thank you for what TVA does in our region – making life better for all of us. Please consider a balanced approach to all pond closure actions – considering environment, economic development, and energy – for the citizens TVA serves. (*Commenter: Wilbourne Markham*)

Response: TVA acknowledges the comment.

9. Comment: TVA is rushing its plans to avoid compliance with the new coal ash rule, which implements stricter standards for safe coal ash storage. (*Commenter: Hunter Oppenheimer)*

Response: See the response to Comment 4. TVA's proposed actions fully comply with the CCR Rule. EPA determined in the CCR rulemaking process that the potential benefits of dewatering CCR impoundments – reducing structural integrity and groundwater contamination risks – were significant and encouraged utilities to dewater and close impoundments quickly. EPA purposefully structured its CCR Rule to encourage utilities to accelerate the closure of CCR impoundments because of the decrease in groundwater risk and increased structural stability that results from eliminating the downward hydraulic pressures of ponded water. These pressures are often referred to as "hydraulic head" which is defined as the force exerted by a column of liquid expressed by the height of the liquid above the point at which the pressure is measured. As promulgated, EPA excluded impoundments that are closed by April 2018 from the rule's other substantive requirements. It said: "EPA adopted this approach to create an incentive to expedite the closure of these units, with all of the significant risk mitigation that such a measure would entail" (80 FR 21302-21408 [April 17, 2015]). TVA identified 10 of its impoundments in Part II of the Draft PEIS that could be closed by April 2018.

On April 18, 2016, after release of the Draft PEIS, EPA asked the D.C. Circuit Court of Appeals to remand and vacate the accelerated closure incentive in a partial settlement of litigation challenging the CCR Rule. EPA took this action because the agency failed to provide an opportunity for notice and comment on the accelerated closure incentive. This action does not affect EPA's technical determination that accelerated closure is beneficial because it will significantly reduce structural failure and groundwater contamination risks. Because of this pending regulatory change, TVA decided not to use the April 2018 incentive closure date as a significant factor in its consideration of the reasonableness of Closure-in-Place or Closure-by-Removal. Instead, TVA takes into account the five-year timeframe that EPA set for completing impoundment closures, 40 CFR §257.102(f). EPA determined that almost all impoundments could be closed within that period absent "unpredictable or variable conditions" (80 Federal Register 21422). An early closure is environmentally preferable to a later closure, and this fact—recognized by EPA—still remains an important consideration in TVA's analyses.

10. Comment: Supports TVA converting to dry storage for CCR management. (*Commenter: US Department of Interior)*

Response: TVA acknowledges the comment.

Comment: Clean, safe water is our most precious commodity. I urge TVA to be transparent and vigilant in guarding our water and in keeping it contaminant-free. The current coal-ash leakage must be properly addressed. (*Commenter: Joan Harshman)*

Response: Consistent with EPA's determination, TVA has concluded that removal of the hydraulic head of water in an impoundment reduces the risk of groundwater contamination under either Closure-in-Place or Closure-by-Removal.

11. Comment: TVA has a lot of work to do to deserve public trust, especially after the 2008 Kingston spill. Using the latest and best technology to engineer maximum control to prevent leaking of toxicants must be one key step in regaining public trust. On behalf of myself, my family, my neighbors, communities downstream, and the public for generations to come--I petition you for TVA standard to be the latest and best technology to engineer maximum control of environmental harms. *(Commenter: Allanah Tomich)*

Response: TVA acknowledges the comment.

12. Comment: Request that TVA incorporate the requirements of the EPA's coal ash rule and the TDEC coal ash order into the study. TVA should also explain how it will select new coal ash disposal areas, while also ensuring that it will comply with state and federal law in constructing those new areas. (*Commenter: Rhonda Cowden)*

Response: The Final PEIS has been revised to better explain the relationship between the administrative order that the TDEC issued to TVA that covers TVA's coal-fired plants in Tennessee, except Gallatin, and the CCR Rule. If TVA constructs or contracts with existing landfills to manage its CCRs in the future, it would ensure that the landfills comply with applicable regulatory requirements. As various sections of the Final PEIS indicate, the movement of CCRs from TVA's coal-fired plants to off-site landfills would result in environmental impacts that have to be considered before this is done.

13. Comment: Concern that TVA conducted insufficient environmental analysis, failure to provide all relevant documents to the public and preferred alternative to permanently leave coal ash in unlined, leaky impoundments. (*Commenters: Angela Garrone, Southern Alliance for Clean Energy and Southern Environmental Law Center*)

Response: Comment noted. TVA evaluated potential environmental impacts at both a programmatic and site-specific level. In doing this, TVA considered the significant amount of data that it has collected through years of monitoring CCR management activities at its plants, the analyses that EPA conducted and considered in the development of its CCR Rule, and analyses and studies that others have conducted. Literature and studies that were used to support analyses contained in the Draft PEIS are listed in separate "Literature Cited" chapters within each NEPA analysis. Most of these documents are readily available in the public domain. Concerns in this comment are addressed in more detail in subsequent answers.

The EPRI reports referenced in the Draft PEIS are intellectual property of EPRI and cannot be given away by EPRI members, including TVA. However, these reports can be obtained from EPRI. The framework analysis which is the foundation for EPRI's other analyses was made available to the public in November 2015 before TVA released its Draft PEIS in December 2015.

14. Comment: Agree with TVA's statement that once closure is complete, the closure in place and closure by removal options under EPA's CCR Rule are equally protective of public health and the environment; indeed, the US Environmental Protection Agency makes this point repeatedly throughout the final rule. (*Commenter: Utility Solid Waste Activities Group)*

Response: TVA acknowledges the comment.

15. Comment: The Draft PEIS should make clear that the CCR Rule does not mandate closure of CCR surface impoundments and that TVA is not proposing to close its CCR surface impoundments due to requirements in the CCR Rule. Nor is the Draft PEIS being undertaken to “assist TVA in complying with the CCR Rule.” Draft PEIS at 1. Rather, TVA has made an independent decision to close its CCR surface impoundments and the Draft PEIS is being conducted by TVA to evaluate the environmental impacts of the two closure options under the CCR Rule pursuant to TVA’s obligations under the National Environmental Policy Act (“NEPA”). TVA should also clarify that all estimated costs and timelines provided in the Draft PEIS are applicable only to TVA’s site-specific circumstances and not to the utility industry as a whole. (*Commenter: Utility Solid Waste Activities Group)*

Response: As noted in the Draft PEIS, EPA initially structured its CCR Rule to encourage regulated entities to accelerate the closure of CCR impoundments because of the decrease in groundwater risk and increased structural stability that results from eliminating the downward hydraulic pressures of ponded water. TVA agrees that the CCR Rule does not mandate closure of CCR surface impoundments. Nevertheless, the implementation of TVA’s stated goal of eliminating all wet CCR storage does assist TVA in complying with the CCR Rule and achieving TVA’s goal of eliminating all wet CCR storage. The Final PEIS represents TVA’s independent analysis of issues related to closure of ash impoundments on the TVA system. We think aspects of this analysis certainly do and will apply to actions proposed by other utilities, but individual utilities can determine this for themselves.

16. Comment: The CCR Closure requirements that TVA is required to meet to comply with the EPA’s CCR regulations overlaps with the responsibilities TVA must meet as a part of the Davidson County Chancery Court Action for the TVA Gallatin site and the TDEC/TVA Commissioner's Order for all other TVA Fossil Plants in Tennessee. The TVA Draft PEIS for Ash Impoundment Closure is designed to meet the EPA’s regulations while the TDEC enforcement orders require TVA to: (1) Determine the areal and vertical extent of CCR material at each TVA Fossil Plant; (2) Determine the extent of soil, surface water and ground water contamination associated with the CCR material at each TVA Fossil plant; (3) Determine any environmental and/or public health threats posed by the CCR materials; and (4) Develop and implement a Remedial Action and Risk Assessment Plan for each TVA Fossil Plant that resolves the environmental and public health threats the CCR material may pose. (*Commenter: TDEC)*

Response: Comment noted. The Final PEIS has been revised to better explain the relationship between the TDEC administrative order, other regulatory programs, and the CCR Rule. We note that in addition to requiring TVA to conduct CCR impact analyses under the direction of TDEC, the TDEC order provides it oversight of TVA’s activities implementing the CCR Rule. EPA encouraged States to do this in the CCR Rule.

17. Comment: The EPA has rated this Draft PEIS as "LO"- or Lack of Objections. The EPA has not identified any significant environmental impacts to the proposed action that would require substantive changes to the Draft PEIS or require the TVA's consideration of different alternatives for the site specific closure plans. (*Commenter: US Environmental Protection Agency*)

Response: TVA acknowledges the comment.

2.2 Public Involvement

2.2.1 Extend the Comment Period

18. Comment: TVA should extend the comment period on the Draft PEIS. (Commenters: *US Environmental Protection Agency (EPA), Hannah Shimabukuro, David Wasilko, Ajeet Khalsa, Adam Hughes, Hunter Oppenheimer, Angela Garrone, Southern Alliance for Clean Energy, Sierra Club, Southern Environmental Law Center, Environmental Integrity Project, National Sierra Club, Tennessee Chapter of the Sierra Club, Statewide Organizing for Community eMpowerment (SOCM), Alabama Rivers Alliance, Shoals Environmental Alliance and Kentucky Environmental Foundation)*

Response: TVA extended the comment period by 14 days. The public comment period totaled 61 days; however, the Draft PEIS was posted on our public Web site more than a week before the beginning of the formal public comment period. The mandatory public comment period is only 45 days.

2.2.2 Public Meetings

19. Comment: TVA received 5 comments regarding public meetings that had to do with meeting format, materials and content. (Commenters: *Martha Deaderick, Jim Wike, J. Watson, Patricia Hart, Rhonda Cowden*)

Response: TVA chose the open forum meeting format to allow individuals to drop in at their convenience and meet with TVA staff to discuss the proposed actions. At these meetings, members of the public were provided the opportunity to look at displays, view a presentation, discuss the proposed actions with our subject matter experts and provide comments. TVA has used the open forum format for many years and thinks it works well.

20. Comment: Could you please provide me with a copy of the Public Notice, which should have been published in a Jackson County Alabama news publication, and which news publication with general circulation in Jackson County Alabama was the notice published, regarding the Public Meeting on Tuesday, January 19, 2016 which was held at the North Jackson High School regarding the Widows Creek Coal Ash disposal alternatives. Also, asked to be added to distribution lists for public notices. One other suggestion, when TVA meets in Jackson County for a formal, or for that matter an informal public meeting, please inform the Jackson County Commission as they have an interest in TVA meetings in this area. Plus, they would make an announcement of the meeting in their sessions, as they have accomplished for past TVA Public Meetings. *(Commenter: Gary Morgan)*

Response: As requested, TVA provided a copy of the public notice and has added Mr. Morgan to distribution lists for future public notices. TVA published notices concerning public meetings in local and regional newspapers and on the project Web site.

2.3 Use of Programmatic EIS for Impoundment Closures

21. Comment: The analysis in the Draft PEIS demonstrates that TVA's programmatic approach to closure of coal ash ponds improperly obscures the extent of site-specific environmental impacts. (*Commenters: Southern Alliance for Clean Energy, Southern Environmental Law Center)*

Response: We disagree. A programmatic environmental review is appropriate to use in the evaluation of a proposal to proceed with multiple projects that are temporally or spatially connected and that will have a series of associated concurrent or subsequent decisions. Programmatic NEPA reviews address the general environmental issues relating to a suite of projects, and can effectively frame the scope of subsequent site and project-specific actions. CEQ regulations provide for programmatic reviews and the tiering process that allows more site-specific actions to rely on programmatic analyses and avoid recreating or redoing relevant analyses.

While TVA performed a programmatic review of impoundment closure in Part I, this analysis in no way obscures or interferes with the completeness or accuracy of the environmental analyses performed for each site-specific facility considered in Part II or that will be undertaken to address proposed closure of other CCR facilities. The specific CCR facilities that are analyzed in Part II and that tier from Part I of the PEIS do not comprise all of the CCR facilities at TVA plants. The tiered NEPA analyses included in Part II appropriately rely upon and integrate the over-arching and bounding analyses performed in the first tier, while also integrating site-specific details and analyses where appropriate.

2.4 Purpose and Need

2.4.1 Artificially Imposes a Short Timeframe (April 2018)

22. Comment: TVA artificially imposes a short timeline for impoundment closure and ignores the full scope of its legal obligation to protect the human health and environment. (*Commenters: Southern Alliance for Clean Energy, Southern Environmental Law Center)*

Response: EPA purposefully structured its CCR Rule to encourage utilities to accelerate the closure of CCR impoundments because of the decrease in groundwater risk and increased structural stability that results from eliminating the downward hydraulic pressures of ponded water. These pressures are often referred to as “hydraulic head” which is defined as the force exerted by a column of liquid expressed by the height of the liquid above the point at which the pressure is measured. As promulgated, EPA excluded impoundments that are closed by April 2018 from the rule’s other substantive requirements. It said: “EPA adopted this approach to create an incentive to expedite the closure of these units, with all of the significant risk mitigation that such a measure would entail” (80 FR 21302-21408 [April 17, 2015]). TVA identified 10 of its impoundments in Part II of the Draft PEIS that could be closed quickly.

On April 18, 2016, after release of the Draft PEIS, EPA asked the D.C. Circuit Court of Appeals to remand and vacate the accelerated closure incentive in a partial settlement of litigation challenging the CCR Rule (environmental groups argued that the rule had been improperly promulgated). This does not affect EPA’s technical determination that accelerated closure will significantly reduce structural failure and groundwater contamination risks. Because of this pending regulatory change, TVA decided not to use the April 2018 incentive closure date as a significant factor in its consideration of the reasonableness of Closure-in-Place or Closure-by-Removal. Instead, TVA takes into account the five-year timeframe that EPA set for completing impoundment closures, 40 CFR §257.102(f). EPA determined that almost all impoundments could be closed within that period absent “unpredictable or variable conditions.” 80 Fed. Reg. 21422. An early closure is environmentally preferable to a later closure, and this fact—recognized by EPA—still remains an important consideration in TVA’s analyses.

23. Comment: The Draft PEIS should provide an accurate purpose and need statement for the proposed action, not the Draft PEIS. For example, TVA could describe the purpose of its action as follows: "The purpose of the proposed closure of TVA's CCR surface impoundments is to respond to operational changes at its coal-fired power plants and to meet its voluntary commitment to close CCR impoundments at these same facilities. *(Commenter: Utility Solid Waste Activities Group)*

Response: TVA acknowledges the comment. The purpose and need has been clarified and restated as follows:

The purpose of this programmatic action is to support the implementation of TVA's stated goal of eliminating all wet CCR storage at its coal plants by closing CCR impoundments across the TVA system, and to assist TVA in complying with EPA's CCR Rule.

2.4.2 Closure Schedule is Voluntary Not Mandatory

24. Comment: Contrary to TVA's interpretation, the coal ash rule does not "encourage" fast-tracking pond closure regardless of the potential threat to public health and the environment. *(Commenter: Southern Environmental Law Center)*

Response: See response to Comment 22.

2.5 Range of Alternatives

2.5.1 The No Action Alternative

25. Comment: The "no action" alternative analyzed in the Draft PEIS violates TVA's existing legal obligations, and its analysis of impacts must therefore reflect the consequences of enforcement by EPA, the State or citizens. The No Action is not a reasonable alternative but TVA structured it to be the baseline. Draft PEIS fails to describe the "no action" alternative accurately, ignoring the TVA Board's pre-existing direction and the predictable consequences of continuing to violate state and federal water pollution and solid waste laws. *(Commenter: Southern Environmental Law Center)*

Response: The No Action Alternative is included because applicable regulations require the consideration of a No Action Alternative in order to provide a baseline for potential changes to environmental resources. For TVA, the No Action Alternative is the baseline for comparing changes resulting from the closure alternatives. TVA agrees that the No Action Alternative is not reasonable and that its own goal to switch to dry CCR storage would lead to changes in the management of CCRs at TVA plants.

26. Comment: The Draft PEIS should state clearly that the "No Action Alternative" is not inconsistent with the requirements of the CCR Rule. Continuing to operate a CCR surface impoundment—rather than closing the impoundment using closure in place or closure by removal—is unambiguously allowed by the CCR Rule so long as the applicable criteria under the Rule are met. To the extent that TVA determines the No Action Alternative is not a reasonable alternative within the context of the Draft PEIS, TVA should support this conclusion using analysis of its own site-specific circumstances. *(Commenter: Utilities Solid Waste Activities Group)*

Response: TVA agrees that the CCR Rule does not necessarily require the closure of CCR impoundments unless certain conditions exist. TVA has restated its Purpose and Need statement in the Final PEIS to help clarify this.

2.5.2 Closure-in-Place

27. Comment: TVA has not considered the alternative to line the current impoundments. In other words, dig up the ash, line the existing ponds, and then put the ash back into them. *(Commenter: Southern Environmental Law Center)*

Response: TVA has considered various options for impoundment closure and has determined that Closure-in-Place and Closure-by-Removal methods were viable closure methods for the ash impoundments within the TVA system. Most of the existing ash impoundments are located in areas with limited space for on-site temporary storage of ash or lack sufficient area that would be needed for storm water management associated with temporary storage of saturated material. Because of the size of many of TVA's CCR impoundments, it would take years to excavate the CCR, move it to a temporary stockpile, design and engineer the lining of the excavated area, and obtain the necessary regulatory approvals to do all of this. In the interim, the CCR would remain exposed to precipitation with the ongoing risk of groundwater contamination. Other factors relating to management of temporary ash piles including maintaining the correct moisture balance to limit fugitive dust must be considered for this method of closure.

28. Comment: It seems to make little sense to relocate the coal ash in TVA storage ponds to landfills. The land where the ash ponds are located is already ruined for most uses. Why disturb additional land somewhere else to move the ash? There are hazards connected with moving that much ash, particularly if it is transported even part way by truck on public roads. Maybe the best argument for leaving the ash in place is that the current and future ratepayers will have to pay for moving it. Some folks probably look at TVA as a cash cow. However, the only money the agency has is that left over from power sales after production and maintenance expenses are paid. *(Commenter: David Mays)*

Response: TVA acknowledges the comment. TVA's analyses of the Closure-by-Removal Alternative agree with this commenter. For future impoundment closures, use of new on-site landfills is a potential option. Future environmental reviews will discuss the impacts of disturbing additional, on-site land, including prime farmland that TVA has purchased around its facilities.

29. Comment: Has TVA considered the option to consolidate CCR at each site into 1 pond? *(Commenter: U.S. Environmental Protection Agency).*

Response: In Part I of the Draft PEIS we describe one of the "Closure-in-Place" methods as being a reduced footprint option, and acknowledges that this may be a viable option for future impoundment closures. For each of the site-specific impoundment closures included in Part II, TVA has evaluated this as a potential option. For example, at WCF the Upper and Lower Stilling Basins would be closed by consolidation of residual CCR materials into the primary ash impoundment.

30. Comment: TVA completely fails to analyze whether its proposal to cap coal ash in place can be done "properly" according to the Coal Ash Rule and state law requirements. (*Commenter: Southern Environmental Law Center)*

Response: The commenter fails to explain what it means by “properly” closing an impoundment. TVA is subject to state and federal requirements related to closure of ash impoundments. TVA will continue to work with state and federal regulatory authorities to ensure that closure methods properly comply with applicable requirements.

31. Comment: Closure-in-Place is not protective of groundwater as ash may remain in contact with groundwater (*Commenter: Southern Environmental Law Center)*

Response: TVA disagrees and notes that EPA determined in the CCR Rule:

> EPA did not propose to require clean closure [close by removal] nor to establish restrictions on the situations in which clean closure would be appropriate. As EPA acknowledged in the proposal, most facilities will likely not clean close their CCR units given the expense and difficulty of such an operation. Because clean closure is generally preferable from the standpoint of land re-use and redevelopment, EPA has explicitly identified this as an acceptable means of closing a CCR unit. However, both methods of closure (*i.e*., clean closure and closure with waste in place) can be equally protective, provided they are conducted properly. [80 Fed. Reg. 21412 (April 17, 2015)].

In response to comments like this, EPA considered the potential implication of groundwater saturated CCR (CCR that is below the groundwater table) on its risk conclusions and concluded that “this uncertainty is unlikely to have an appreciable effect.” EPA, *Human and Ecological Risk Assessment of Coal Combustion Residuals*, 5-10 - 5-11 (December 2014).

Regardless of the location of ash with respect to the water table, TVA expects Closure-in-Place or Closure-by-Removal will reduce groundwater contamination impacts relative to baseline (current) conditions. In its comments, SELC directed TVA’s attention to the reduction in groundwater contamination that has occurred at the Wateree coal-fired plant operated by South Carolina Electric & Gas Company (SCE&G). According to SELC, SCE&G is the process of excavating the CCR impoundments at Wateree that are within the water table. About one-third of the ash (876,000 tons) has been removed to date and arsenic contamination levels already have fallen by 95 to 99 percent. SELC asserts that this confirms the benefit of closure by removal. Since two-thirds of the CCR remains in the impoundments or more than 1.7 million tons and presumably some or all of this is in contact with the groundwater, TVA thinks this example shows the benefits of dewatering a CCR impoundment, a necessary step for either the close in place or closure by removal method, on reducing groundwater contamination, consistent with TVA’s and EPA’s analyses.

Groundwater will be monitored after closure to detect groundwater impact improvements in accordance with an approved state closure plan and CCR post-closure requirements, which will include monitoring, assessment and corrective action, if appropriate. If groundwater contamination exceeds applicable standards, additional action would be taken to address this in the future.

2.5.3 Closure-by-Removal

32. Comment: Duke Energy has chosen to use the Closure-By-Removal Alternative at all of their sites. Why are they able to do this and TVA can’t? *(Commenter: Southern Alliance for Clean Energy)*

Response: This is incorrect. Under North Carolina legislation, Duke was required to remove CCR at certain of its plants and to study removal methods at its remaining plants. Very recently, North Carolina's Department of Environmental Quality (DEQ) assigned Duke's remaining ash ponds risk levels that will require closure by removal under the state's legislation, but according to media reports, DEQ questions whether this is appropriate, and Duke is reported as saying it is not possible to accomplish closure-by-removal on the schedule mandated by the state legislation. DEQ plans to seek changes to the state legislation. This development is consistent with TVA's analysis.

33. Comment: This is absolutely UNACCEPTABLE and amounts to gross negligence. Digging that contaminated dirt out and moving it to a safer location will be cheaper than the legal team & settlements that will ensue. *(Commenter: Chris Rucker)*

Response: TVA acknowledges the comment. The Final PEIS assesses the potential impacts and costs of both Closure-in-Place and Closure-by-Removal. The cost of Closure-by-Removal would be substantially higher than Closure-in-Place. See response to Comment 69 for additional information on comparing estimated costs for both Closure-in-Place and Closure-by-Removal Alternatives.

34. Comment: The programmatic Draft PEIS does not consider a reasonable range of clean closure alternatives, such as:

1) Removal to an on-site lined landfill;
2) Removal by truck to lined landfills at varying distances with different types of trucks;
3) Removal by barge, rail, and intermodal transport. *(Commenter: Southern Environmental Law Center)*

Response: Additional information has been added to the Final PEIS in response to these comments. With respect to potential alternatives related to the use of existing on-site landfills, TVA considered this for several sites, no existing lined landfills exist on-site that may be considered for use as disposal sites for impoundment closures (e.g., Allen, John Sevier and Widows Creek Fossil Plants). For other sites, it should be noted that such landfills are in current operation and planned for receiving CCR materials from operating plants (e.g., Bull Run and Kingston Fossil Plants), and as such, no capacity exists for use in impoundment closures on-site. For future impoundment closures, use of new on-site landfills is a potential option. However, TVA has received comments opposing the siting of new CCR landfills on-site (at Kingston and Gallatin Fossil Plants) and the Southern Environmental Law Center expressed concerns about siting new landfills on sites. Based on TVA experience, siting new landfills often takes 5 to 10 years to be evaluated, engineered and designed, permitted and constructed.

With respect to other modes of transport of CCR materials under the Closure-by-Removal Alternative, this comment does not identify the types of trucks TVA should consider. TVA used a 15-ton truck because it is a widely available size. TVA considered the potential use of larger, articulated dump trucks for off-site transport of CCR, but this mode of transport was considered to be highly impactful and inconsistent with weight limits on public roads set by state departments of transportation. TVA assumed a representative distance to landfills in the Draft PEIS (30 miles) as a basis for assessing impacts, recognizing that distances could in fact, be greater (and more impactful) or shorter (less impactful).

TVA also considered that while each mode of transportation has a different frequency of accident, each mode also has different magnitudes of impacts from an accident. For example, a barge accident may release large volumes of CCR directly into a body of water and the location increases both the environmental impact as well as mitigation efforts. We note that members of the SELC coalition, the Sierra Club and Environmental Integrity Project, are actively opposing as unacceptably risky the use of barges in the removal of CCR from an impoundment operated by First Energy. A truck accident would have a lower volume of CCR released than a barge or train accident, therefore, the environmental impacts and mitigation efforts may be less when compared to a barge or train accident. However, a truck has an increased chance to be in an accident with another vehicle.

TVA assessed the reasonableness of using barge as a transport mode in Part I, Chapter 2. This analysis demonstrated that barge transport was not a reasonable alternative. Similarly, TVA assessed the reasonableness of using rail as a transport mode in Part I, Chapter 2. This mode of transport was determined to be viable for consideration in future impoundment closures depending on site-specific conditions.

35. Comment: Coal ash originally comes from the mines the coal came from. Put it back where it came from. Not all mines are 'wet' use the dry shafts to store the ash. The coal cars are going back to the mines empty, fill one out of a hundred with ash. Tell the EPA to go jump in the lake when they object and they will. *(Commenter: George Wood)*

Response: The comment is acknowledged. The Office of Surface Mines (OSM) and EPA are working to develop federal regulations concerning minefill. Tennessee does not allow CCR to be used for minefill but Alabama and Kentucky allow the use of CCR for mine reclamation. Coal and coal ash have significantly different characteristics and using coal mines to dispose of coal ash would not be as simple as loading coal ash into the rail cars that brought coal to power plant sites. See the response to Comment 39.

36. Comment: TDEC observed that the BRF and the KIF each have two impoundments with one impoundment at each plant smaller in size and volume than the other. For the purpose of completing a more comprehensive assessment, TDEC recommends that TVA consider the option of Closure-by-Removal of the smaller impoundment and Closure-in-Place of the larger impoundment at each CCR site in the context of the proposed actions in the Final Draft PEIS. *(Commenter: Tennessee Department of Environmental Conservation)*

Response: In Part I of the Draft PEIS, TVA has described one of the “close-in-place” methods as being a reduced footprint option, and acknowledges that this may be a viable option for future impoundment closures. For each of the site-specific impoundment closures included in Part II, TVA has evaluated this as a potential option. For example, at Widows Creek the Upper and Lower Stilling Basins will be closed by consolidation of residual CCR materials into the primary ash impoundment. This could require State approval with the attendant delays those processes bring.

2.5.4 Preferred Closure Alternative

37. Comment: Recommends Alternative C. (*Commenter: Frances Lamberts, Martha Deaderick*)

Response: TVA acknowledges the comment.

38. Comment: Much land will be needed to store our waste. (*Commenter: Jim Wike*)

Response: TVA acknowledges the comment.

39. Comment: If coal can be transported to TVA, why can it not be removed in a similar fashion? *(Commenter: Hannah Shimabukuro)*

Response: See the response to Comment 35. The infrastructure used to transport and unload coal is not the same infrastructure to load and transport CCR. As noted in the Final PEIS, rail or barge transport would require the installation of new CCR loading and unloading infrastructure. Unloading infrastructure would not be located on TVA property (the location where CCR would be sent). Barge transportation was not considered a viable method to transport CCR to an off-site landfill (see Part I, Subsection 2.2.4.2). For rail transportation, a rail carrier would be needed. Rail cars would need to be lined to support CCR removal operations, and rail facilities would have to be expanded and improved at most facilities to support CCR loading and unloading operations. Environmental risks from discharges or releases may occur. After the Kingston spill in 2008, rail was used to transport some CCR to the Arrowhead Landfill in Perry County, Alabama. However, the infrastructure used to load the CCR was removed and is no longer available. Also, the effort involved in transporting by rail turned out to be labor intensive, required dedicated rail cars and was slower than anticipated. Additional information has been added to the Final PEIS text to better address this issue.

40. Comment: The Closure-in-Place alternative would allow CCRs to be managed in a manner that prevents any potential exposure to the public and which is consistent with the industrial character of the sites where these facilities already exist. Traffic would be considerably harmed by the Closure-by-Removal Alternative. CCR already managed at these locations. Locations are already off limits to the general public and often secured from trespassing by fences or security patrols. Prevents exposure to public and is in line with industrial character where these sites already exist. Additional efficiencies could be achieved through the use of CCR for contouring the fill materials below the final cover. Closure-by-Removal seems wasteful: (1) transfer of CCR from one location to another now creates multiple locations where need to be managed and/or potential environmental effects; (2) waste of fuel to perform excavation of CCR, transport CCR, create another disposal location and take multiple years; (3) expose people who live along transportation route to safety concerns such as exposure to CCR and truck traffic as well as wear and tear on roads requiring maintenance; and (4) empty hole may need to be filled requiring construction equipment and trucks to excavate and bring in fill dirt. (*Commenter: Paul Puckett*)

Response: TVA acknowledges the comment.

41. Comment: TVA should move all coal ash to safer dry, lined storage areas safely away for our waterways and drinking water sources. Covering up the ash with insufficiently constructed caps would allow the toxic waste to continue polluting. TVA's draft plan fails to prevent toxic coal ash from entering our drinking water supplies and state's treasured lakes, rivers and streams. (*Commenter: Sierra Club)*

Response: TVA acknowledges the comment. See the Final PEIS Part I, Sections 3.6 and 3.7 for discussions and analyses regarding potential effects on surface water and groundwater that may be used as public water supplies.

42. Comment: Does TVA plan to use Closure-by-Removal at any of the sites? If so, do you plan to haul any of this material to the new impoundment at WCF? This needs to be done by removal, for the public safety and more importantly, almost all utilities down river draws drinking water from the Tennessee River. (*Commenter: Bruce Purdy, North Alabama Electric Cooperative*)

Response: TVA has determined that its preferred closure alternative is Closure-in-Place at the site-specific impoundments. TVA does not plan to construct a new impoundment at Widows Creek. TVA is aware of no data showing that drinking water at utilities downstream are being impacted. See the Final PEIS Part I, Section 3.7 for discussions and analyses regarding potential effects on surface water resources. Further, consistent with EPA's determination, TVA has concluded that removal of the hydraulic head of water in an impoundment reduces the risks of groundwater contamination and structural instability under either Closure-in-Place or Closure-by-Removal.

43. Comment: Covering up coal ash pits will not prevent them from contaminating groundwater and thereby threatening drinking water, human health, flora and fauna. Have we learned nothing from mistakes of the past? Please reconsider this draft plan. We cannot simply cover these pits and bury our heads in the sand. Our lives and the future of our land are at stake. The lands and waters we call home have given us so much. The least we can do is demand their safekeeping by the energy industries, particularly coal. Think of Flint, Valdez, the Gulf. We can do better. We can be a positive example, not an embarrassing and tragic one. TVA can be a leader in environmental stewardship rather than a disciple of the status quo. (*Commenter: Holley Roberts)*

Response: TVA acknowledges the comment. Note that the analyses in both the programmatic and site-specific NEPA reviews included a thorough treatment of all environmental resources and factors including groundwater, drinking water, human health, flora and fauna. Closure-by-Removal and Closure-in-Place are both expected to reduce the risk of groundwater contamination.

44. Comment: In the greater Knoxville area, the Bull Run and Kingston coal-fired steam plants together have the capacity to store at least 5 billion gallons of coal-ash waste. Much of this waste at both plants is currently stored in unlined pits (coal-ash ponds) dangerously close to rivers and lakes. The ash contains arsenic, lead, and other dangerous heavy metals, substances that can cause a host of health problems, including cancer, brain damage, and developmental defects. In its draft plan, TVA plans to construct a cap over coal ash waste where it is stored, even though the utility's own monitoring data shows that groundwater near these sites is being polluted with toxic metals. This "cover up" approach would keep the pollution in contact with groundwater, allowing contamination to continue unmitigated. The Kingston Steam Plant ash storage pit failure cost billions in reclamation and gained international infamy. If leaky pits are left in place, rate-payers could be stuck with an unprecedented pollution legacy for decades to come. I appeal to TVA to remove its coal ash to lined, dry storage away from our communities and waterways. This approach is prudent and protective of rate-payers' water quality and reduces liability from further release of contaminants. (*Commenter: Cindy Kendrick)*

Response: TVA acknowledges this comment. Note that the analyses in both the programmatic and site-specific NEPA reviews included a thorough evaluation of adverse human health or environmental effects of both closure alternatives. Remediation of the Kingston ash spill cost slightly more than $1 billion, not billions. The Kingston spill was the catalyst for TVA's plans to cease managing its CCRs in impoundments and convert to dry management systems. Removing CCR from impoundments would reduce the risk of groundwater contamination, but so would Closure-in-Place. EPA determined, and TVA's analyses agree, that dewatering impoundments substantially reduces the risk of structural failures and groundwater contamination. Finally see TVA's response to Comment 31 concerning (1) the issue of ash in contact with groundwater and (2) the overall concern that the Closure-in-Place Alternative is harmful to human health and the environment.

45. Comment: We encourage TVA to remove its coal ash from unlined pits and transfer it to more safely lined, dry storage sites away from our waterways. This approach is prudent and protective of rate-payers' water quality as well as liability risks from more ash spills. TVA's proposal to put synthetic liners on top of coal ash that is stored in leaky, unlined pits close to waterways falls alarmingly short in protecting water quality. (*Commenter: Sandra Goss, Tennessee Citizens for Wilderness Planning*)

Response: TVA acknowledges this comment. See responses to Comments 43 and 44.

46. Comment: As TVA develops its study, I respectfully urge you to prioritize removing waste from unlined pits, especially in areas over karst bedrock, and transferring that material to lined, dry storage sites away from groundwater and important waterways. Taking these steps will protect the public's health and our environment. *(Commenter: Sandra Goss, Tennessee Citizens for Wilderness Planning)*

Response: TVA acknowledges this comment.

47. Comment: We encourage TVA to remove its coal ash from unlined pits and transfer it to more safely lined, dry storage sites away from our waterways. This approach is prudent and protective of rate-payers' water quality as well as liability risks from more ash spills. TVA's proposal to put synthetic liners on top of coal ash that is stored in leaky, unlined pits close to waterways falls alarmingly short in protecting water quality. (*Commenter: Rhonda Cowden*)

Response: TVA acknowledges this comment. Dewatering CCR impoundments will significantly reduce the risk of structural failure as well as the impacts of failure if this should occur. TVA will continue to work with state regulatory authorities throughout the closure process for all impoundments to ensure that closure methods continue to protect public health and the quality of the environment.

48. Comment: TVA should not leave coal ash in unlined, leaky impoundments along our rivers and waterways and that is why I am concerned that TVA's analysis seems to strongly favor "Closure-in-Place." The best solution is what other leading Southeastern utilities are doing: responsibly removing toxic coal ash to lined, dry storage away from our rivers and waterways. TVA should conduct proper analysis of all of the options for closing these sites, including the "Closure-by-Removal" option. (*Commenter: Angela Garrone, Southern Alliance for Clean Energy*)

Response: TVA acknowledges this comment. TVA is aware that some utilities are using the Closure-by-Removal Alternative. Reasons for this vary. TVA will continue to work with state regulatory authorities throughout the closure process for all impoundments to ensure that closure methods remain sufficient to protect public health and the quality of the environment.

49. Comment: As TVA correctly points out, depending on site-specific considerations, the length of time and activities associated with closing a CCR surface impoundment through the closure by removal option can result in more significant environmental impacts when compared to the closure in place option. Therefore, the closure in place option is often more preferable from an environmental perspective than the closure by removal option. Further, as discussed below, because the length of time to complete the closure by removal option may far exceed the timeframe allowed for closure under the CCR rule, closure by removal may not even be a viable regulatory option in certain circumstances. *(Commenter: Utility Solid Waste Activities Group*)

Response: TVA acknowledges this comment.

50. Comment: Certain site-specific factors may result in additional potential adverse impacts when utilizing the closure by removal option. These factors include: 1) Removal of CCR: Under closure by removal, CCR must be removed and transported to another location for disposal. This results in increased air emissions due to increased traffic and idling vehicles; increased risk of vehicular accidents due to traffic congestion and additional large trucks on the roads; and increased risk of spills associated with transit. The bigger the CCR surface impoundment (and thus the more CCR to remove), and/or the further the distance to the final disposal location, the more adverse impacts. 2) Borrow/fill material: Borrow/fill material must be transported to the surface impoundment for reclamation. This transportation results in increased air emissions, due to increased traffic and idling vehicles, and increased risk of vehicular accidents, due to traffic congestion and additional large trucks on the roads. 3) Worker safety: Excavations into CCR surface impoundments are particularly dangerous. In addition, extensive trucking operations associated with closure by removal increases injuries and fatalities associated with truck accidents. Removal activities can take significantly longer than closure in place because all CCR must be removed from the impoundment before the site is reclaimed. Depending on the size of the unit and the amount of CCR contained within the impoundment, the time frame for closure by removal can require decades. We note that the CCR Rule requires closure to be completed within five years (with up to two additional five year extensions). See 40 CFR § 257.102. If closure by removal cannot be completed within this time frame, it would not meet the requirements of the CCR Rule. *(Commenter: Utility Solid Waste Activities Group)*

Response: TVA acknowledges this comment. TVA also has identified these factors as important with respect to making decisions about Closure-in-Place or Closure-by-Removal.

51. Comment: We are a member of the Utility Solid Waste Activities Group ("USWAG"), and support the comments provided by USWAG. Ameren supports many of TVA's analyses and conclusions. Specifically, Ameren supports TVA's contemplated beneficial use of CCR for purposes of closing a CCR surface impoundment-e.g., for use in flowable fill, for waste stabilization or solidification purposes, for incorporation into the final cover system, or for use in grading and contouring: Ameren believes these types of beneficial uses are authorized under the CCR rule and that they provide a number of important environmental benefits. Ameren also agrees with TVA's statement that once closure is complete, the closure in place and closure by removal options under EPA's CCR Rule, are equally protective of public health and the environment. EPA makes this very point repeatedly throughout the final rule. The closure option appropriate for any given impoundment is a highly site-specific decision. As TVA notes, the process and steps necessary to close a surface impoundment through the closure by removal option can result in environmental and secondary impacts when compared to the closure in place option. Therefore, the closure in place option is often more preferable from an environmental perspective than the closure by removal option. (*Commenter: Ameren*)

Response: TVA acknowledges the comment. TVA analyses indicate that the beneficial use of CCR to close impoundments holds real promise. The CCR Rule allows beneficial uses of CCR if appropriate demonstrations are made.

52. Comment: Ameren wishes to clarify certain statements made in the Draft PEIS. 1) The Draft PEIS should state clearly that the "No Action Alternative" is not inconsistent with the requirements of the CCR Rule. 2) TVA should consider identifying these other potential CCR beneficial uses in the Draft PEIS. 3) Ameren agrees with both TVA and EPA that closure in place and closure by removal is equally protective of public health and the environment. However, the closure by removal option has additional potential adverse impacts. Removal of large volumes of CCR would require extensive earth moving equipment and transport vehicles. A continuous stream of truck traffic creates congestion, road and spill hazards, increased air emissions and a tremendous burden on roadways and communities. The transportation of borrow/fill material to the surface impoundment for reclamation also creates an additional transport impact. Lastly, there is the human safety impact that results from the excavation, transportation, and filling associated with the removal option. Closure in place is environmentally protective and does not include some of the separate environmental impacts associated with removal. We agree with the TVA's statements that removal activities can take long periods of time. The CCR Rule requires that closure be completed within specified timeframes and it could be possible that closure by removal cannot be completed within those timeframes; it would not meet the requirements of the CCR Rule. 4) Ameren agrees that the EPRI framework models provided support for TVA's own site-specific conclusions. Ameren does not believe that the EPRI model is necessary in all circumstances. Ameren respectfully suggests that TVA remove any statements that suggests otherwise. (*Commenter: Ameren*)

Response: The Final PEIS notes that the No Action Alternative is inconsistent with TVA's plans to convert all of its wet CCR systems to dry systems. It also is inconsistent with the general direction of EPA's CCR Rule, but TVA agrees that the CCR Rule does not necessarily require that impoundments be closed. See the response to Comment 15. The Final PEIS identifies actions common to all closure alternatives, one of which involves the consideration of beneficial use. TVA acknowledges the adverse impacts associated with excavation and removal of CCR in this comment and has identified these factors as important with respect to making decisions about Closure-in-Place or Closure-by-Removal: Lastly, as noted in the Final PEIS, the analyses done by EPRI and EPA, along with other technical reports to which the Final PEIS cites, were used by TVA to advance TVA's understanding of CCR impoundment closure issues.

53. Comment: Supports Closure-in-Place as being the more economical option. TVIC urges TVA to pursue whatever approach is the most economical. (*Commenter: Tennessee Valley Industrial Committee)*

Response: TVA acknowledges the comment.

54. Comment: TVA may choose to pursue CCR impoundment Closure-in-Place at any of its Fossil Plants. However, should TVA begin CCR surface impoundment closures at any of its Tennessee fossil plants and TDEC subsequently determines based on soil, surface water, ground water and/or geologic instability that Closure-in-Place is not protective of public health and/or the environment, then TDEC shall require TVA to commence appropriate corrective action including removal of CCR surface impoundments where TVA has begun or completed Closure-in-Place. (*Commenter: Tennessee Department of Environmental Conservation*)

Response: TVA acknowledges the comment and has integrated that process into the description of its alternatives in Part I, Chapter 2. TVA will continue to work with TDEC and other state regulatory authorities throughout the closure process for all impoundments to ensure that closure methods comply with applicable requirements and protect public health and the quality of the environment.

2.5.5 Beneficial Use

55. Comment: In Part I, Table 3-18 "Coal Combustion Residuals Generated by TVA from 2010-2013," TDEC recommends that TVA update table to include 2014 beneficial use data, if available. *(Commenter: Tennessee Department of Environmental Conservation)*

Response: TVA has updated the table in Part I with data from 2014 and 2015.

56. Comment: The Draft PEIS does not consider a reasonable range of clean closure alternatives, such as beneficial use. *(Commenter: Southern Environmental Law Center)*

Response: Beneficial reuse is considered by TVA as part of all ash management activities.

57. Comment: USWAG supports TVA's contemplated beneficial use of CCR for purposes of closing a CCR surface impoundment—e.g., for use in flowable fill, for waste stabilization or solidification purposes, for incorporation into the final cover system, or for use in grading and contouring. USWAG believes these types of beneficial uses are authorized under the CCR rule and that they provide a number of important environmental benefits. Other beneficial uses of CCR for closure purposes include the use of CCR for contouring, to achieve final grade, and waste stabilization or solidification. The beneficial use of CCR for closure of CCR surface impoundments will result in environmental benefits. First, beneficial use of CCR reduces the need for virgin materials, thereby conserving natural resources and valuable energy that would be needed to obtain those virgin materials. See 80 Fed. Reg. 21302, 21349 (April 17, 2015). The beneficial use of CCR from on-site also significantly reduces the potential environmental effects that result from the transportation of virgin material from off-site, such as impacts to air quality from vehicle emissions or the increased risk of traffic accidents due to a higher number of large trucks on the road. The Draft PEIS should also highlight these environmental benefits of beneficially using CCR for closure purposes. *(Commenter: Utilities Solid Waste Activities Group)*

Response: TVA acknowledges the comment.

58. Comment: TVA is currently using temporary storage of CCR as an interim management method pending construction of new CCR facilities. TDEC recommends that TVA consider in the context of Alternative B, Closure-in-Place, in the Final PEIS the potential for beneficial reuse of CCR materials. Temporarily stored CCR material removed from an impoundment could be beneficially reused in regions where markets exist. The removed material could be prepared for end use and stored temporarily until shipped offsite for reuse. TVA should also document associated environmental impacts using this approach. *(Commenter: Tennessee Department of Environmental Conservation)*

Response: TVA acknowledges the comment.

59. Comment: The Final PEIS should include analysis of an alternative that includes removing ash and engaging in and/or developing a beneficial reuse market in Tennessee, Alabama and/or Kentucky. (*Commenter: Southern Environmental Law Center*)

Response: Beneficial reuse is considered by TVA as part of all ash management activities. Table 1-3 in Final PEIS Part I identifies the beneficial use percentages by type of CCR. The table provides the average percentages from 2010-2014 and the actual percentages of beneficial use for 2015. For example, Cumberland Fossil Plant's gypsum is used at a wallboard plant that Georgia Pacific constructed adjacent to the plant. TVA has an active marketing program to identify opportunities for the beneficial use of CCR.

60. Comment: Santee Cooper, a publicly owned utility in South Carolina, is closing its coal ash ponds by removing the ash and trucking it to companies that will recycle it—a concept known as beneficial reuse. *(Commenter: Southern Environmental Law Center)*

Response: TVA acknowledges this comment. TVA has an active marketing program to identify opportunities for the beneficial use of CCR.

61. Comment: As my company has been conducting promising R&D in the conversion of CCRs into value-added green building and related products, we would like to know if TVA would consider a third disposal option, i.e., "onsite encapsulation and storage" until such time as markets are opened up and developed. *(Commenter: David White)*

Response: A change in market conditions or new technologies may allow the evaluation of other alternatives for CCR management in the future. Should such an alternative technology be available and viable in the future, TVA would conduct a separate NEPA review to consider that alternative as appropriate.

2.6 Need to Comply with Other Federal and State Laws

62. Comment: There needs to be more transparency to the public about which permits will be altered/obtained and the implications of those permits and licenses. *(Commenter: Kaela Odell)*

Response: Part I, Section 1.7 of the Final PEIS identified potential permits that might need to be modified or revised due to closure activities. Similarly, Part II, Site-Specific NEPA Review contains a section on permits that may need to be obtained or modified. TVA has in-place procedures and processes and has invested a significant amount on controls to comply with state and federal permits.

63. Comment: In addition to satisfying NEPA, TVA's proposal to close its coal ash ponds must comply with other state and federal laws governing coal ash disposal and water pollution. *(Commenter: Southern Environmental Law Center)*

Response: We did not mean to suggest by focusing on the new CCR Rule that other regulatory programs would not apply to CCR management activities. EPA determined that compliance with its CCR Rule would appropriately protect human health and the environment. Other applicable regulatory programs would help ensure this. TVA will continue to work with TDEC and other state and federal regulatory authorities to ensure that closure methods remain sufficient to protect public health and the quality of the environment.

64. Comment: The CCR Closure requirements that TVA is required to meet to comply with the U.S. EPA CCR regulations overlaps with the responsibilities TVA must meet as a part of the Davidson County Chancery Court Action for the TVA Gallatin site and the TDEC/TVA Commissioner's Order for all other TVA Fossil Plants in Tennessee. The TVA Draft PEIS for Ash Impoundment Closure is designed to meet the EPA regulations while the TDEC enforcement orders require TVA to: 1) Determine the areal and vertical extent of CCR material at each TVA Fossil Plant; 2) Determine the extent of soil, surface water and ground water contamination associated with the CCR material at each TVA Fossil plant; 3) Determine any environmental and/or public health threats posed by the CCR materials; and 4) Develop and implement a Remedial Action and Risk Assessment Plan for each TVA Fossil Plant that resolves the environmental and public health threats the CCR material may pose. *(Commenter: Tennessee Department of Conservation)*

Response: Comment noted. TVA expects to fully comply with all regulatory requirements that apply to CCR management activities, including the TDEC order.

65. Comment: At a January meeting of TVA's Regional Energy Resource Council (RERC), a representative of TVA suggested that, in contrast to utilities in North and South Carolina, no federal or state law requires TVA to remove its ash to dry, lined storage if that is the disposal option that adequately protects public health and the environment. *(Commenter: Southern Environmental Law Center)*

Response: It is correct that neither federal nor state law require TVA or, we believe, other utilities to use the Closure-by-Removal method at every facility. North Carolina legislation requires Duke to use Closure-by-Removal at some of its impoundments and to evaluate this method at its remaining impoundments. Two South Carolina utilities entered into consent decrees requiring use of Closure-by-Removal. TVA's analyses confirm EPA's determination that either closure method will be protective of human health and the environment if properly done.

2.7 Need for Full Public Disclosure

2.7.1 EPRI Model and Report

66. Comment: The public's ability to comment meaningfully on the Draft PEIS has been thwarted by TVA's refusal to disclose key analyses of environmental impacts.*(Commenters: Southern Environmental Law Center, Frances Lamberts, David Wasilko, Ajeet Khalsa, Adam Hughes Hunter Oppenheimer, Angela Garrone, Southern Alliance for Clean Energy, Adam Hughes).*

Response: TVA disagrees. The analyses done by EPRI and EPA, along with other technical reports to which the Draft PEIS cites, were used by TVA to advance TVA's understanding of CCR impoundment closure issues. None of these analyses and reports are used in lieu of TVA conducting its own independent analyses of issues and these analyses have been appropriately summarized in the Draft PEIS. The EPRI reports are intellectual property of EPRI and cannot be given away by EPRI members, including TVA. They are proprietary documents and can be obtained directly from EPRI. The framework analysis which is the foundation for EPRI's analyses was made available to the public in November 2015 before TVA released its Draft PEIS in December 2015.

67. Comment*:* USWAG agrees that the EPRI model provides support for TVA's own site-specific conclusions. However, the Draft PEIS suggests that the EPRI model could provide "other utilities a standard technical foundation for making decisions about impoundment closure approaches." USWAG does not believe that the EPRI model will be available or applicable in all contexts, and TVA should remove any statements that suggests otherwise. (*Commenter: Utility Solid Waste Activities Group*)

Response: TVA concurs that the EPRI framework may not be applicable in all contexts and clarification has been added to the Final PEIS.

2.7.2 Freedom of Information Act (FOIA)

68. Comment: NEPA requires that TVA make public the data and analysis that support its proposed action. *(Commenter: Southern Environmental Law Center*)

Response: See the response to Comment 66. SELC states that it cannot adequately critique the Draft PEIS analyses without being given copies of EPRI's reports for free. TVA disagrees; the Draft PEIS analyses stand on their own footing and these are sufficiently summarized in the Draft PEIS to permit public comment. The EPRI framework analysis that SELC wants has been publicly available since November 2015. We appreciate that SELC would like to avoid paying the $25,000 cost of obtaining the report from EPRI, but note that SELC's current financial report for the year ending in March 31, 2015 shows net assets in excess of $66 million.

2.7.3 Costs and Estimated Time for Closure Alternatives

69. Comment: TVA provides no support for the cost and timing estimates in the Draft PEIS, and the experience of other utilities demonstrates that TVA estimates are inflated. (*Commenter: Southern Environmental Law Center*)

Response: TVA relied on previous CCR impoundment closure experience and professional judgment to develop preliminary cost and duration estimates. For example, cost estimates were developed based on assumed labor rates, and landfill tipping and disposal fees. Duration estimates considered transportation variables, pre and post closure activities and assumed working days per year. TVA has provided the Southern Environmental Law Center, as requested, information supporting its cost and duration estimates. SELC states that Duke Energy and Santee Cooper have lower Closure-by-Removal costs than the TVA estimates but did not provide information on how these cost estimates were derived and what activities were included in the cost estimates. SELC also failed to provide any information concerning duration estimates for closure activities.

Based on further analysis, TVA refined the duration and cost estimates in the Final PEIS based on information identified below:

- The volume of CCR was increased at JSF based on updated information.
- Borrow material needed at KIF was increased to address stability issue for Closure-by-Removal Alternative.
- Consideration of a standardized estimate for approvals/permitting prior to initiating closure activities.
- CCR density was adjusted to reflect the average density of CCR from TVA facilities. The revised density reduced tipping fee costs for the Closure-by-Removal Alternative.

- Revised the number of work days per year to reflect TVA planning practice for construction activities. This revision of work days per year increased duration of closure activities.

A revised comparison of cost and duration estimates for closure alternatives is provided in Table 1.

Table 1. Comparison of Cost and Duration Estimates for Closure Alternatives

	Closure-in-Place		Closure-by-Removal Using Trucks			Closure-by-Removal Using Rail		
Site	Cost (millions)	Duration (years)	Cost (millions)	% Increase in Cost from Closure-in-Place	Duration (years)	Cost (millions)	% Increase in Cost from Closure-in-Place	Duration (years)
ALF	$3.5	1.7	$20	457%	2.7	$23	557%	2.7
BRF	$13	1.7	$274	2008%	24.7	$287	2108%	24.3
COF	$10	1.7	$249	2390%	22.7	$228	2180%	22.3
JSF	$13	1.7	$64	392%	6.2	$75	477%	6.1
KIF	$40	1.7	$107	168%	10.5	$73	83%	9.4
WCF	$200	2.7	$2,300	1050%	170.6	$2,060	930%	84.3
Total	$280		$3,014			$2,746		

70. Comment: TVA must include an appropriate risk ladder for Alternative B to reflect the costs of ongoing contamination and future liability associated with this alternative**.**
(Commenter: Southern Environmental Law Center)

Response: TVA has accumulated years of data on the health of the aquatic systems near its plants that would be most impacted if its CCR impoundments were materially affecting water quality and the environment. These data do not show such impacts. Dewatering and capping CCR impoundments, Alternative B, are expected to further reduce the risk of contamination impacts. Continuing oversight of regulatory agencies provides additional assurance that potential impacts remain immaterial. While it is possible that future remedial actions mandated by regulatory or judicial processes could increase costs, this uncertainty exists with either closure method.

We note, for example, that SELC's efforts to secure the excavation and removal of CCR at Duke's plants to other locations in North Carolina are being opposed by other environmental advocacy groups whose members object to the off-site disposal. Additionally, to accelerate the cleanup of the Kingston ash spill, TVA moved some of the recovered ash to a lined landfill in Perry County, Alabama, the kind of action that SELC advocates. This was approved by EPA, TDEC, and the Alabama Department of Environmental Management, but is now being characterized as an example of environmental injustice by other advocacy groups.

71. Comment: Understands cost would be higher for closure by removal. *(Commenter: Martha Deaderick)*

Response: TVA acknowledges this comment

72. Comment: The TVA should not, on the basis of cost avoidance primarily as one might gather from the Draft PEIS, preclude - absent thoroughly comprehensive study data on potential water impacts - the option of ash removal and lined pond storage, for at least the potentially most problematic, current impoundments. *(Commenter: Frances Lamberts)*

Response: While cost of impoundment closure (and the resultant cost to the TVA rate-payer) is an important factor, TVA evaluates and weighs other factors related to the human and natural environments and is committed to ensuring the health and safety of the public and the environment. The Draft PEIS addresses potential impacts on water quality.

2.8 Groundwater

73. Comment: The Draft PEIS fails to disclose and analyze accurate baseline conditions that affect potential groundwater contamination. *(Commenter: Southern Environmental Law Center)*

Response: Groundwater data have been provided for each plant site in the site-specific NEPA analyses contained in Part II. The extent and duration of the information varies between plants and CCR units. In response to the CCR Rule and state requirements, TVA is installing and improving groundwater monitoring at all its sites. These additional data will help TVA and the states make decisions about future corrective measures that would be appropriate. Based on available information, TVA expects any groundwater impacts to be notably reduced following the dewatering process.

74. Comment: The Draft PEIS does not mention the levels of groundwater contamination presently or how these would be addressed. *(Commenters: Southern Environmental Law Center, Angela Garrone, Southern Alliance for Clean Energy, Hannah Shimabukuro Sandra Goss, Tennessee Citizens for Wilderness Planning, Ajeet Khalsa)*

Response: Groundwater data have been provided for each plant site in the site-specific NEPA analyses contained in Part II and recent groundwater monitoring reports have been posted on the Draft PEIS Web site. In response to the CCR Rule and state requirements, TVA is installing and improving groundwater monitoring at all its sites. These additional data will help TVA and the states make decisions about future corrective measures that would be appropriate. Based on available information, TVA expects groundwater impacts to be notably reduced following the dewatering process.

75. Comment: TVA does not know where the uppermost aquifers are. You cannot conclude that there will be no groundwater contamination without this information. (*Commenters: Southern Alliance for Clean Energy, Southern Environmental Law Center, Kaela Odell, Frances Lambert*s)

Response: The commenter is correct that TVA has not completed the analyses to locate the uppermost aquifer areas as required by EPA's CCR Rule. The deadline in the CCR Rule for utilities to locate the uppermost aquifer at regulated areas is October 2018, and that time is needed for a thorough analysis. TVA does, however, have some water table elevation information that can be used to roughly estimate the level at which groundwater is first encountered at its sites. This information does not reflect the location of the uppermost aquifer, because “first groundwater encountered” and “the uppermost aquifer” are two different concepts.

In drafting the CCR Rule, EPA initially proposed to require the placement of landfills or impoundments “with a base that is located a minimum of 2 feet above the upper limit of the natural water table.” EPA then changed the rule to place the focus of the requirement on the “uppermost aquifer” instead of the “water table.” As pointed out to EPA during the comment period, “[t]he natural water table can be an expression of the uppermost aquifer but usually is an expression of seasonally saturated low permeability sediments such as clayey glacial drift. These low permeability sediments do not produce enough water to qualify as an aquifer under the proposed rules let alone provide enough water from a private or public water supply. Comment No. EPA-HQ-RCRA-2009-0640-08226-41 by Ohio Environmental Protection Agency. Thus, the level of the first groundwater encountered is not necessarily the level of the “uppermost aquifer”; that determination depends on the *quantity* of water encountered. The red clayey soils that exist throughout the Southeast, for example, are fine-grained materials that do not easily transmit water. Thus, though clay may yield enough water for a groundwater sample, it does not necessarily yield enough water for use as a public or private drinking water supply. Indeed, EPA has interpreted the term “uppermost aquifer” in guidance to mean an area that yields a “significant” or “useable” amount of groundwater.

At any rate, based on TVA’s, EPA’s, and EPRI’s analyses, whether or not a CCR impoundment intersects with a groundwater table, either closure method will still improve groundwater quality (reduce groundwater contamination). Ignoring the duration of some of these projects, Closure-by-Removal would benefit groundwater quality more than Closure-in-Place, but the latter would still have positive benefits.

While TVA has not completed analyses to determine the uppermost aquifer, it has data from which water table elevations can be roughly extrapolated using data from plant monitoring wells for the units presented in the site specific EIS sections. There is substantial uncertainty in these calculations because monitoring wells were not sited in any specific aquifer or continuous connected water-bearing zone, but were placed to monitor first surficial water or the first saturated zone. Also, these elevations were derived on averages of surrounding wells, without accounting for whether all the wells used in the average are screened in the same water-bearing zone or discontinuous zones. This may cause some discrepancies in the average elevations if higher head pressures exist in different screened zones. It is evident at some units (e.g., COF and WCF) that mounded water table conditions exist, which may influence water levels at the surrounding wells, but is not a representation of the uppermost aquifer elevations. Currently, wells that show potential inundation of ash in the water table, may show significant drop after cap and closure is completed. In addition, there is uncertainty regarding the depth of CCR impoundments because the elevation of impoundment bottoms as built is uncertain. With these caveats, Table 2 below provides estimates for water table elevations at plants and the depth of CCR impoundments.

Table 2. Water Table Elevations

Plant	Unit	Estimated Lowest Elevation (ft amsl)	Historic Water Table Elevation (averages based on wells closest to CCR unit) (ft msl)
ALF	West Impoundment	200	191
BRF	Fly Ash Impoundment / Sluice Channel	780	798
COF	Ash Impoundment No. 4	420	427
JSF	Bottom Ash Impoundment	1140	1109
KIF	Sluice Trench	724	746
KIF	Stilling Impoundment	725	737
WCF	Main Ash Impoundment	600	609
WCF	Upper / Lower Ash Stilling Impoundments	600	602
WCF	Dredge Cell	600	600

76. Comment: TVA fails to analyze the impacts on groundwater of its proposal merely to decant rather than dewater coal ash prior to capping. (*Commenter: Southern Environmental Law Center*)

Response: TVA intends to dewater all of its sites as part of closure activities. Dewatering methods will follow standard industrial practices. The Final PEIS has been revised to clarify this.

77. Comment: The discharge of water and monitoring should include sampling and analyzing microbial communities in groundwater before and after treatment. *(Commenter: Katie Odell)*

Response: TVA follows federal and state requirements for groundwater monitoring that include protocols for all appropriate analytical parameters.

78. Comment: TVA would leave coal ash in areas where groundwater contamination already occurs, guaranteeing that contamination will continue. (*Commenter: Hunter Oppenheimer, Sierra Club)*

Response: See response to Comment 31. Based on available information, TVA expects groundwater impacts to be notably reduced following the dewatering process, which would be an initial step for either Closure-by-Removal or Closure-in-Place.

79. Comment: The conclusion of the "hypothetical" analysis in EPRI's undisclosed Impact Assessment—that groundwater contamination will improve even when ash is in continuous contact with groundwater—is directly contradicted by a previous EPRI study, which found that capping an unlined landfill would have *no* beneficial effect on groundwater contamination in such circumstances. It is further contradicted by TVA's own studies at the Gallatin ash pond, which concluded that capping in place "would not yield a significant reduction in risks to the groundwater transition zone" into the river, and that groundwater improvement into the future with the cap (versus an uncapped scenario) would be "minimal." *(Commenter: Southern Environmental Law Center)*

Response: The Hypothetical Site model is conceptually different than the HN West impoundment referenced in the 2001 EPRI report, and therefore we would not expect it to predict concentration relationships similar to HN West. Conceptual differences are:

a) The hypothetical site was assumed to be dewatered and capped, while HN West was dewatered, but not capped. Dewatering and capping for the hypothetical site was simulated by reducing the vertical mass flux of leachate to groundwater relative to active operation. This reduction applies to both intersecting and non-intersecting groundwater scenarios (CCR was modeled both in and above groundwater). The model continued to simulate a horizontal mass flux of leachate to groundwater under the intersecting groundwater scenario. This differs from actual conditions at HN West because the HN West site was dewatered, but not capped, and no measures were taken to enable runoff or otherwise remove precipitation water from the CCR surface, so all precipitation water that did not evaporate was able to infiltrate to groundwater. As a result, the vertical flux of leachate to groundwater was conceptually greater than it would be if a cap had been constructed, and a groundwater mound persisted beneath the HN West impoundment (EPRI 2001, page 4-13).

b) The hypothetical site conceptually has a different hydrogeological flow regime than the HN West site. The HN West site had radial groundwater flow away from the groundwater mound beneath the CCR impoundment, even after dewatering (EPRI 2001, Figure 4-3 and page 4-13), and as a result, most of the groundwater flowing past the shallow monitoring wells close to the impoundment was recharged in the CCR impoundment, meaning there was little opportunity for concentration reduction via mixing with upgradient groundwater (i.e., monitoring wells adjacent to the impoundment were essentially monitoring leachate). Conversely, monitoring wells farther from the HN West impoundment, that monitored a mixture of groundwater and leachate, had an observed decrease in concentrations due to the reduction in mass flux resulting from dewatering (see PZ-25 in EPRI 2001, Figure 4-8; PZ-27 is a different story, slow recovery at this well is due to the low hydraulic conductivity of the materials it is screened in).

c) The HN West impoundment was situated over a groundwater mound where groundwater flows radially out from beneath the impoundment, while the Hypothetical Site model assumed groundwater flowed from upgradient to downgradient beneath the impoundment.

TVA maintains a robust environmental assessment program at all of its power plants including groundwater and ecological monitoring. TVA performs fish tissue analysis as part of its ecological monitoring program. This program has been ongoing for many years and has found no harm to aquatic species. This is also supported by whole effluent toxicity testing at TVA's discharges which demonstrates no toxicity to aquatic life. This is further confirmed by fish tissue analyses adjacent to TVA's Gallatin fossil plant, which SELC conducted. These analyses also found no contamination above screening levels.

The Gallatin report to which SELC alludes was a risk assessment screening analysis of potential contamination associated with a CCR facility at TVA’s Gallatin plant. TVA ceased using that facility, an impoundment, in 1970 and subsequently closed it. The risk assessment concluded there were only minimal risks and that the benefits of upgrading the areas cap would be limited.

80. Comment: At the public meeting, I was very concerned to learn that TVA only screens groundwater wells surrounding impoundments only once every six months, and that the heightened monitoring after a violation bumps that up to only one test quarterly. Given the proximity of these impoundments to major waterways as well as the water table level this makes me very nervous as a resident of Roane County. I would like to challenge TVA to commit to all the standards of EPA's 2014 Coal Ash Rule even for any impoundments that are capped in advance of the 2018 deadline. I am not impressed that TVA is motivated to avoid having to comply by monitoring requirements. *(Commenter: Allanah Tomich)*

Response: TVA understands that EPA intends to rewrite sections of the CCR Rule so that all existing CCR impoundments, including inactive impoundments, are subject to the CCR Rule requirements for monitoring and post-closure care (EPA Motion to U.S. Court of Appeals for the D.C. Circuit, April 18, 2018)

81. Comment: Comprehensive pre-decisional groundwater testing should be (have been) performed for all of the TVA ash impoundments, with information accessible to the public in accordance with the CCR Rule. *(Commenter: Frances Lamberts)*

Response: Groundwater monitoring data exist and has been provided for TVA's plants in the Final PEIS as well as on the Final PEIS Web site.

82. Comment: TVA plans to construct a cap over coal ash waste where it is stored, even though the utility's own monitoring data shows that groundwater near these sites is being polluted with toxic metals. This "cover up" approach would keep the pollution in contact with groundwater, allowing contamination to continue unmitigated. The Kingston Steam Plant ash storage pit failure cost billions in reclamation and gained international infamy. If leaky pits are left in place, rate-payers could be stuck with an unprecedented pollution legacy for decades to come. I appeal to TVA to remove its coal ash to lined, dry storage away from our communities and waterways. *(Commenter: Cindy Kendrick)*

Response: See the Response to Comment 44.

83. Comment: The only effective method for preventing groundwater contamination is to use the Closure-by-Removal method. *(Commenter: Southern Alliance for Clean Energy)*

Response: TVA's analyses confirm EPA's determination in the CCR Rule that Closure-in-Place and Closure-by-Removal are equally protective if done properly. Part I, Section 3.6 of the Final PEIS provides details concerning benefits to groundwater resulting from implementation of Closure-in-Place. Dewatering an impoundment and preventing infiltration of runoff and precipitation by capping the impoundment reduce the hydraulic head and this reduces the movement of coal ash constituents into the groundwater. Even when CCR is in contact with groundwater, dewatering and capping an impoundment should reduce contamination risks. The level of reduction would be less than if CCR is excavated and removed when it is in contact with groundwater, but it would be rare that groundwater is not improved.

84. Comment: Another southeastern utility, SCE&G, is utilizing removal and dry ash storage in lined landfills to implement the CCR Rule. When it removed thousands of tons of ash from a wet pond on the bank of the Catawba River, groundwater contamination at the site, as determined by pre-and-post monitoring, plummeted drastically and rapidly. At one monitoring well, arsenic was found to be decreased 99 percent from the level before ash removal, which then had been several times above the legal limit. *(Commenter: Frances Lamberts)*

Response: TVA has also tracked the reported results of impoundment closure at SCE&G facilities. However, because much of the CCR material in the impoundments referenced remain on site during the observed monitoring period, the dewatering of the facility is considered to be a more likely contributor to the observed reduction in groundwater constituent concentrations. This result appears to validate TVA's conclusion that dewatering is particularly important and effective in controlling the gradient and flow of constituents to off-site areas. See the response to Comment 30.

85. Comments: TVA should include strategies for mitigating subsurface geologic stability concerns such as solidification and treatment in place for groundwater contamination when closing a surface impoundment in place in Alternative B of the Final PEIS. Solidification could increase stability and create a better foundation for close-in-place components and increase construction loads during closure activities. *(Commenter: Tennessee Department of Environmental Conservation)*

Response: As noted in Part I, Section 3.5.2.2, of the PEIS, TVA, in cooperation with EPA, has evaluated the static stability of all impoundments at existing coal-fired facilities. Where necessary, TVA has implemented recommendations to improve stability and as a result, dike stability for all impoundments meet minimum safety factors under static conditions. See http://www3.epa.gov/epawaste/nonhaz/industrial/special/fossil/surveys2/index.htm.

TVA is also currently investigating seismic stability for all of its ash impoundments. Any identified deficiencies or unacceptable seismic risks at existing ash impoundments will be addressed through appropriate mitigative measures that may include rock toe, soil berm construction, and concrete/steel pile installation, or other measures, as appropriate. TVA also continues to study solidification alternatives for stabilization. During the Kingston release cleanup, TVA conducted a deep soil mix pilot study but testing determined it did not provide adequate stabilization benefits and would be expensive to implement. As a result, the wall at Kingston was constructed for stabilization. At GAF, TVA is evaluating whether to make a slurry cement from fly ash and gypsum. The CCR that would be used is dry and has not been in an impoundment which would require digging it up, drying it, mixing it, and then putting it back in the impoundment. The potential use of slurry cement would depend on site-specific conditions. The use of slurry cement at GAF has not been approved by TDEC. For the impoundments identified in Part II, solidification has been considered but will not be implemented due to the technology having some uncertainty, not an industry standard and cost. For future closures, TVA will continue to evaluate stabilization as an option.

86. Comment: Nowhere in the Draft PEIS does TVA discuss the potential for sinkhole formation at sites with significant karst features, such as at Gallatin, Colbert, Kingston and Widows Creek. TVA has experienced sinkhole formation at its unlined landfill at Kingston, which contaminated groundwater and triggered an Order for remedial action by the State of Tennessee. Similarly, Ash Pond 5 at Colbert Fossil Plant developed sinkholes and has continuously contaminated groundwater since the 1980s, despite the ash having been moved to drier, unlined storage. *(Commenter: Southern Environmental Law Center)*

Response: Karst geology does pose risks. There are large areas of karst throughout the eastern United States. According to EPA, the U.S. Geologic Survey estimates that 25 percent of the United States has karst geology so this is a widespread issue. There are well-recognized methods of "engineering" karst geology. TVA employed such methods to address a karst risk at its recently permitted CCR landfill at Kingston. Employing these methods at existing CCR impoundments would require dewatering and excavating the accumulated CCR and this would have its own risks. Excavating CCR above karst geology risks fracturing underlying areas, possibly causing the release of CCR material and increasing safety risks to workers. Unless significant amounts of CCR are being lost from an impoundment, indicating an active karst system that has opened below an impoundment, dewatering and capping the CCR would reduce the risk of a karst-related failure and limit the movement of the dewatered CCR into the groundwater. With appropriate monitoring, it should be possible to identify a karst failure below a dewatered CCR impoundment and remediate that failure (e.g., plugging or solidifying CCR material at that location) before large amounts of CCR are lost.

2.9 Surface Water

2.9.1 Treatment Prior to Discharge to Surface Waters

87. Comment: TDEC believes that wastewater treatment will be required for all alternatives considered in the Draft PEIS. TVA should include general information about wastewater treatment and NPDES permitting requirements when describing the proposed actions in the Final PEIS. *(Commenter: Tennessee Department of Environmental Conservation)*

Response: TVA anticipates providing additional treatment to discharges in response to EPA's recently issued Effluent Limitation Guidelines. TVA has revised the PEIS to expand the discussion of wastewater treatment. Renewal applications for NPDES permits and will address wastewater treatment for the entire plant site and discharges during impoundment closure. These permit renewals will focus in greater detail on wastewater discharges than is in the PEIS, which focuses on impoundment closure methodologies.

2.9.2 Seepage

88. Comment: The Draft PEIS generally discusses seepages from the coal ash impoundments (pages 66, 68, and 69). The EPA suggests that the TVA provide a more detailed discussion on seepages from ash ponds that reach surface waters in the Draft PEIS. Specifically, the TVA should discuss how and what plans are being considered to eliminate or obtain permits for known or potential seepages of pollutants from the ash ponds under all the alternatives (i.e., No Action, Closure-in-Place, and Closure-by-Removal). For the Closure-in-Place Alternative and Closure-by-Removal Alternative, the Final PEIS might also address potential seepages that occur prior to closure of the ash ponds and any potential seepages that will remain after the ash ponds are permanently closed. *(Commenter: U.S. Environmental Protection Agency)*

Response: State regulatory agencies are aware of the occurrence of seeps at CCR impoundments and have addressed or are beginning to address them in NPDES permitting processes. Pursuant to our permits, we inspect and mitigate for seepage at all impoundment locations. We are unaware of any seeps currently reaching surface water at TVA plants. When seeps are found, they are quickly remediated by stopping the leak and/or installing seep collection features that reroute seeps back to permitted NPDES infrastructure. TVA also applies dam safety principles to inspection procedures.

2.9.3 Mitigation Measures

89. Comment: The analysis of surface water impacts in the Draft PEIS is incomplete and fails to discuss mitigation measures for coal ash contamination. *(Commenter: Southern Environmental Law Center)*

Response: Assessments of potential impacts on surface water quality are provided in Part I, Section 3.7 and in parallel sections of each site-specific NEPA review in Part II. TVA is working with state regulatory agencies on post-closure assessment, monitoring, and if appropriate, corrective action measures for each impoundment. However, TVA conducts comprehensive ecological and water quality monitoring, and this indicates no adverse impact to surface waters and ecological communities from the operation of our facilities.

90. Comment: Even though TVA's own studies show that water near its coal plants are being polluted with toxic wastes, the proposed plan would leave coal ash in contact with lakes, rivers, and groundwater indefinitely. *(Commenter: Sierra Club)*

Response: TVA conducts comprehensive ecological and water quality monitoring that indicates no adverse impact to ecological communities from the operation of our facilities. Assessments of potential impacts on surface water quality are provided in Part I, Section 3.7 and in parallel sections of each site-specific NEPA review in Part II. Coal ash contains heavy metal constituents that under some conditions can be leached into the environment, but it is not itself a toxic or hazardous waste. A large number of research studies and analyses of the effects of the 2008 Kingston ash spill were conducted, supervised, or reviewed by TVA, TDEC, the Tennessee Department of Health in concert with the Agency for Toxic Substances and Disease Registry, and EPA, and a formal natural resource damage assessment was completed. These demonstrate that even the release of 5.4 million cubic yards of coal ash directly into surface water had very little impact on public health or the environment, except for the immediate physical impacts of the spill itself. See the response to Comment 31.

91. Comment: TVA proposes to discharge untreated liquids from decanting and dewatering into rivers and streams. Yet its analysis fails to account for the fact that TVA’s existing NPDES permits do not contain numerical limits for discharge of key coal ash constituents, including heavy metals such as arsenic. Nor do TVA’s permits require it to sample for such constituents. (*Commenter: Southern Environmental Law Center*)

Response: While TVA’s NPDES permits do not have numerical limits for the discharge of metals, TVA is nonetheless required to manage its discharges in a manner that maintains in-stream water quality standards established for the receiving waters by state permitting authorities. Meeting water quality standards means that human health and aquatic life uses of the stream are protected. Most of TVA’s NPDES permits include requirements for monitoring metals. When dewatering ash ponds for closure, TVA must demonstrate that discharges will continue to meet NPDES permit limits and that water quality standards in the receiving stream will be protected. TVA also conducts monitoring at greater frequencies than required by the NPDES permit when conducting dewatering activities. TVA has plans in place to provide additional treatment to discharges when warranted to maintain water quality standards in surface waters.

2.9.4 Dewatering

92. Comment: TVA fails to follow the CCR Rule by planning to merely decant rather than dewater coal ash prior to capping. *(Commenter: Southern Environmental Law Center)*

Response: TVA intends to dewater at all of its sites. A dewatering method that follows standard industry practice will be used.

93. Comment: Decanting and discharging this waste water into rivers, streams, and reservoirs without proper treatment will transfer contamination from one location and medium to another with undetermined, cumulative effects. Decanted and dewatered liquids that are discharged without treatment into receiving streams will contain constituents that are not included in an NPDES permit, some of which have been documented to harm receiving surface waters. Such constituents include arsenic, boron, sulfate, and selenium, as examples. Despite this very real risk of surface water contamination, the Draft PEIS contains only a non-committal, offhand mention of the possibility of "additional treatment." This discussion falls far short of a commitment to appropriate mitigation of significant environmental impacts required by NEPA. (*Commenter: Southern Environmental Law Center*)

Response: Dewatering-associated discharges that maintain established permit limits and surface water quality standards have clearly known effects – human health and aquatic life uses are protected. TVA is committed to compliance with all applicable discharge requirements and water quality standards during dewatering activities; and where needed, will implement the level of wastewater treatment necessary to meet that commitment. See the response to Comment 90.

94. Comment: The Final PEIS should include a detailed description of the decanting operations that will occur prior to Closure-in-Place and Closure-by-Removal. Specifically, the document should address any applicable dam safety regulations to avoid instability during draw-down of the ash pond water. Decanting may not be appropriate under existing National Pollution Elimination Discharge System (NPDES) permits without complying with additional safeguards. TVA should consult with the State permitting authority prior to decanting to ensure that the proposed activities are compliant with NPDES requirements. *(Commenter: Environmental Protection Agency)*

Response: While TVA's NPDES permits are not required to have numerical limits for the lawful discharge of metals, TVA is nonetheless required to manage its discharges in a manner that maintains in-stream water quality standards established for the receiving waters by state permitting authorities. Meeting water quality standards means that human health and aquatic life uses of the stream are protected. Most of TVA's NPDES permits include requirements for monitoring metals. When dewatering ash impoundments for closure, TVA must demonstrate that discharges will continue to meet NPDES permit limits and that water quality standards in the receiving stream will be protected. This demonstration is accomplished by collecting representative surface water samples from the impoundment to be dewatered and conducting laboratory analysis, particularly for metals. The results are then used by TVA to determine if there is any reasonable potential for a constituent to exceed state surface water quality standards in the receiving water. The data and results of the reasonable potential analysis are submitted to the state permitting authority which then makes the final determination regarding appropriate coverage of the dewatering discharge under the facility NPDES permit. TVA also conducts monitoring at greater frequencies than required by the NPDES permit when conducting dewatering activities. TVA anticipates providing additional treatment for discharges in response to EPA's recently issued Effluent Limitation Guidelines and this should further ensure continued maintenance of water quality standards.

2.9.5 Effluent Limitation Guidelines

95. Comment: Moreover, the analysis in the Draft PEIS apparently fails to take into account regulation under the ELGs discussed in Section III. In North Carolina, the State has developed technology-based effluent limitations (TBELs) for coal ash indicator pollutants (arsenic, selenium and nitrate/nitrite) for the NPDES permit at Riverbend Steam Station. The state agencies that regulate TVA's coal plants are required to develop TBELs for these sites as well. (*Commenter: Southern Environmental Law Center*)

Response: TVA complies with the Effluent Limitations Guidelines (ELGs) and Standards for the Steam Electric Power Generating Point Source Category as developed by EPA and implemented by the state permitting authorities in Alabama, Tennessee, and Kentucky. EPA recently (November 2015) revised the ELGs for the power industry to include more stringent wastewater treatment requirements which will apply to TVA facilities as NPDES permits are renewed (in progress). TVA does not operate any steam electric power generating facilities in North Carolina.

96. Comment: The Draft PEIS does not discuss any efforts by TVA to determine the presence or extent of solid coal combustion wastes in adjacent rivers and streams. Sampling by third parties has indicated a substantial amount of coal ash in sediments near TVA's Gallatin coal-fired plant. Further, the Draft PEIS does not include any discussion about the potential effects of liquid and solid CCRs that are influent to receiving streams in the form of groundwater discharges, accumulated sediments, sediment pore water, surface water discharges from impoundments, or CCR solids that are lying in river sediment. Although TVA vaguely discusses a groundwater monitoring mitigation measure on page 19 of the Draft PEIS, groundwater monitoring is just one component of a comprehensive sampling program. Comprehensive sampling is a critical component of any mitigation measure proposed for significant impacts to surface waters. (*Commenter: Southern Environmental Law Center*)

Response: For purposes of selecting an impoundment closure method and complying with the CCR Rule, these commenters fail to explain why the presence of CCR in surface water bodies that may have been released in the past should be an important consideration. There have been releases of CCR from TVA facilities directly to surface water bodies, Kingston for example. This does not help TVA distinguish between the merits of using the closure in place or closure by removal method. Moreover, available information and data indicate that any direct releases to surface water in the past have not resulted in material impacts. TVA conducts comprehensive ecological and water quality monitoring that indicates no adverse impact to surface waters and ecological communities from the operation of our facilities. See the response to Comment 90.

2.10 Wildlife

97. Comment: The Draft PEIS applies its flawed groundwater and surface water analysis to evaluate the potential impacts on wildlife, threatened and endangered species and aquatic ecology. In its discussion of aquatic ecology, for example, TVA simply states that "waste water discharges during decanting will meet existing permit limits…." In its discussion of impacts to endangered and threatened species, TVA says nothing about potential impacts to aquatic species, despite listing at least 11 of them “on or very near TVA generating facility reservations.”

As discussed above, existing permits do not establish limits for key coal ash parameters and therefore will do nothing to prevent extensive surface water pollution. In addition, TVA has not identified any method of pre-treatment before discharging decanted water. Because groundwater and surface water impacts are likely to be much more significant than TVA acknowledges in the Draft PEIS, it must provide new analysis of potential impacts on aquatic ecology, wildlife and threatened and endangered species as well, and it must propose reasonable mitigation measures, such as clean closure and pretreatment of decanted water and pore water.

In a letter from the Maryland Department of Natural Resources to the Virginia Department of Environmental Quality regarding the Possum Point Power Station in Virginia, the State of Maryland provided extensive documentation of impacts of coal ash pollution on aquatic life and fisheries. In particular, the letter documents the potential for selenium, a constituent of coal ash, to bioaccumulate in aquatic food chains. *(Commenter: Southern Environmental Law Center)*

Response: TVA has extensive experience documenting the impacts; and in many cases, the lack of impacts of CCR on aquatic, terrestrial and avian wildlife from the Kingston spill. Extensive bioaccumulation studies were conducted on CCR constituents, including selenium. This experience led to the publication of over 40 peer-reviewed articles published in major scientific journals. None of these studies identified any real risk of harm to wildlife or aquatic species.

98. Comment: The studies of aquatic life need to be extensive, forward thinking. *(Commenter: Ajeet Khalsa)*

Response: TVA has a comprehensive river and reservoir monitoring program to evaluate the surface water quality and ecological health of waters. Surface waters are collected and chemically analyzed, and fish and benthic macroinvertebrates (aquatic insects) are sampled and associated population and community conditions assessed. This information provides an indication of current conditions, allows trends to be identified, and establishes a baseline for comparing future water quality and ecological conditions. Detailed assessment studies are conducted as water quality or ecological conditions warrant. The link to the TVA reservoir health monitoring program is: https://www.tva.gov/Environment/Environmental-Stewardship/Water-Quality/Reservoir-Health-Ratings.

2.11 Threatened and Endangered Species

99. Comment: Once the preferred alternative for a site-specific CCR impoundment is selected, DOI will further consult with TVA to address any site-specific endangered species and migratory bird concerns. Provided federally listed species and migratory bird habitat information to further inform TVA. *(Commenter: Department of Interior)*

Response: TVA acknowledges the comment.

100. Comment: DOI is available to assist TVA related to Indiana bat or Northern Long-eared bat concerns if forest habitat removal will occur in temporary laydown areas or during closure activities. TVA will need to make a determination as to whether the closure activities are exempted from the incidental take prohibitions in the final 4(d) Rule. *(Commenter: Department of Interior)*

Response: TVA acknowledges the comment. These types of impacts were investigated in the site-specific analysis for this Final PEIS. No impacts are anticipated.

101 Comment: Many of the CCR impoundments have known groundwater contamination and discharge directly to or are located within and adjacent to large rivers that support a number of federally-listed mussel species. The reach of the Ohio River near the Shawnee Station Fossil Plant in McCracken County, KY is federally designated critical habitat for the endangered rabbitsfoot. As filter feeders, mussels are sensitive to contaminants and function as indicators of water quality. The potential for water quality degradation resulting from the release of contaminants from the CCR impoundments should be addressed to determine if federally listed mussel species would be directly or indirectly affected by CCR impoundment closure activities. *(Commenter: Department of Interior)*

Response: TVA maintains a robust environmental assessment program at all of its power plants including groundwater, surface water and ecological monitoring. This program has been ongoing for many years and has found no harm to aquatic species. This is also supported by whole effluent toxicity testing at TVA's discharges which demonstrates no toxicity to aquatic life. These analyses also found no contamination above screening levels. Under either closure method, impoundments would be dewatered and available information indicates that this should have a positive effect on any ongoing contamination. Discharges from impoundments are controlled in accordance with state-issued NPDES permits.

102. Comment: According to DOI databases, several bald eagle nests are located near CCR impoundments in Tennessee and Kentucky. On-site personnel should be informed of the possible presence of bald eagle nests within the vicinity of the project area and should identify, avoid, and immediately report any such nests to DOI. *(Commenter: Department of Interior)*

Response: TVA will do this.

103. Comment: The federally endangered least tern may utilize CCR impoundment habitats adjacent to the Lower Mississippi and Ohio Rivers for nesting and foraging when the water levels in these rivers are high. *(Commenter: Department of Interior)*

Response: TVA acknowledges the comment and has worked with the U.S. Fish and Wildlife Service concerning the least tern.

104. Comment: DOI identified that SHF is located in known Indiana bat habitat and the species potentially occurs at Paradise Fossil Plant site. *(Commenter: Department of Interior)*

Response: For the sites addressed in this document, TVA performed habitat assessments for any site having a potential effect on trees. TVA will continue to perform these studies as appropriate, for future impoundment closure projects.

2.12 Floodplain

105. Comment: TVA's analysis of floodplain impacts is incomplete because it fails to evaluate the potential for catastrophic waste washout in flood conditions. (*Commenter: Southern Environmental Law Center*)

Response: TVA takes into account flood risks and designs to reduce the risk of catastrophic failures during flooding events. In addition, TVA conducts analysis dealing with the probable maximum flood (PMF) within its dam safety program and takes action to address unacceptable risks.

106. Comment: At the Kingston site, what is the elevation of the bottom of the impoundment? I am interested in whether it is above the 750' elevation that TVA requires for inhabited structures. *(Commenter: Phil Bartok)*

Response: The base of the ash located in the stilling impoundment is located at the 730-foot elevation.

2.13 Wetlands

107. Comment: The Draft PEIS ignores the significant impact to wetlands. *(Commenter: Southern Environmental Law Center)*

Response: SELC misunderstands TVA's analysis of wetlands. TVA does consider whether wetlands are jurisdictional under USACE but we consider impacts to all wetlands (jurisdictional or other). See Section 3.13 of the Final PEIS. SELC references a report by RT Environmental Services that appears to misunderstand the requirements for evaluating impacts to wetlands under NEPA. USACE and state regulatory agencies do not determine impacts and potential mitigation for wetlands that no longer exist or were previously impacted by the existing impoundments, particularly as many of these impoundments have been in place for decades.

2.14 Transportation

2.14.1 Analysis

108. Comment: The transportation analysis in the Draft PEIS fails to analyze reasonable alternatives and to provide basic information regarding key assumptions, and thus fails to examine the potential impacts of clean closure. (*Commenter; Southern Environmental Law Center)*

Response: TVA assessed the reasonableness of using barge as a transport mode in Part I, Chapter 2.0. This analysis demonstrated that barge transport was not a reasonable alternative. TVA disagrees with the statement in the Atherton report that concludes that equipment, loading and unloading infrastructure used for movement of coal are the same regarding movement of CCR. In addition, the Atherton report did not consider the transport of CCR from the barge facility to the receiving landfill for those sites without barge access. We also note that members of the SELC coalition, the Sierra Club and Environmental Integrity Project, are actively challenging as too risky the movement of CCR by barge by First Energy in Pennsylvania. They identify several barge accidents occurring in the Monongahela River where CCR was spilled or released (Environmental Integrity Project, Sierra Club and EarthJustice on First Energy's Application for Minor Modification of Permit No. 300370 for the Hatfield's Ferry Power Station Coal Combustion By-Product Landfill to

Dispose of Coal Combustion Waste Generated at the Bruce Mansfield Power Station (June 2015).

TVA assessed the reasonableness of using rail as a transport mode in Part I, Chapter 2. Additional information has been added to the Final PEIS in response to this comment. This mode of transport is determined to be viable for consideration in future impoundment closures and was considered at all sites evaluated in Part II.

TVA conducted a thorough and complete analysis of transport of CCR by truck and concluded that trucking is an effective mode of transport as it uses the existing roadway infrastructure to readily serve the plant site subject to impoundment closure and the receiving landfill. TVA disagrees with the conclusions of the Atherton Report (as referenced in the comment) regarding details that are missing from TVA's analysis.

109. Comment: Flaws in the transportation analysis, and the lack of other publicly available evidence to support TVA's conclusions, lead to deficiencies in the analysis of air quality, greenhouse gases, and noise. *(Commenter: Southern Environmental Law Center)*

Response: See the response to Comment 108. TVA disagrees with the generalized conclusion regarding adequacy of analysis of these resources. TVA's analyses of potential air quality, greenhouse gas, and noise impacts can be found at Section 3.1, 3.2 and 3.19 in Part 1. Noise analyses also can be found in Section 3.13 for each of the site-specific analyses in Part II. Additional information has been added to the discussion of transportation impacts in response to comments.

2.14.2 Safety

110. Comment: TVA did not consider removal by truck to lined landfills at varying distances with different types of trucks. *(Commenter: Southern Environmental Law Center)*

Response: This comment does not identify the types of trucks TVA should consider. TVA considered the potential use of larger, articulated dump trucks for off-site transport of CCR, but this mode of transport was considered to be highly impactful and inconsistent with weight limits on public roads set by DOTs. TVA assumed a representative distance for landfills in the PEIS (30 mi) as a basis for assessing impacts. Movements could be longer or shorter. If longer, potential impacts likely would increase. If shorter, potential impacts would likely decrease.

2.14.3 Traffic

111. Comment: My main concern is for traffic which will be on our roads. The trucks are going to destroy our roads. *(Commenter: Jim Wike)*

Response: TVA appreciates the comment and has considered traffic impacts on nearby and regional roadways for each alternative under consideration.

112. Comment: The graphs of truck traffic for the CCR alternative are very impressive. Clearly the impacts could be significant but it is difficult to compare them to the impacts of trucking in borrow material without a similar graph for the truck traffic for the Closure-in-Place alternative. *(Commenter: Peter Scheffler)*

Response: The volume of borrow material that would be needed to cap and cover an impoundment generally would be less than the amount of CCR material that would be excavated and moved to a landfill, significantly less for large CCR impoundments (see Part I, Table 2-3). Also, borrow material likely would be necessary to complete the contouring of excavated impoundments under the close by removal method. For comparison purposes, truck movements to support the close by removal method would be higher, probably significantly higher, than truck movements to support the close in place method.

2.15 Socioeconomics – Environmental Justice

113. Comment: The Draft PEIS fails to analyze key socioeconomic and environmental justice impacts, including consumption of contaminated well water and fish. (*Commenter Southern Environmental Law Center)*

Response: TVA maintains a robust environmental assessment program at all of its power plants including groundwater, surface water and ecological monitoring. TVA is not aware of information indicating that TVA CCR activities are impacting the health of users of drinking water wells near TVA facilities, including the specific sites that TVA evaluates and is proposing to close in Part II of the PEIS. TVA's ecological monitoring confirms the absence of impacts on aquatic species near TVA's plants. There could be environmental justice impacts associated with the transportation of CCR and borrow material. These impacts are analyzed in Part I, Section 3.14 and in Part II where applicable. TVA closely follows media reports about CCR management activities. There appears to be a growing environmental-justice concern about the movement of CCR to off-site landfills in other communities. This is something that TVA would investigate in subsequent site-specific environment reviews. See the response to Comment 114.

114. Comment: Today, coal ash is treated like garbage, wind and rain carry it to nearby homes, which are predominantly black and low-income residents. TVA should ensure that no communities of color are adversely affected by the capping of these ponds. (*Commenter: Ajeet Khalsa*)

Response: See the response to Comment 113. TVA analyzed the potential for disproportionately high and adverse human health or environmental effects of both closure alternatives on minority and low-income populations. The results of the analysis indicated that any impacts to minority and low-income populations associated with closure activities would be related to transport of borrow material on-site and/or CCR off-site. These impacts include increased noise, traffic and dust generated by the increase in truck traffic on public roadways. For large CCR impoundments, off-site movement of CCR could take years to complete and these associated impacts could occur over a long period of time.

115. Comment: EPA recommends that TVA conduct public meetings for citizens that live in the areas near any final ash disposal sites under consideration*. (Commenter: U.S. Environmental Protection Agency).*

Response: Comment noted. TVA did this at the locations where it has proposed near-term impoundment closures and would do so when it proposes closure of other impoundments in the future.

2.16 Air Quality

2.16.1 Greenhouse Gas Emissions

116. Comment: The EPA acknowledges that the TVA referenced a study to characterize potential emissions levels of greenhouse gases (GHG) relative to each of the alternatives. The TVA did not quantify the GHG emissions for activities associated with Alternative B, (Closure-in-Place) and Alternative C (Closure-by-Removal). The EPA recommends that the Final PEIS provide estimates of the GHG emissions associated with these alternatives and include an analysis of reasonable alternatives and/or practicable mitigation measures to reduce project-related GHG emissions. Example tools for estimating and quantifying GHG emissions can be found on Council of Environmental Quality's NEPA.gov web site. The estimated GHG emissions can serve as a reasonable proxy for climate change impacts when comparing the proposal and the alternatives under consideration. (*Commenter: U.S. Environmental Protection Agency*)

Response: TVA manages the effects of climate change on its mission, programs and operations within its environmental management processes. However, as stated in Part I, Section 3.2 of the PEIS, GHG emissions associated with the proposed closure activities would be temporary and relatively minor, albeit emissions would be greater for the Closure-in-Place method and, therefore, would not warrant a quantitative analysis. Similarly, given the relatively low volumes and temporary duration of GHG emissions a more comprehensive lifecycle analysis is not warranted.

2.16.2 Life Cycle Analysis

117. Comment: TVA should include the Draft CEQ guidance on lifecycle analysis for air quality and greenhouse gas emissions. Perhaps a full lifecycle analysis is not necessary, but the concept should be considered and discussed. (*Commenter: Southern Alliance for Clean Energy*)

Response: TVA manages the effects of climate change on its mission, programs and operations within its environmental management processes. However, as stated in Part I, Section 3.2 of the PEIS, GHG emissions associated with the proposed closure activities would be temporary and relatively minor and, therefore, would not warrant a quantitative analysis. Similarly, given the relatively low volumes and temporary duration of GHG emissions a more comprehensive lifecycle analysis is not warranted.

2.16.3 Fugitive Dust/Particulate Emissions

118. Comment: Part I, Chapter 3, Page 39 and Part II, Kingston Fossil Plant, Chapter 2, page 11 cites Best Management Practices (BMP's) for controlling fugitive dust emissions to include by wet suppression (watering unpaved roads) while this is an acceptable practice for controlling dust emissions, it causes an erosion and sedimentation control issue not addressed by the BMP's (at least not specifically cited in this document). Construction equipment exiting sites track out mud on tires, wheels and undercarriages. This dust/mud is then deposited on public paved thoroughfares and, subsequently, ends up in waters of the state. The Roane County Environmental Review Board (RCERB) recommends that these BMP's be amended to require vehicle undercarriage/tire wash stations at all exits from the construction sites**.** *(Commenter: Roane County Environmental Review Board)*

Response: TVA will include truck wash stations at each site as a BMP and this would address the Roane County Environmental Review Board's concern about construction equipment leaving the site with mud on tires, wheels and undercarriages (see Part I, Section 2.7).

119. Comment: TDEC recommends that TVA take all precautions to limit increasing particulate concentrations. TVA should consider air quality impacts, specifically potential particulate or dust impacts associated with moving movement or relocation of CCR materials or contaminated soils in the Draft PEIS. TDEC recommends that TVA carefully monitor ambient air quality using existing nearby monitors and restrict certain activities or implement additional safeguards when monitoring indicates that NAAQS or other exposure levels are nearing exceedance levels. TDEC recommends that TVA place greater emphasis on the use of on-site monitoring to confirm minimal air impacts anticipated or identified as likely to occur in the Final PEIS. *(Commenter: Tennessee Department of Environmental Conservation*)

Response: TVA acknowledges this comment. TVA commits to work with TDEC and other state regulatory entities as appropriate throughout the closure process for each impoundment. Fugitive dust control measures and other BMPs would be routinely employed to reduce particulate matter releases.

120. Comment: TVA overstates the impacts of fugitive dust emissions associated with clean closure. These impacts can be mitigated by a commitment to "no visible emissions" and use of a control plan for fugitive dust, including dust suppression agents. *(Commenter: Southern Environmental Law Center)*

Response: TVA would employ fugitive dust controls measures and other BMPs at all of its sites and for the movement of CCR and agrees that this would reduce potential impacts.

2.17 Land Use

121. Comment: TVA has not included enough information on long term land use for the sites. *(Commenter: U.S. Environmental Protection Agency)*

Response: All sites will have post-closure plans and requirements that will include follow-up monitoring and maintenance of the cover system for 30 years if CCR ponds are closed in place. Therefore only limited use beyond CCR disposal is anticipated. If alternative uses of closed CCR sites are proposed in the future, TVA would conduct appropriate, additional environmental reviews. The post-closure plan and groundwater monitoring plan would be revisited, revised and approved as needed to capture any changes in the cover system configuration or potential land use that might be necessary for changes in use. As EPA observed when it retained Closure-by-Removal as an option in its CCR Rule that Closure-by-Removal would better support changes in land use than would the Closure-in-Place option. TVA notes, however, that its power plant sites tend to be large and it is possible that part of a site could be committed to other uses even if CCR facilities are closed in place. Google, for example, is constructing a data center on part of TVA's Widows Creek plant site away from the plant's CCR facilities.

122. Comment: TDEC recommends that TVA consider converting the excavations created by CCR removal into wetlands and/or flood storage in Alternative C, Closure-by-Removal, of the Final PEIS. *(Commenter: Tennessee Department of Environmental Conservation)*

Response: TVA will consider land use opportunities in the future as appropriate.

2.18 Landfill

123. Comment: Landfill used must be permitted and meet both CCR Rules as well as state-landfill requirements. *(Commenter: Southern Environmental Law Center)*

Response: TVA agrees and will continue to work with state and federal regulatory authorities to appropriately permit new and existing landfills under applicable regulatory programs.

124. Comment: If TVA uses municipal landfill space, what happens when it is full of CCR material? Then they will have to build new landfills? What about these long term socioeconomic effects? *(Commenter: U.S. Environmental Protection Agency)*

Response: At the programmatic level, TVA anticipated as part of the Closure-by-Removal Alternative, sending CCR to an existing, permitted landfill with adequate capacity. In Part I, Section 3.25, TVA considered the potential cumulative effects of placement of CCR materials in existing off-site landfills and recognized that this could have an adverse effect on the available capacity and lifespan of landfills within the region.

For the site-specific analysis, TVA anticipated that there was adequate existing landfill capacity for potential Closure-by-Removal for those sites where this closure alternative was reasonable.

125. Comment: TVA should discuss management of leachate from the final disposal site (e.g., landfill). TVA needs to know if leachate from any receiving landfills could end up in POTW sites. Has this been considered as a long term effect? Would those sites be able to handle the leachate? If any leachate from the off-site landfill is to be collected and sent to a domestic wastewater treatment plant for treatment prior to discharge, the Draft PEIS should address the adequacy of treatment for dissolved metals at the receiving domestic treatment facility under this potential alternative. *(Commenter: U.S. Environmental Protection Agency)*

Response: If Closure-by-Removal is implemented at any of TVA's CCR impoundments, and that material is sent to a permitted MSW landfill for disposal, the leachate would be managed according to the terms and conditions of the receiving landfill's industrial user discharge permit with any receiving POTW. Any issues associated with the cost of treatment of additional leachate at receiving landfills is expected to be addressed in contractual agreements with the receiving landfill. TVA would not contract for disposal of its CCR materials with any MSW landfill which could not manage its leachate under the landfills discharge permit or contract with a permitted POTW.

126. Comment: Alternative C would require off-site disposal at a regulated facility and both proposed facilities are located in Tennessee. TDEC recommends that TVA discuss disposal capacity, site tonnage caps (if applicable), and permitted hours of operation in the Final PEIS. *(Commenter: Tennessee Department of Environmental Conservation)*

Response: For the programmatic analysis, TVA was not specific about a particular receiving landfill location and used general characteristics and assumptions regarding distance and capacity to assess impacts. While particular landfill characteristics regarding capacity, tonnage caps and hours of operation may vary from landfill to landfill, TVA does not believe these features would notably affect the outcome of the impact assessment performed. At the site-specific level, two representative receiving Subtitle D landfills were identified to assess potential impacts of Alternative C. This analysis constituted a reasonable basis for assessing impacts of off-site transport and disposal of CCR for each respective site.

127. Comment: If closure by removal is what you decide to do, we have the perfect place for you to take it to - Roberta Landfill II, III, and IV - in Oneida, TN. This is an 800-acre undeveloped landfill that has passed the Jackson law (400 acres are permitted). This a woman-owned company and it has rail access (Norfolk Southern) and has 100 rail car spur. *(Commenter: Gina Phillips)*

Response: TVA acknowledges the comment.

2.19 Waste Management

128. Comment: TDEC notes that various waste materials may be generated from the use of onsite equipment during construction activities. This will occur for both closure of CCR sites in place and closure of CCR sites by removal. When solid waste is generated during closure activities, per TDEC regulations, TVA will be required to characterize the type of waste (solid waste or hazardous waste) to ensure the wastes are properly disposed or recycled in accordance with TDEC regulations. Additionally, in the event of any spills (fuel, lubricating oils, solvents or any other liquid waste), the contractor shall characterize the type of liquid spilled, report the spill to TDEC, and propose collection and cleanup of the liquid as required by TDEC regulations. *(Commenter: Tennessee Department of Environmental Conservation)*

Response: TVA commits to work with TDEC and other state regulatory entities as appropriate throughout the closure process for each impoundment.

129. Comment: TVA's descriptions of likely actions under Alternative C, Closure-by-Removal, seems to indicate that only RCRA Subtitle D Municipal Solid Waste Landfills (MSWLFs) would be considered by TVA as CCR disposal facilities. Recently, the EPA Region 4 office, has addressed issues in more than one southern State involving the potential conversion of (non-coal) mining pits and non-MSWLF state-permitted landfills into lined solid waste management units that could accept CCR. There has been some confusion on the part of citizens, local governments, and others pertaining to the specific requirements for these facilities.

For any facilities (excluding state-permitted MSWLFs), that intend to receive/dispose of CCR generated at the TVA facilities, in addition to meeting state requirements, the permittee would also be subject to the applicable provisions of the CCR Rule. The EPA understands that TVA is fully aware of the minimum criteria for siting, designing, constructing, reporting, and operating solid waste management facilities that can receive CCR. The TVA may wish to emphasis and disclose the additional requirements for non-MSWLFs receiving CCR in future NEPA documents so as to better inform the public and other stakeholders. (*Commenter*: *U.S. Environmental Protection Agency*)

Response: TVA acknowledges this comment. TVA would do this on a site-specific basis as appropriate in the future. As suggested by EPA in another comment, we have provided a link to the CCR Rule in the Final PEIS.

130. Comment: In Part I, Table 3-18 "Coal Combustion Residuals Generated by TVA from 2010-2013," TDEC recommends that TVA add 2014 data to the table, if available. *(Commenter: Tennessee Department of Environmental Conservation)*

Response: TVA has updated Table 1-3 in Part I with data from 2014 and 2015 with the most recent information regarding CCR generation at TVA facilities. Table 3-18 was eliminated as this was a redundant table.

131. Comment: TDEC recommends that TVA include an explanation of why the Allen Fossil Plant and John Sevier Fossil Plant require the same amount of Borrow Material, 15,000 yd., in the Final PEIS. The Allen Fossil Plant impoundment is 22 acres in size and the John Sevier Fossil Plant impoundment is 42 acres in size. (*Commenter: Tennessee Department of Environmental Conservation)*

Response: The closure of the impoundment at John Sevier entails a reconfiguration of CCR materials into a smaller area that is consistent in size to that of Allen. Accordingly, the amount of borrow material is similar for these two sites.

132. Comment: Are there enough already permitted borrow areas for the volume of overburden needed? *(Commenter: Peter Scheffler)*

Response: Based on its experience with obtaining borrow material to support projects in the past, TVA anticipates that an adequate number of on-site or off-site permitted borrow areas exist with sufficient capacity to provide needed volumes of borrow material.

2.20 Safety

133. Comment: There is a lack of information to support TVA's claim concerning worker safety conditions. TVA has not considered its own data for worker safety and transportation issues from the Kingston spill. *(Commenters: Alliance for Clean Energy, Southern Environmental Law Center)*

Response: Part 1, Section 3.21 of the PEIS provides an analysis that includes worker safety. National statistics show as truck miles increase accidents with injuries and fatalities increase. The Atherton analysis submitted by SELC with its comments contains such statistics. National statistics indicate that from 2001-2009 there were 132 fatalities per 1 million miles traveled and more than 1,600 injuries per mission miles traveled.

Deep excavations into the CCR impoundment required under the Closure-by-Removal Alternative are particularly dangerous as noted by reports of accidents leading to injury or death in the industry. As discussed in *Challenges of Closing Large Fly Ash Ponds*, accidents, near misses and fatalities have been reported at impoundments during operations and closure activities (Seymour, et. al. 2013 and Johnson 2014). Equipment, such as bulldozers and trucks, can become bogged down, disabled and engulfed. For example, while removing fly ash from an impoundment in Kentucky, an excavator was operating approximately 200 ft from the side of the impoundment when the exposed surface of the fly ash slid over an underlying soft, apparently saturated area carrying the excavator and killed its operator. The fly and ash and water engulfed the excavator and operator who could not escape and died.

During the CCR recovery activities at KIF, one worker fatality occurred. TVA does consider worker safety its highest goal and its goal is to minimize risk to work safety. Despite constant attention to safety, accidents still happen.

134. Comment: No fatalities from Duke Closure-by-Removal activities. *(Commenter: Southern Environmental Law Center)*

Response: TVA acknowledges this comment. TVA is not aware of any publicly available data on injuries from Duke closure activities.

2.21 Native American Consultation

135. Comment: TVA should reach out to the Catawba (Charlotte) and USET (Nashville) Native American tribes. *(Commenter: U.S. Environmental Protection Agency)*

Response: The United South & Eastern Tribes is an inter-tribal organization made up of federally recognized tribes with offices in Nashville, Tennessee. TVA has a government-to-government relationship with the federally recognized tribes who are members of USET and consult directly with the individual tribes. The Catawba Indian Nation is the only federally recognized tribe in the state of South Carolina. Their Web site states that they have lived on their ancestral lands along the banks of the Catawba River dating back at least 6000 years. Before contact with the Europeans, it is believed that the tribe inhabited most of the Piedmont area of South Carolina, North Carolina, and Virginia. Their geographical area is outside of the TVA area (Franklin, Patrick counties in VA, Curry, Yadkin, etc. in NC).

2.22 Cumulative Impacts

136. Comment: The analysis of cumulative impacts does not include the cumulative effects of leaving coal ash in continuous contact with groundwater for decades or dumping untreated water into rivers and streams. (*Commenter: Southern Environmental Law Center)*

Response: TVA addressed cumulative impacts in Part I Section 3.25 and in the appropriate site-specific sections. See the response to Comments 31, 78, 84 and 90.

137. Comment: The analysis of cumulative impacts associated with Alternative C overstates the impacts associated with this alternative. This analysis relies heavily on the flawed transportation, air quality and greenhouse gas analyses, discussed in Sections IV.F.7-8. (*Commenter: Southern Environmental Law Center)*

Response: Comment noted. Environmental impact analyses typically involve varying levels of uncertainty. This is true with the analyses done for Alternative C. Recognizing this, we think the analyses done for and summarized in the PEIS are adequate.

2.23 Site-Specific Comments

This section identifies responses to comments on Part II, Site-Specific Reviews.

2.23.1 General Comments

General Comments are those that were submitted for all of the Site-Specific NEPA Reviews in Part II of the PEIS

138. Comment: Because each site-specific analyses in Part II tiers to the flawed programmatic analysis in Part I, each one fails to satisfy the disclosure and analysis requirements of NEPA. (*Commenter: Southern Environmental Law Center)*

Response: TVA disagrees with the conclusion that the site-specific analyses in Part II PEIS are fundamentally deficient. TVA conducted a thorough and complete analysis of all reasonable alternatives in both the programmatic and site-specific reviews of impoundment closures considered in this PEIS. Responses to specific comments as they relate to the general conclusions of this comment are provided in the text below. While EPA recommended that TVA provide additional information for some of the resource area analyses in its March 7, 2016 letter, it commented that it did not identify any significant environmental impacts that would require substantive changes in the Draft PEIS or the consideration of additional closure alternatives.

139. Comment: All impoundments considered in the site specific analyses presented in Part II do not have to close by April 2018. (*Commenter: Southern Environmental Law Center)*

Response: That is correct and TVA has revised the Final PEIS to clarify this. See response to Comment 22.

140. Comment: TVA's self-imposed fast track to closure unreasonably constrains the alternatives analyzed for closure of each of the impoundments assessed in the site specific analyses presented in Part II *(Commenter: Southern Environmental Law Center)*

Response: Comment noted. TVA has updated the PEIS respecting the assumed schedule for closing. After release of the Draft PEIS, EPA asked the D.C. Circuit Court of Appeals to remand and vacate the accelerated closure incentive in a partial settlement of litigation challenging the CCR Rule (environmental groups argued that the rule had been improperly promulgated). This does not affect EPA's technical determination that accelerated closure will significantly reduce structural failure and groundwater contamination risks. Because of this pending regulatory change, TVA decided not to use the April 2018 incentive closure date as a significant factor in its consideration of the reasonableness of Closure-in-Place or Closure-by-Removal. Instead, TVA takes into account the five-year timeframe that EPA set for completing impoundment closures [see CFR §257.102(f)]. EPA determined that almost all impoundments could be closed within that period absent "unpredictable or variable conditions." 80 Fed. Reg. 21422. An early closure is environmentally preferable to a later closure, and this fact—recognized by EPA—still remains an important consideration in TVA's analyses. There are two primary action alternatives for impoundment closure: Closure-in-Place and Closure-by-Removal. While some of the features of these primary alternatives can be varied (e.g., off-site movement of CCR under the Closure-by Removal Alternative could be by truck or rail; some amount of CCR could be beneficially used) and these variations have been raised by some commenters, no commenter, including SELC, has identified a different primary alternative.

141. Comment: The Draft PEIS notes that groundwater has not exceeded groundwater protection standards. This is not a legitimate implication as standards for some constituents exceed EPA Child Health Advisory and EPA Lifetime Health Advisory standards. *(Commenter: Southern Environmental Law Center)*

Response: TVA disagrees. Drinking water standards – maximum contaminant levels or MCLs – are widely accepted and used to benchmark water quality and for enforcement purposes. (It should be noted that using MCLs for this purpose is conservative because they are designed to be measures of finished or treated drinking water, not raw water that is monitored by groundwater monitoring systems.) EPA health advisory standards provide only informal guidance and are set at levels considered to be without appreciable health risks.

142. Comment: TVA fails to analyze how impacts to groundwater and surface water from Alternative B (capping in place) may affect drinking water resources, including well water as concentrations of various constituents exceed EPA guidelines for safe drinking water. (*Commenter: Southern Environmental Law Center)*

Response: See the response to Comment 141. EPA guidelines are not enforceable limits, but are advisories for users of the water. The Draft PEIS provides information and data about surface water and groundwater, including results from TVA's groundwater monitoring systems that benchmark against EPA's drinking water maximum contaminant levels.

143. Comment: The analysis of surface water, wetlands and floodplain impacts is inadequate as the analysis in Part I is inadequate. (*Commenter: Southern Environmental Law Cente*r)

Response: TVA disagrees with this broad assertion. Impacts to surface water, floodplains and wetlands are thoroughly analyzed in Part I and Part II of the Draft PEIS. Additionally, in its letter dated March 07, 2016, the EPA review of the Draft PEIS did not identify any impacts that would require substantive changes to the document.

2.23.2 Allen Fossil Plant

144. Comment: The Draft PEIS does not describe the groundwater elevations at Allen or make any attempt to estimate the amount of ash that may be saturated with groundwater. (*Commenter: Southern Environmental Law Cent*er)

Response: See response to Comment 75. TVA will be assessing the groundwater conditions near the West Ash Impoundment as part of developing a groundwater monitoring plan for the state required post-closure groundwater monitoring plan.

145. Comment: The Draft PEIS entirely fails to analyze how impacts to groundwater and surface water from Alternative B may affect drinking water resources including well water, and surface water as well as the health of the fish population within McKellar Lake. Given that negative health impacts due to consumption of contaminated water and fish are far greater and more immediate than the environmental justice impacts associated with increased truck traffic, TVA fails to analyze the full range of impacts to environmental justice communities. (*Commenter: Southern Environmental Law Cen*ter)

Response: TVA analyzes groundwater and surface water impacts in the Part II, ALF Site-Specific NEPA review in Sections 3.1 and 3.2 of the PEIS. The Tennessee Wildlife Resources Agency fish advisory for McKellar Lake and 303(d) listing does not identify coal ash as a source of the contaminants. This is an industry-heavy area, with many sources for other pollutants. In addition, there are no drinking water wells within 1 mile of the plant. Environmental justice impacts as a result of the proposed closure actions are primarily related to transportation of CCR and borrow material and these impacts are analyzed in Section 3.9 of Part II, the site-specific NEPA review.

146. Comment: TVA states that “[n]o representative monitoring records specific to the West Ash Impoundment regarding groundwater quality are available.” This is not accurate. TVA sampled well P2, down- or side- gradient of the West Ash Impoundment and just over 200 yards away, at least six times between 2004 and 2015, most recently in August 2014. (*Commenter: Southern Environmental Law Center*)

Response: The historic wells (P1, P2, P3, P4, and P5) at Allen are not an appropriate network of wells to monitor the West Ash Impoundment holistically nor from a compliance and regulatory perspective. While well P2 may be side-gradient from the West Ash Impoundment, the groundwater flow fluctuates widely here based on the Mississippi River and Lake McKellar surface water elevations, and has even been shown to flow inland, away from Lake McKellar. TDEC solid waste regulation 0400-11-01-.04 requires a minimum of one upgradient and two downgradient monitoring well locations to accurately characterize a unit. The current monitoring network does not meet these minimum requirements for the West Ash Impoundment, and also does not provide an appropriate distribution of wells to fully characterize groundwater at the West Ash Pond.

147. Comment: TVA discontinues monitoring of potentially dangerous pollutants. In particular, arsenic in well P2 has averaged 10 ug/L, which shows that the groundwater is unsafe to drink This is much higher than the arsenic in the nearest up- gradient well, P1 (1.5 ug/L), suggesting that the West Ash Impoundment and/or the chemical pond located nearby is the source of the contamination. (*Commenter: Southern Environmental Law Ce*nter)

Response: See the response to Comment 146. TVA continues to conduct all required groundwater monitoring. The monitoring referenced by this comment was done voluntarily to support research and was subject to available project funding. Arsenic detected in groundwater samples cannot be assumed to result from CCR contamination in this area. Naturally occurring levels of arsenic Shelby County, Tennessee soils are in the 10,000 ug/L) range (Koop 2001), which is much greater than detected at any of the Allen groundwater wells. TVA studied the potential source of the arsenic detected in the sampled wells using a qualified consultant, Key Environmental, Inc. This study concluded: “Based on careful consideration of all of the available information for the site, and via consideration of substantial information regarding groundwater quality for the Mississippi River alluvial groundwater, it has been concluded that arsenic detected in site groundwater samples is representative of naturally-occurring conditions and is not related to plant activities, including, but not limited to, the operation of the inactive west ash pond and the active east ash pond.” *Alternate Source Demonstration Arsenic Concentrations in Groundwater*, Allen Fossil Plant, Tennessee Valley Authority (October 2013).

148. Comment: TVA’s analysis is not supported by the available evidence. Arsenic in well P6, down-gradient of the East Ash Pond, is not by any definition “anomalous.” Arsenic concentrations in that well fluctuate between 15 and 43 ug/L, consistently higher than the MCL for arsenic (10 ug/L). There is no “anomalous” reading within the dataset for well P6. And it is not the only well with high arsenic; down-gradient wells P2 and P3 have both exceeded the MCL. Well P6 is not an anomaly within the groundwater monitoring network at Allen. (*Commenter: Southern Environmental Law Center*)

Response: See the response to Comment 147. Arsenic levels in well P6 were anomalous with respect to the other wells onsite, none of which show the same levels of arsenic. This supports the determination in TVA's 2013 Alternate Source Demonstration study that arsenic contamination was naturally occurring.

149. Comment: Despite TVA's suggestion to the contrary, there is direct evidence in the Allen groundwater database that arsenic is not naturally occurring at the levels seen at Allen: the average concentration in up-gradient well P1 is 1.5 ug/L, while the average value in well P6 is 30.6 ug/L—20 times higher than background. As described below, well P6 also has elevated concentrations of coal ash indicator pollutants. This means that the groundwater in well P6 is contaminated by coal ash, and the high arsenic readings are almost certainly a part of that contamination. (*Commenter: Southern Environmental Law Center*)

Response: See the response to Comment 147. As part of the alternate source study performed by Key Environmental, groundwater well data from the municipal treatment works were also evaluated. These wells are upgradient from the Allen site, and also show levels of arsenic of the same magnitude of well P2 and P6. Levels of arsenic in well P6 average 30 µg/L which is much less than natural levels of arsenic found in Shelby County soils of 10,000 ug/L.

150. Comment: Well P6, which as discussed above has the highest on-site concentrations of arsenic, also has the highest on-site concentrations of boron. This strongly suggests that the arsenic in well P6 is coming from coal ash. (*Commenter: Southern Environmental Law Center*)

Response: See the responses to Comments 147 and 149.

151. Comment: TVA must also evaluate the potential impact to surface water and sediment from the migration of contaminated groundwater, before it has enough information to choose between Alternatives B and C (*Commenter: Southern Environmental Law Center*)

Response: The PEIS contains summaries of groundwater and surface water quality conditions and impacts at both the programmatic and site-specific levels. TVA's analyses conclude that either alternative will have a positive impact on groundwater and surface water quality. If CCR material intersects with the water table at Allen or at other TVA plants, the improvement in groundwater quality would be less under the close in place method compared to the close by removal method over the long-term, but it still is expected to be positive or beneficial.

152. Comment: The analysis of floodplain impacts is inadequate because it fails to mention that the impoundment is located within the 100 year floodplain. (*Commenter: Southern Environmental Law Center*)

Response: Section 3.3.1 of the PEIS notes: The lowest crest elevation of the West Ash Impoundment berm is 226.9 ft. Although the West Ash Impoundment is shown on the FIRM as being within the 100-year floodplain of McKellar Lake, the low crest elevation would be above the 100-year flood elevation and below the 500-year flood elevation. With the respect to the assertion that the analysis of surface water and wetlands is inadequate, there is not enough information for TVA to respond.

153. Comment: I write you to encourage you to consider the long term consequences when deciding upon a solution for the ash impoundment ponds near the retired Allen Fossil Coal Plant. As a concerned citizen with a degree of understanding of some of the factors that need to be considered when making such decisions, I would champion Alternative C - Closure-by-Removal. This suggestion I base on specific points in the Draft PEIS's report that indicate that Alternative C will remove the possibility of any groundwater interaction as described in section 3.6.2.3. The Ash ponds in question are not sealed on the bottom and pose a risk to the groundwater, which feeds directly into a residential area on Keller Lake and source of local food. Though individuals are advised against consuming fish products from the lake, the original use of the lake was for recreation and fishing. Over time this has changed as pollution has increased but individuals continue to use it for its original planned purpose and some hope that the lake will be returned to this purpose. To conclude, though the costs might be more and other risks during transportation, the long term consequences of allowing an unsealed Ash pool to seep into local groundwater used for recreation and food, poses a great risk that will last longer than 70 years. The One Health framework that recognizes the role the environmental and animal health plays on human health. Knowing that the CCR will interact with groundwater and the uppermost aquifer makes clear that the only acceptable option for long term consequences on human health will result in your choosing Alternative C - Closure-by-Removal." (*Commenter: Russell Brooke*)

Response: See the response to Comment 151. TVA considered the impact to groundwater and surface water in in its analysis of closure methods at all of its ash impoundments. See Part I, Sections 3.6 and 3.7, and parallel sections for site-specific analyses in Part II. While the improvement in groundwater quality is expected to be less when CCR intersects with the water table, it still would be improved under the close in place alternative. In identifying its preferred closure method at specific sites, TVA weighed a number of factors, including impacts on environmental resources in addition to groundwater quality.

2.23.3 Bull Run Fossil Plant

154. Comment: The analysis of groundwater impacts in the Draft PEIS contains no discussion of the location of the uppermost aquifer and whether the coal ash in the Sluice Channel and Fly Ash Impoundment sits within the water table. Without this critical information, it is impossible to evaluate the appropriate closure method at Bull Run. (*Commenter: Southern Environmental Law Center)*

Response: See response to Comment 75. TVA will be further assessing the groundwater conditions near the Sluice Channel and Fly Ash Impoundment as part of developing a groundwater monitoring plan for the state required post-closure groundwater monitoring plan.

155. Comment: Wells near TVA's bottom ash/gypsum disposal area show elevated and unsafe concentrations of several pollutants to say that groundwater has not exceeded groundwater protection standards implies that there is no contamination. *(Southern Environmental Law Center)*

Response: See Response to Comment 141. TVA disagrees with the comment. The comment refers to a table showing exceedances of EPA guidelines for drinking water standards. Drinking water standards--maximum contaminant levels or MCLs--are widely accepted and used to benchmark water quality and for enforcement purposes (It should be noted that using MCLs for this purpose is conservative because they are designed to be measures of finished or treated drinking water, not raw water that is monitored by groundwater monitoring systems). EPA health advisory standards provide only informal guidance and are set at levels considered to be without appreciable health risks. Intake records from the West Knox Utility District indicate no impacts from CCR contamination that might be associated with Bull Run.

156. Comment: The Draft PEIS erroneously states that the groundwater analytical data show no evidence of groundwater contamination from the Dry Fly Ash Landfill. *(Commenter: Southern Environmental Law Center)*

Response: The statement in the PEIS refers to the latest groundwater monitoring reports that show no evidence of groundwater contamination above groundwater protection standards for TDEC required constituents from the Dry Fly Ash Landfill at BRF. These reports reflect groundwater conditions since operational changes and partial closure of the Dry Fly Ash Landfill. Older monitoring reports show groundwater impacts prior to partial closure of the landfill.

157. Comment: Due to coal ash contamination, the groundwater near the fly ash landfill is extremely unsafe to drink. *(Commenter: Southern Environmental Law Center)*

Response: TVA does not agree with the comment. There are no drinking water wells downgradient of the Dry Fly Ash Landfill. The comment refers to exceedances of EPA Advisory screening levels which are inappropriately used in this application because they are designed to be measures of finished or treated drinking water, not raw water that is monitored by groundwater monitoring systems. EPA health advisory standards provide only informal guidance and are set at levels considered to be without appreciable health risks.

158. Comment: TVA does not identify the nearest Subtitle D landfill that would be the likely choice for permanent off-site storage of Bull Run coal ash under the Closure-by-Removal Alternative. Without knowing where the coal ash waste would likely be stored off-site, it is impossible to evaluate potential impacts under Alternative C. Although it is likely this information was not included in the Draft PEIS because TVA improperly screened out Alternative C for the Bull Run site-specific analysis, many of the reasons TVA cites for screening out Alternative C rest on potential environmental justice impacts associated with the haul route for removal activities. *(Commenter: Southern Environmental Law Center)*

Response: The PEIS states that the primary route to access BRF would be SR 170 (Section 3.11) and as such this route would be utilized to transport CCR to an off-site landfill. A sensitive population requiring environmental justice considerations was identified along this route.

159. Comment: The Fly Ash Pond, and possibly the Sluice Channel, significantly encroach on waters of the United States, but there is no discussion in the Draft PEIS of the need to obtain a permit for disposal of coal ash in these waters. Nor does the Draft PEIS discuss the need to obtain landfill approval required by the State of Tennessee. *(Commenter: Southern Environmental Law Center)*

Response: Permits that may be required are identified in the PEIS. TVA will continue to work with TDEC and other state and federal regulatory authorities to ensure that closure methods and subsequent monitoring measures are sufficient to protect the public health and quality of the environment. We think the assumption made by SELC's contractor (RT Environmental Services) that the closure of impoundments converts them to landfills and requires landfill permits is fundamentally wrong and no support is provided for this. EPA determined that dewatered and capped CCR impoundments pose no greater risks than inactive landfills, 80 Fed. Reg. 21342 (April 17, 2015), not that closed impoundments become landfills.

2.23.4 Colbert Fossil Plant

160. Comment: The Draft PEIS fails to establish accurate, site-specific baseline conditions for Ash Impoundment 4 and therefore does not adequately analyze groundwater impacts. *(Commenter: Southern Environmental Law Center)*

Response: See response to Comment 75. We do not agree with the comment as baseline groundwater conditions are discussed in Section 3.1, Part II, COF Site-Specific Review. Regardless of the location of ash with respect to the water table, TVA expects closure in place or closure by removal will both show improvement in groundwater quality relative to baseline (current) conditions. If, after monitoring, state standards are still not met for groundwater, TVA may be required to perform risk assessment or corrective action. TVA's own experience has shown that groundwater contamination is reduced just by removing wet operations from an ash unit. This appears to be a result of dewatering the Wateree Plant CCR impoundment that SELC brought to TVA's attention.

161. Comment: In defiance of its own data and the Consent Order, TVA simply states in the "cumulative effects" portion of the site-specific analysis, that surface and groundwater are not adversely affected by leaving Ash Impoundment 4 in place. (*Commenter: Southern Environmental Law Center*)

Response: We do not understand how this determination defies TVA data or the "Consent Order," which presumably refers to the consent decree that was entered into for Colbert. The analysis of cumulative effects states that resources that are not affected or that have an overall beneficial impact as a result of the proposed action are not considered for cumulative effects. TVA's analyses indicate that the Closure-in-Place alternative (Alternative B) would improve groundwater quality and therefore are beneficial, compared to the No Action Alternative that establishes the baseline.

162. Comment: Ash Impoundment 4 is filled with ash to a depth (elevation) of roughly 420 feet. TVA must identify the uppermost aquifer, determine whether and to what extent the ash in Ash Pond 4 is below the water table, and then start the NEPA process. (*Commenter: Southern Environmental Law Center*)

Response: Determining the elevation of the uppermost aquifer is a requirement of the CCR Rule, and TVA is in the process of doing this where applicable in compliance with that rule. See the Response to Comment 75. TVA's analyses conclude that either closure alternative will have a positive impact on the groundwater quality whether or not the coal ash intersects with the water table.

163. Comment: The Draft PEIS fails to address risks of catastrophic failure based on the instability of the dikes of Ash Pond 4 and consequent risk of surface water contamination. The Draft PEIS also fails to address impacts to wetlands, despite the fact that Ash Pond 4 is located in the middle of a wetland. Moreover, the Draft PEIS fails to identify removal and restoration of the wetland as a mitigation measure for impacts to wetlands. (*Commenter: Southern Environmental Law Cent*er)

Response: Stability of the dikes at Ash Pond 4 is addressed in Section 2.2 and potential impacts to wetlands are addressed in Section 3.8 of the Colbert Environmental Review.

164. Comment: As TVA knows, there are no state requirements for groundwater monitoring systems for ash ponds in Alabama. TVA may have installed groundwater monitoring wells due to its past violations of the law, but there is no state law ensuring that those will continue to be monitored. The final EIS should make this fact about Alabama state law clear. (*Commenter: Southern Environmental Law Center*)

Response: The Alabama Department of Environmental Management (ADEM) has required groundwater monitoring be included in all the approved closure and post closure plans for TVA's ash impoundments in Alabama. These closure plans have been approved under the authority of ADEM's Waste Programs Branch, Solid Waste Program and in accordance with Division 13 of ADEM Administrative Code. Section 2.4 of Part II COF Site-Specific Review notes that TVA will implement supplemental groundwater mitigative measures that could include monitoring, assessment, or corrective action programs. State requirements provide an additional layer of groundwater protection to minimize risk.

2.23.5 John Sevier Fossil Plant

165. Comment: The Draft PEIS fails to establish accurate, site-specific baseline conditions for the Bottom Ash Impoundment and therefore does not adequately analyze groundwater impacts. *(Commenter: Southern Environmental Law Center)*

Response: See Response to Comment 75. TVA is continuing to assess the nature and extent of any constituents that may be associated with CCR impoundments. In response to the CCR Rule and state requirements, TVA is installing and improving groundwater monitoring at all its sites. This additional data will help TVA and the states make decisions about future corrective measures that would be appropriate. Based on available information, TVA expects any groundwater impacts to be notably reduced following the dewatering process.

166. Comment: In Part I, Table 1-2 "TVA Fleet-wide Coal-fired Power Plants," the John Sevier Fossil Plant ash impoundment is identified as active. TDEC received a Notice of Intent (NOI) from TVA to begin closure of the impoundment, identifying the impoundment as currently inactive. TVA shall clarify the status of this impoundment in the Final PEIS. *(Commenter: Tennessee Department of Environmental Conservation*)

Response: The John Sevier impoundment is inactive. This table has been corrected.

167. Comment: These commenters supported a new boat ramp or reopening the old boat ramp so fisherman can access fishing near the dam**.** *(Commenters: Joe Ekton, James Owens, Gary Dawn, Earl Mullins, David Simpson, Wayne Price, Robert Turner, Jerry Simpson, Darlene Sexton, Bob Simpson, Trent Wesley, Rufus Rogers)*

Response: Measures to mitigate the impact of closure of the boat ramp at John Sevier are currently being considered by TVA. These measures include development of a new boat launch and bank fishing facilities in the area and will be addressed in a supplemental environmental analysis that is presented to the public.

168. Comment: TVA must conduct a more comprehensive analysis of groundwater quality, in addition to a detailed assessment of the distance, if any, between the base of the bottom ash pond and uppermost groundwater aquifer, before it can make meaningful conclusions about potential groundwater impacts under alternative closure scenarios. *(Commenter: Southern Environmental Law Center)*

Response: See response to Comment 75**.** The baseline groundwater condition at the JSF Bottom Ash Pond is expected to be improved by the Closure-in-Place method. If, after monitoring, state requirements are not met for groundwater, corrective action measures would have to be evaluated and implemented to address any continuing problems. TVA's own experience has shown that groundwater impacts are improved just by removing the hydraulic head from an ash unit. Similarly, TVA expects that Closure-in-Place would provide even greater benefits to groundwater.

169. Comment: TVA's analysis of surface water impacts contains a mathematical error. Table 3-1 shows an intake aluminum concentration of 0.26 mg/L and an Outfall 008 discharge concentration of 3.56 mg/L, and then predicts a total discharge concentration of 0.0390004 mg/L. This must be an error because the total discharge concentration would have to be at least as high as the lower of the two concentrations being mixed, so at least 0.26 mg/L. The correct total discharge concentration for aluminum should be 0.260*157 mg/L. (Commenter: Southern Environmental Law Center)*

Response: Table 3-1 has been corrected.

2.23.6 Kingston Fossil Plant

170. Comment: The Draft PEIS does not describe the groundwater elevations at the Stilling Impoundment or Sluice Trench or make any attempt to estimate the amount of ash that may be saturated with groundwater. *(Commenter: Southern Environmental Law Center)*

Response: See response to Comment 75. TVA is continuing to assess the nature and extent of any constituents that may be associated with CCR impoundments. In response to the CCR Rule and state requirements, TVA is installing and improving groundwater monitoring at all its sites. This additional data will help TVA and the states make decisions about future corrective measures that would be appropriate. Based on available information, TVA expects any groundwater impacts to be notably reduced following the dewatering process.

171. Comment: It is well-established that the Kingston plant is located in an unstable area with karstic features. The DEIS contains no analysis of the risk of groundwater and surface water contamination from collapse of the bedrock, despite the site's history of sinkhole development. *(Commenter: Southern Environmental Law Center)*

Response: See response to Comment 86.

172. Comment: TVA relies on TDEC groundwater standards and extremely intermittent testing results to downplay the amount of currently known groundwater contamination at the Kingston site. TVA acknowledges arsenic and cobalt contamination in the groundwater, but claims that these testing results were anomalies. (*Commenter: Southern Environmental Law Center)*.

Response: As described in Section 3.1.1.2 Part II, KIF Site-Specific NEPA Review and the groundwater reports posted on the TVA Web site, only one sample collected in December

2014 has exceeded Groundwater Protection Standards for arsenic. Since data collected after that time shows significantly lower results, TVA cannot draw a conclusion about the elevated level and inconsistency of one sample. Many factors can affect results, including laboratory error, interference issues, and cross contamination. If, after post-closure monitoring, state standards are not consistently met for groundwater, TVA would be required to perform risk assessment or corrective action to meet state requirements. TVA's own experience has shown that just by removing wet operations from an ash unit, groundwater impacts are improved. Similarly, TVA expects Closure-in-Place would provide even greater benefits to groundwater.

173. Comment: In short, the local groundwater is currently hazardous to human health. To the extent that the coal ash left in the stilling pond and sluice trench is below the local water table these pollutants will continue to leach out of the ash for the foreseeable future, regardless of whether TVA caps the two areas. This would render the groundwater useless for human use for decades to come. As the contaminated groundwater migrates into the local surface water and sediment, it will present additional risks to the local ecosystem. *(Commenter: Southern Environmental Law Center).*

Response: TVA does not agree that the local groundwater is hazardous to human health. The comment refers to exceedances of EPA Advisory screening levels which are inappropriately used in this application because they are designed to be measures of finished or treated drinking water, not raw water that is monitored by groundwater monitoring systems. EPA health advisory standards provide only informal guidance and are set at levels considered to be without appreciable health risks. In addition, there are no drinking water wells downgradient of the Stilling Impoundment or Sluice Trench that would be affected by groundwater impacts. TVA expects closure in place will reduce groundwater contamination at KIF. TVA will be working with the state to evaluate groundwater impacts, which may include risk assessment and further mitigative measures beyond closure to ensure no impacts to human or ecological health.

174. Comment: TVA does not identify the nearest Subtitle D landfill that would be the likely choice for permanent off-site storage of coal ash. Without knowing where the coal ash waste would likely be stored off-site, it is impossible to evaluate potential impacts to air and noise and environmental justice under Alternative C. (*Commenter: Southern Environmental Law Center*)

Response: As stated in Part I, the PEIS identifies a 30-mi radius for transport of CCR to an off-site permitted landfill. The PEIS states that the primary route to access KIF would be Interstate Highway 40, and US 70 and Swan Pond Road (Section 3.11). If the transport route utilized Interstate Highway 40 to reach Swan Pond Road, there could be a potential impact a low-income population and raise environmental justice concerns. Also, as shown in Part I Table 2-6 air and noise impacts associated with offsite transport of CCR would be greater than those associated with closure-in- place.

175. Comment: In its discussion of surface water quality and impacts, TVA also fails to properly assess the impacts to surface water caused by the rerouting of the current waste stream discharged through Outfall 001. The Draft PEIS states that impacts associated with re-routing of these waste streams would be evaluated at a later time in a subsequent NEPA evaluation and design process as there is not enough information to TVA must include all necessary and relevant information and analysis associated with environmental impacts of its action. *(Commenter: Southern Environmental Law Center)*

Response: As stated in Section 3.2.2, the analysis summarized in Table 3-1 demonstrates that current operations from Outfall 001 do not have an adverse impact on surface water quality. At this time, there is not enough information available to produce future operations mixing analysis. However, it is anticipated that the quality of the water would be maintained because these flows would be treated in a lined treatment impoundment and channel, thus eliminating any potential seepage. Additionally, waste water treatment would be introduced as appropriate to ensure compliance of discharge waters with NPDES permit limits and TDEC water quality criteria.

2.23.7 Widows Creek Fossil Plant

176. Comment: The Draft PEIS does not describe the groundwater elevations at the Ash Impoundment Complex or make any attempt to estimate the amount of ash that may be saturated with groundwater*. (Commenter: Southern Environmental Law Center)*

Response: See response to Comment 75. As stated in Section 3.1, Part II, WCF Site-Specific NEPA Review, TVA is in the process of further studying groundwater characteristics near WCF and evaluating the existing groundwater monitoring system. Based upon the findings of these studies, and in consultation with ADEM, TVA will recognize state-specific interpretations of usable groundwater as it evaluates the depth to the uppermost aquifer at WCF. Regardless, TVA's analyses conclude that either closure alternative will have a positive impact on the groundwater quality whether or not the coal ash intersects with the water table.

177. Comment: TVA failed to analyze several alternatives to hauling the coal ash to the Arrowhead landfill when it analyzed removing the ash by rail. *(Commenter: Southern Environmental Law Center)*

Response: TVA utilized its experience with moving large volumes of CCR by rail at Kingston to develop the bounding analysis of the feasibility of CCR removal by rail at WCF**.** Additional information concerning the use of rail transport as an option has been included in both Part I, Chapter 2.0 and in WCF Part II, Section 2.2.

178. Comment: TVA also failed to analyze the option of an on-site coal ash landfill—one that complies with all location restrictions in the Coal Ash Rule, including the requirements for unstable areas. It did consider the option of an on-site landfill in its 2014 Environmental Assessment for the closure of the gypsum stack, and estimated that a 155-acre, on-site landfill would cost $108 million, but failed to do so in this DEIS. *(Commenter: Southern Environmental Law Center)*

Response: As stated in the 2014 Environmental Assessment, this alternative was dismissed as not reasonable due to excessive cost and environmental impacts. In addition, the landfill identified in the EA does not have sufficient capacity to store the CCR from the Ash Impoundment Complex.

179. Comment: The Ash Impoundment Complex is located in an unstable karst area (*Commenter: Southern Environmental Law Center)*

Response: See response to Comment 86. The PEIS recognizes that WCF is located in the Valley and Ridge Physiographic Province and potentially in a karst area but based on monitoring, stability calculations and installation of an impermeable cover, TVA does not anticipate any safety or environmental concerns. Groundwater monitoring will comply with state requirements. TVA has developed the Advanced Technology for Impoundment Monitoring center to identify and respond to a CCR impoundment issues before an emergency can happen. TVA has installed over 7,000 real-time sensors to monitor ash impoundments 24 hours a day, 7 days a week. A centralized monitoring system provides notifications and TVA has action levels if changes are occurring at an impoundment.

180. Comment: I am commenting specifically about Widow's Creek CCR. I believe alternative B - closure in place option, is the best option for Widow's Creek CCR. It is clearly the only practical option. I also agree with the RERC advice statement that TVA, with its mission in environmental stewardship, should ensure that it has a robust policy on monitoring of CCR facilities to ensure that TVA is not causing environmental damage. There should be an ongoing and routine inspection and maintenance of the dikes and areas around the CCR areas. I think it is TVA's responsibility to make sure these areas are maintained so there is not a future contamination problem. We also believe TVA, ADEM, and the local water utilities should coordinate and continue monitoring both test wells near the CCR areas and raw water at the water intakes to insure problems don't develop over time. *(Commenter: Roger Goodrich)*

Response: TVA acknowledges the comment. A reference to the RERC advice statement is included in Part I, Section 1.6, Summary of Public and Agency Coordination Process. TVA plans to monitor groundwater at all of its plant sites.

181. Comment: TVA has failed to provide information of groundwater contamination in the DEIS. (*Commenter: Southern Environmental Law Center)*

Response: TVA agrees that limited data at the WCF Ash Pond Complex makes groundwater impacts difficult to assess. For this reason, TVA has proposed as part of the closure plan, groundwater monitoring including upgradient or background groundwater monitoring. Using background monitoring data, TVA can further assess the extent to which constituents are attributed to the Ash Impoundment Complex versus naturally occurring elements. TVA will also be able to monitor the groundwater as the Ash Impoundment Complex is closed and as the potentiometric surface at the stack decreases after capping. If, after post-closure monitoring, state standards are not consistently met for groundwater, TVA may be required to perform risk assessment or corrective action to meet state requirements.

2.23.8 Gallatin Fossil Plant

182. Comment: I just wanted to comment about the coal ponds located in your Gallatin TN facility. As a member of this community for my whole life, I think this an outrage and the TVA should come in and clean this mess up! I grew up most of my life right down the road from your plant and looking back now only god knows what my family has ingested over the years. I am not a tree hugger by no means and support coal 100%. I no longer live near this facility but me and my family use the river weekly that the plant is now leaking into. I may have grown up exposed to this and never knew it but I will be damn if my children do! Where is the outrage from the TWRA or the Corp of Engineers? Are we just gonna sit by and let this poison our water supply and our children. This has to be fixed now! For the future of our water ways and our children's children*. (Commenter: Josh O'Neal)*

Response: Neither the comprehensive human health and environmental risk assessments conducted for the Kingston ash spill nor TVA's long-running biological monitoring programs in the Tennessee and Cumberland Rivers have identified any real risk to human health or the environment from CCR exposure. It is understandable that members of the public may be concerned about potential impacts of CCR. TVA's groundwater monitoring data show some degree of isolated contamination at a limited number of on-site monitoring wells at TVA facilities, but this does not signify that there are real risks to human health or the environment as environmental advocacy groups continually assert. TVA has years of data indicating this is untrue.

The Kingston spill studies included more than 4,000 air samples, 4,500 river and groundwater samples, 1,600 sediment samples, and more than 5,500 bird, fish, turtle, snail, mayfly, and raccoon samples, resulting in over 400,000 reported chemical analyses, and thousands of field observations looking for effects. In addition to TVA, Oak Ridge National Laboratory, the U.S. Army Corps of Engineers, other entities and several universities conducted independent studies. For example, the Tennessee Department of Health investigated potential contamination of municipal drinking water systems and private wells from the Kingston ash spill and found no contamination.

The amount of coal ash and coal ash contaminants released in the Kingston spill was massive in comparison to any amounts that may leak from TVA's other facilities. If that spill resulted in no real risks, we would except similar results at TVA's other facilities and this is what our biological monitoring programs show at those facilities. Recently, the Southern Environmental Law Center sampled fish caught near the Gallatin plant and none of its sample results exceeded applicable standards.

183. Comment: I am alarmed by TVA's plan to deal with coal ash at its Gallatin facility. TVA's proposal to leave the ash in unlined pits is unacceptable. It is well-documented that coal ash pollution continues to flow from your Gallatin Plant into the Cumberland River, which provides drinking water for 1.2 million residents downstream. SELC, on behalf of the Sierra Club, has filed a notice of intent to sue TVA over the Cumberland Fossil Plant, where your own studies show that more than forty years of coal ash waste stored in unlined pits is illegally contaminating groundwater. This is shocking. As a rate payer, the cost of those lawsuits is born by me and other customers. Not to mention the health effects. I urge you to dispose of the coal ash in lined pits away from the water. (*Commenter: Ann Ercelaw*)

Response: See the response to Comment 182. Based on TVA's comprehensive risk assessment and TVA's long running biological monitoring program in the river, we have not discerned any risk of harm to human health or the environment. TVA is not proposing to close CCR impoundments at Gallatin in the near term and these are not addressed in the site-specific analyses in the Draft PEIS. Moreover, TVA under the direction and oversight of TDEC is conducting additional investigations at Gallatin that will help inform the decision about closure methods.

2.24 Southern Environmental Law Center Consultant Report Comments

The SELC retained several environmental consulting services to review and analyze the Draft PEIS. SELC attached these reviews/documents in support of their comments. TVA has considered these reviews/documents and has provided responses to several of the documents as well as addressed comments and concerns raised by these reports in responding to Southern Environmental Law Center comments as presented in this document.

2.24.1 Atherton Report

184. Comment: Transportation and material handling figure prominently in a cost benefit analysis of the options. The Draft PEIS does not offer enough detail for the reader to judge the completeness of this analysis and make an informed evaluation of the transportation plan presented therein. *(Commenter: Southern Environmental Law Center, Atherton Report)*

Response: TVA assessed the reasonableness of using barge as a transport mode in Part I, Chapter 2.0. This analysis demonstrated that barge transport was not a reasonable alternative for TVA plants. TVA disagrees with the statement in the Atherton report that concludes that equipment, loading and unloading infrastructure used for movement of coal are the same regarding movement of CCR. In addition, the Atherton report did not consider the transport of CCR from the barge facility to the receiving landfill for those sites without barge access (e.g., John Sevier Fossil Plant). We note that a couple of SELC coalition members, the Sierra Club and Environmental Integrity Project, are actively opposing barge movements of CCR from a First Energy plant as too risky due to potential for barge accidents.

TVA assessed the reasonableness of using rail as a transport mode in Part I, Chapter 2. This mode of transport is determined to be viable for consideration in future impoundment closures.

TVA conducted a thorough and complete analysis of transport of CCR by truck and concluded that trucking is an effective mode of transport as it uses the existing roadway infrastructure to readily serve the plant site subject to impoundment closure and the receiving landfill. TVA disagrees with the conclusions of the Atherton Report regarding details that are missing from TVA's analysis.

185. Comment: Under current conditions the TVA facilities are equipped to move coal from a barge landing and/or the rail siding into the plant. They are also equipped to move the byproducts away from the plant to some on site storage. Similar handling capabilities would be needed to move the CCR material to barge or rail. *(Commenter: Southern Environmental Law Center, Atherton Report)*

Response: TVA has expanded its discussion of transportation impacts in Section 2.2.4 in Part I of the Final PEIS generally and, as appropriate, in the site-specific reviews.

186. Comment: No discussion of containerized intermodal solution as a transportation option. *(Commenter: Southern Environmental Law Center, Atherton)*

Response: TVA is not aware of utilities using containerized intermodal transportation for CCR and this seems to be a very inefficient and costly way of moving CCR compared to other transportation alternatives. The consultant mentions the ease of stacking containers, but does not address how containers would be loaded and unloaded and the infrastructure that would have to be constructed to do this.

187. Comment: TVA did not consider a range of truck types in its transportation analysis. *(Commenter: Southern Environmental Law Center, Atherton Report)*

Response: TVA considered the potential use of larger, articulated dump trucks for off-site transport of CCR, but this mode of transport was considered to be highly impactful and inconsistent with weight limits on public roads set by DOTs. We think using 15-ton trucks, which are widely available, in our transportation analyses is reasonable.

188. Comment: The Atherton Report discusses differences in safety statistics and accident frequencies among the three modes of transportation varies in the same direction as volume hauled and per mile. *(Commenter: Southern Environmental Law Center, Atherton Report)*

Response: While each mode of transportation has a different frequency of accident, each mode also has different magnitudes of impacts from an accident. For example, a barge accident may release large volumes of CCR directly into a body of water and the location increases both the environmental impact as well as mitigation efforts. A truck accident may have a lower volume of CCR released than a barge or train accident, environmental impacts and mitigation efforts when compared to a barge or train accident. However, a truck has an increased chance to be in an accident with another vehicle such another truck or passenger vehicle.

2.24.2 Global Environmental, LLC Report (Mark Quarles)

189. Comment: TVA's evaluation of remedial alternatives and selection of programmatic Closure-in-Place corrective measures in the Draft PEIS does not meet state-specific or US EPA Coal Combustion Residuals Rule requirements for soil, groundwater, surface water, and sediment contamination. *(Commenter: Global Environmental, Southern Environmental Law Center)*

Response: TVA has been working and will continue to work with state regulatory authorities on closure plans for individual impoundments to ensure that closure methods and subsequent monitoring measures are sufficient to protect the public health and quality of the environment. TVA disagrees that Closure-in-Place would not meet CCR Rule requirements. EPA observed that most CCR impoundments would be closed in place and, in fact, assumed that all impoundments would be closed in place in its Regulatory Impact Analysis (December 2014).

190. Comment: TVA's selected Closure-in-Place corrective action fails to dewater all water in the impoundments, and as a result, does not meet EPA requirements for ash impoundment closure. *(Commenter: Global Environmental, Southern Environmental Law Center)*

Response: TVA intends to dewater at all of its sites as needed prior to closure. This has been clarified in the PEIS.

191. Comment: Although TVA included a section in the Draft PEIS related to surface water uses and water quality in the streams and reservoirs, the Draft PEIS includes no plans to sample those areas for CCRs that have been documented at some TVA facilities. *(Commenter: Global Environmental, Southern Environmental Law Center)*

Response: See the response to Comment 96. TVA has extensive experience documenting the impacts; and in many cases, the lack of impacts of coal combustion residuals on aquatic, terrestrial and avian wildlife from the Kingston spill. Extensive bioaccumulation studies were conducted on CCR constituents, including selenium. Additionally, TVA has a comprehensive river and reservoir monitoring program to evaluate the surface water quality and ecological health of waters. Surface waters are collected and chemically analyzed, and fish and benthic macroinvertebrates (aquatic insects) are sampled and associated population and community conditions assessed. This information provides an indication of current conditions, allows trends to be identified, and establishes a baseline for comparing future water quality and ecological conditions. Detailed assessment studies are conducted as water quality or ecological conditions warrant. The link to the TVA reservoir health monitoring program is: https://www.tva.gov/Environment/Environmental-Stewardship/Water-Quality/Reservoir-Health-Ratings.

192. Comment: Without knowing basic depth and hydraulic head conditions of the uppermost aquifer at each site, TVA cannot claim that Closure-in-Place would comply with the required closure performance standard. *(Commenter: Global Environmental, Southern Environmental Law Center)*

Response: EPA determined in the CCR Rule that the uppermost aquifer is where groundwater impacts and location requirements should be determined. TVA is in the process of determining the location of uppermost aquifers at active facilities through the CCR Rule. Regardless, TVA has determined consistent with EPA that dewatering and capping impoundments will have a positive impact on groundwater impacts. See the Response to Comment 75.

193. Comment: TVA incorrectly applies its interpretation in the Draft PEIS of what is an "uppermost aquifer" in terms of the CCR Rule applicability, the association with state-specific groundwater quality standards, and closure and corrective action implications. *(Commenter: Global Environmental, Southern Environmental Law Center)*

Response: See the Response to Comment 192.

2.24.3 RT Environmental Services

194. Comment: RT Environmental Services report finds "that the Programmatic Environmental Impact Statement is incomplete and insufficient in scope as a basis to draw conclusions on future management of already deposited coal ash at TVA facilities." *(Commenter: RT Environmental Services, Southern Environmental Law Center)*

Response: TVA conducted a thorough and complete analysis of all reasonable alternatives in both the programmatic and site-specific reviews of impoundment closures considered in this PEIS. In a March 7, 2016 letter, EPA said: "EPA has rated this Draft PEIS as "LO" – or Lack of Objections. The EPA has not identified any significant environmental impacts to the proposed action that would require substantive changes to the Draft PEIS or require the TVA's consideration of different alternatives for the site-specific closure plans."

195. Comment: The DEIS failed to evaluate compliance with State and Federal regulations. *(Commenter: RT Environmental Services, Southern Environmental Law Center)*

Response: TVA has revised the PEIS to clarify that its focus on the CCR Rule does not signify that it would not comply with other applicable regulatory requirements. TVA will continue to work with state and federal regulatory agencies to ensure that impoundment closures comply with other applicable requirements. The regulatory oversight provided by those other programs adds further assurance that closure of CCR impoundments will appropriately address and safeguard against risks to public health and the environment.

196. Comment: TVA failed to consider the implications of changing from "storage" to "disposal". For example, the CCR impoundments being closed have not been subject to appropriate siting reviews. *(Commenter: RT Environmental Services, Southern Environmental Law Center)*

Response: See the response to Comment 159. TVA has been and will continue to work with state regulatory authorities on closure plans for individual impoundments to ensure that closure methods and subsequent monitoring measures are sufficient to protect the public health and quality of the environment. The closure and capping of CCR impoundments do not turn closed impoundments into facilities that must be permitted as new landfills.

197. Comment: TVA failed to consider floodplain encroachment and potential for "catastrophic waste washout." *(Commenter: RT Environmental Services, Southern Environmental Law Center)*

Response: TVA takes into account flood risks and designs to reduce the risk of catastrophic failures during flooding events at its impoundments. In addition, TVA conducts analyses dealing with the probable maximum flood (PMF) within its dam safety program and takes action to address unacceptable risks. TVA applies dam safety guidelines to its CCR impoundments.

198. Comment: TVA failed to consider wetlands and remediation when new disposal facilities are being contemplated. Wetland impacts should be considered (even if already filled) as potential new disturbances. *(Commenter: RT Environmental Services, Southern Environmental Law Center)*

Response: RT Environmental Services misunderstands the requirements for evaluating impacts to wetlands. TVA does consider whether wetlands are jurisdictional under USACE but we consider impacts to all wetlands (jurisdictional or other). See Section 3.13 of the Final PEIS.

199. Comment: TVA failed to consider stability and determine there is no potential for leachate/liquid short circuiting due to vertical construction of dikes on waste materials. Slopes constructed of ash material sitting atop other ash material have created preferential leachate pathways. *(Commenter: RT Environmental Services, Southern Environmental Law Center)*

Response: TVA considers stability concerns as part of the development of site-specific closure plans for each impoundment. Cover designs will include potential leachate pathways so the cover system can meet federal and state cover performance standards.

200. Comment: TVA failed to consider whether ash is or is not placed within the water table. *(Commenter: RT Environmental Services, Southern Environmental Law Center)*

Response: See response to Comment 75. Based on how groundwater monitoring wells were sited, water level data does not necessarily reflect the elevation of the groundwater table. These wells were not sited with the purpose of determining groundwater elevations. EPA determined in the CCR Rule that the uppermost aquifer is where groundwater impacts and location requirements should be determined. TVA is in the process of determining the location of uppermost aquifers at active facilities through the CCR Rule. Regardless, TVA has determined consistent with EPA that dewatering impoundments and capping them will have a positive impact on groundwater impacts, whether or not they are in groundwater.

201. Comment: TVA overemphasized the potential for dust emissions. The industry standard for construction specifications is for there to be “no visible emissions”, which assures that significant dust emissions are not created. “As long as TVA consents to the use of appropriate materials for dust control and agrees that “no significant visible emissions” will be permitted during the clean closure, dust control should not be an impediment to clean closure. *(Commenter: RT Environmental Services, Southern Environmental Law Center)*

Response: TVA does not agree that it overemphasized the potential for dust emissions in evaluating closure alternatives. TVA does agree that the use of appropriate BMPs can reduce and minimize the potential for fugitive dust emissions from either Closure-in-Place or Closure-by-Removal activities.

Appendix B – Regional Energy Resource Council Presentation

Regional Energy Resource Council

January 20-21, 2016

Memphis, Tennessee

Term 2 RERC Members

Lance Brown
Partnership for Affordable Clean Energy

Anne Davis
Southern Environmental Law Center

Wayne Davis
University of Tennessee

John Evans
State of North Carolina

Catherine Glover
Chamber of Commerce and Industry

Rodney Goodman
Habitat for Humanity

Wes Kelley
Columbia (TN) Power & Water Systems

Pedro Mago
Mississippi State University

Peter J. Mattheis
Tennessee Valley Industrial Committee

Robert Martineau, Jr.
State of Tennessee

Alice Perry
State of Mississippi

Goodrich "Dus" Rogers*
Jackson County (AL) Economic Development Authority

Joe Satterfield
Blue Ridge Electric Members Cooperative (ret'd)

Jack Simmons
Tennessee Valley Public Power Association

Stephen Smith
Southern Alliance for Clean Energy

John Warren
Commonwealth of Virginia

Lloyd Webb
Olin Chlor Alkali

Susan R. Williams
SRW & Associates

* RERC Chair

Today’s Meeting

Meeting Purpose

- Welcome New Term and FACA/RERC Orientation
- TVA Update and Policy Update
- Information and Advice on Coal Combustion Residuals Impoundment Closure Alternatives
- Public Input Listening Session
- Field Trip: Tour Allen Fossil Plant/impoundments

Agenda – January 20, 2016

10:00	**Welcome and Introductions**	Dus Rogers, Chairman Joe Hoagland/ DFO Council Members
	Safety Moment	Jo Anne Lavender, Facilitator
10:15	**Meeting Purpose**	Hoagland
10:20	**Overview of Agenda**	Lavender
10:25	**FACA / RERC Orientation**	Kelly Love, OGC
10:30	**RERC and TVA Update**	Hoagland
10:45	*Break*	
11:00	**Policy Update**	Brenda Brickhouse
11:45	*Lunch*	
1:00	**Introduction of Advice Topic**	Lavender

Agenda – January 20, 2016 (cont'd)

1:10	**Orientation – Coal Combustion Residuals (CCR)**	Scott Turnbow
1:45	**Modeling Impoundment Closure Options:** **Electric Power Research Institute (EPRI)**	Bruce Hensel
2:30	*Break*	
2:45	**Overview: CCR Impoundment Closure Draft EIS**	Amy Henry
3:05	**Preliminary Discussion**	Council, Lavender
3:30 – 4:30	**Public Listening Session**	Lavender facilitate
4:30	**Wrap Up, Overview of Evening and Day 2**	Rogers/ Hoagland/ Lavender
5:30	**Reception and Dinner** *Special Recognition of Clifford Stockton*	

Agenda – January 21, 2016

7:30	*Breakfast*	
8:30	**Allen Fossil Plant Field Trip**	Council
11:30	*Lunch*	
12:30	**Welcome, Review of Day 1**	Hoagland/ Lavender
12:45	**CCR Impoundment Closure Draft EIS**	Henry
1:15	**CCR Discussion and Advice to TVA**	Council / Lavender facilitate
2:15	*Break*	
2:30	**CCR Discussion and Advice to TVA (cont.)**	Council / Lavender facilitate
3:30	**Summary, RERC Next Steps**	Lavender/ Rogers / Hoagland
3:45	**Adjourn**	

Introduce Advice Topic

Jo Anne Lavender

RERC Advice Topic

Coal Combustion Residuals (CCR) Impoundment Closure Alternatives

- CCR Overview
- EPRI: Modeling CCR Impoundment Closure Options
- CCR Impoundment Closure Draft EIS
- Allen Fossil Plant Tour

RERC Advice Questions

1. What do you think about TVA seeking public comment on these closure alternatives including holding meetings in communities near coal-fired plants?

2. TVA has evaluated multiple criteria (listed below) in the Draft EIS. Is there anything important that we missed?

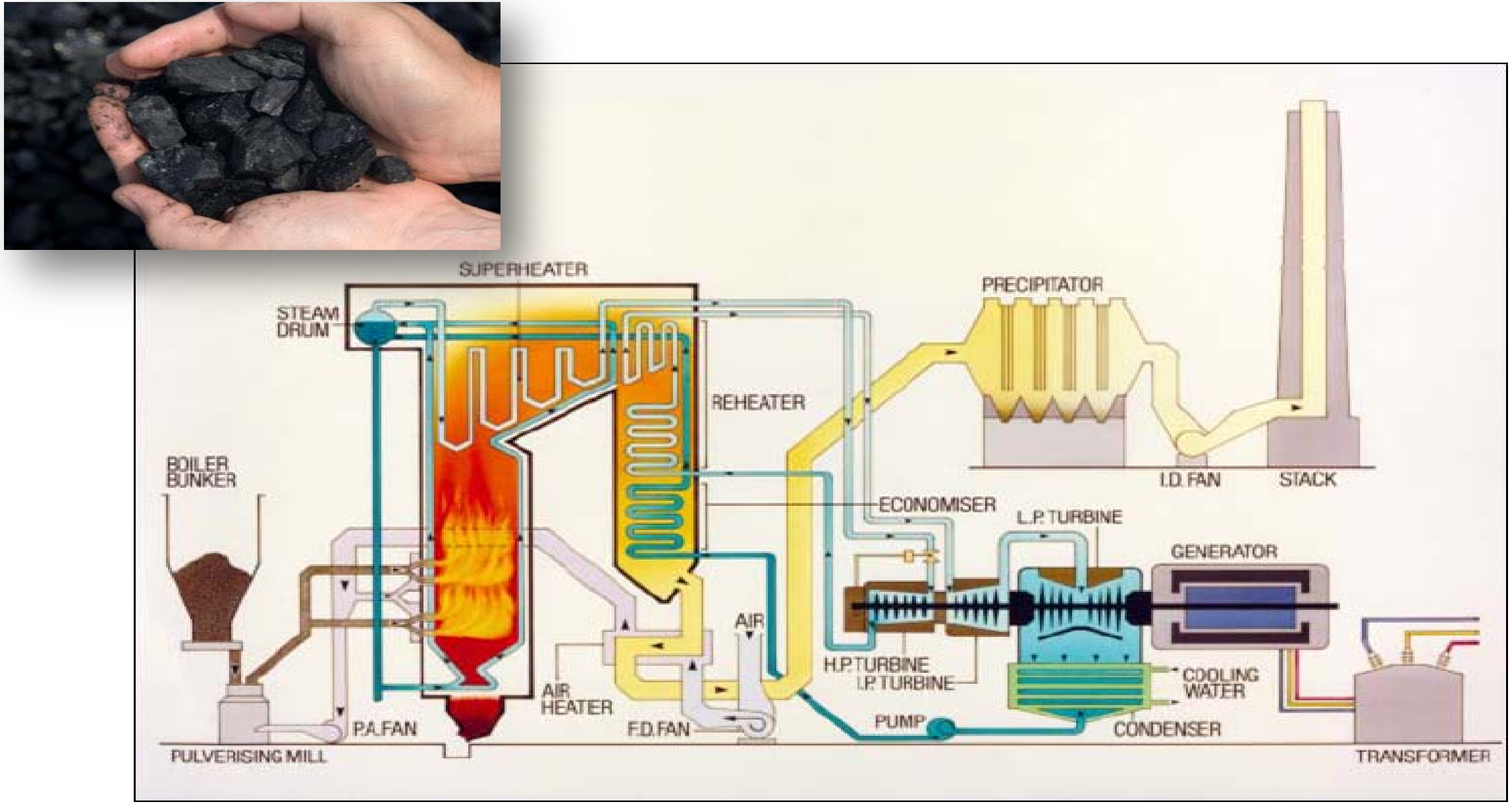
- Volume of CCR materials
- Mode and duration of transport (borrow/fill) activities
- Schedule of closure (milestones of CCR Rule)
- Impoundment Stability (static, seismic)
- Risk to human health & safety (workers, motorists)
- Effects to adjacent environmental resources (wetlands, groundwater, surface water, air, biota, historic resources)
- Environmental Justice
- Cost

3. From your perspective, what are the pros and cons for the closure in place alternative, and for the closure by removal alternative?

Overview
Coal Combustion Residuals

Scott Turnbow, General Manager
Strategy and Engineering
Civil Projects & CCP Management

CCR Overview

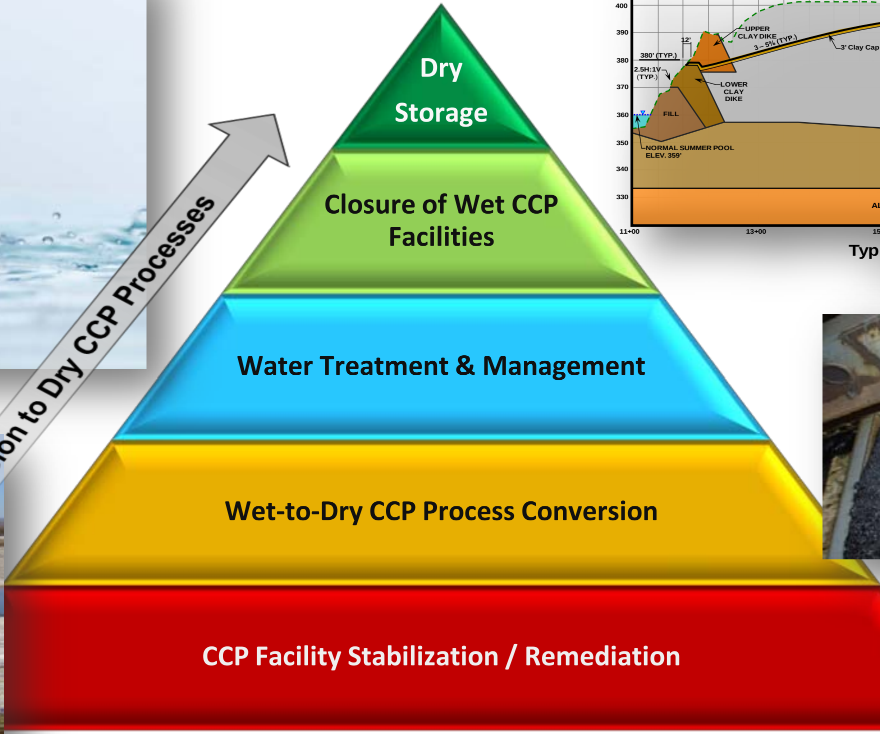


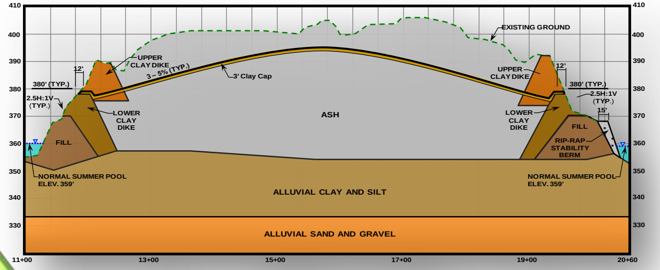
CCR Overview

Wet Process

Dry Process

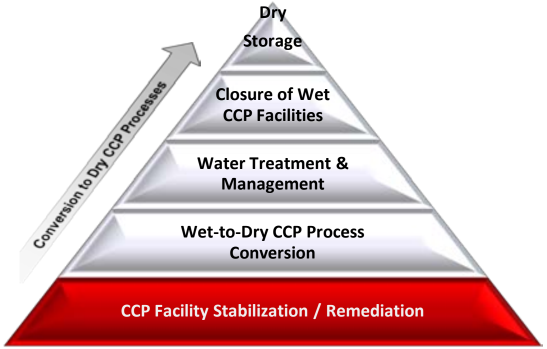
CCR Overview





Typical Dike Section

Initial Programmatic Approach



Construction of Improvements at Bull Run

Phase 1 – Facility Review

- Records Review/Staff Interviews
- Site Condition Review
- Recommendations for Future Analysis, Studies, and Program Improvements
- Final Report Issued June 24, 2009

Phase 2 – Engineering Assessments

- Geotechnical Explorations
- Hydrologic and Hydraulic Analysis
- Dam Safety Hazard Classifications
- Piping/Spillway Inventories

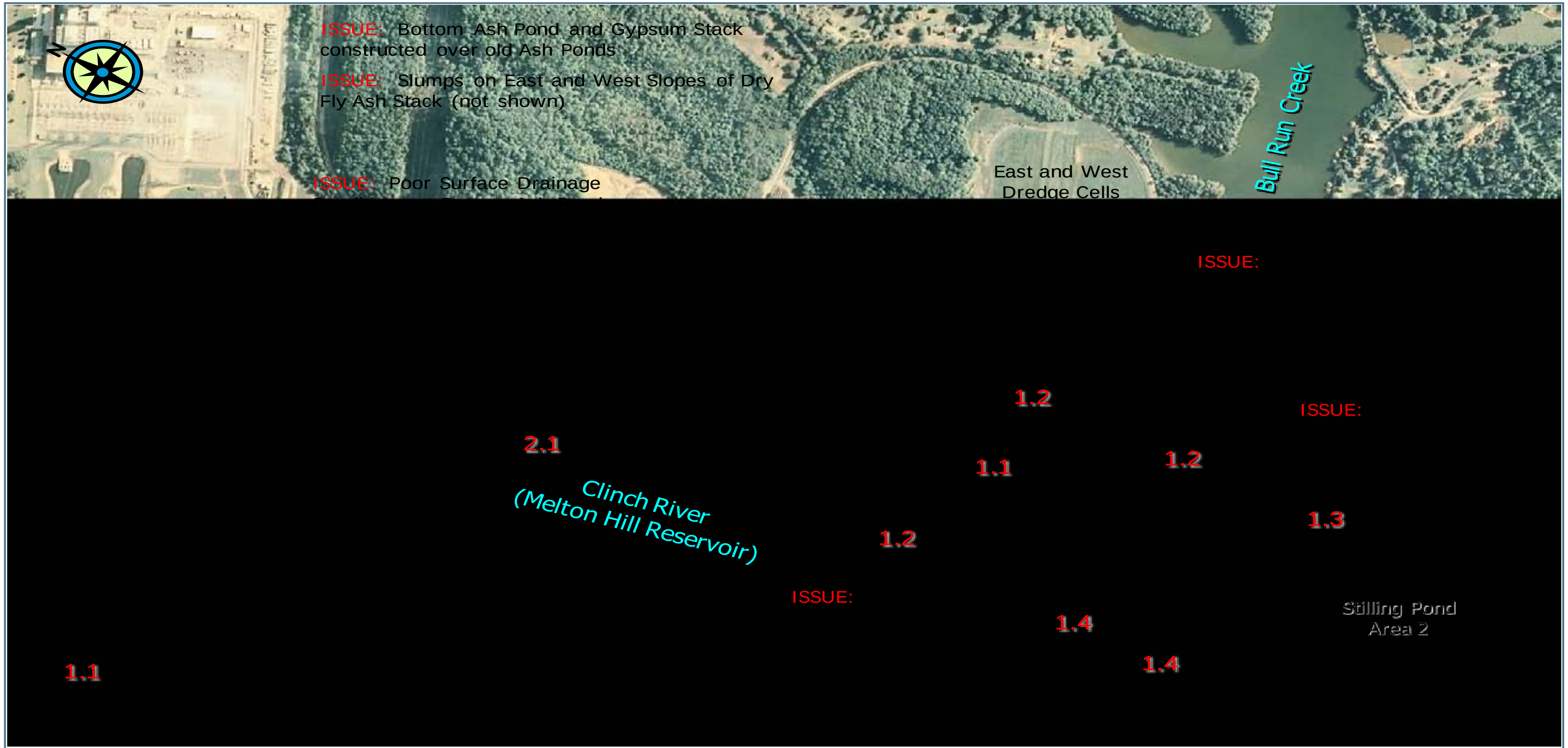
Phase 3 – Remediation Design and Construction

- Structural Deficiencies
- Improve Freeboard (Storage)
- Risk Reduction (Spillways, Hazards Classification)

Phase 4 – Programmatic Improvements

- Dam Safety Inspection Training
- Programmatic Documents

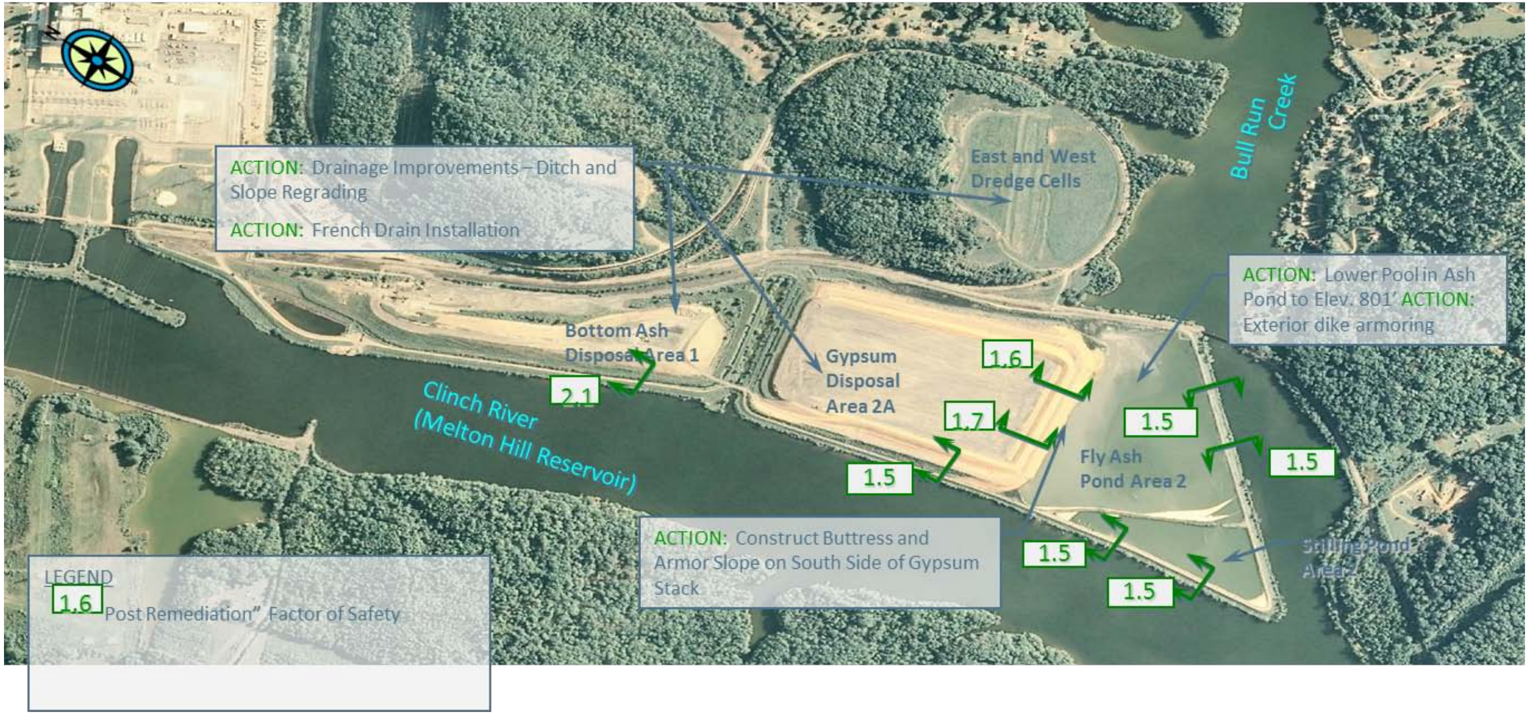
Bull Run: Phase 2 Assessment



As Found Stability Conditions

Bull Run: Gypsum Stack Toe (before)

Bull Run: Phase 3 Remediation



Bull Run: Gypsum Stack Toe (after)

Instrumentation Monitoring

Advanced Technology Impoundment Monitoring

- Monitors in real time, the health and stability of all TVA CCP facilities.
- The ATIM center provides multiple screens and computers for simultaneous analysis and risk management of CCP facilities.
- The ATIM center provides a location for emergency preparedness and monitoring off CCP facilities.

Instrumentation Monitoring

Advanced Technology Impoundment Monitoring

Instrumentation Monitoring

Advanced Technology Impoundment Monitoring

Instrumentation Automation

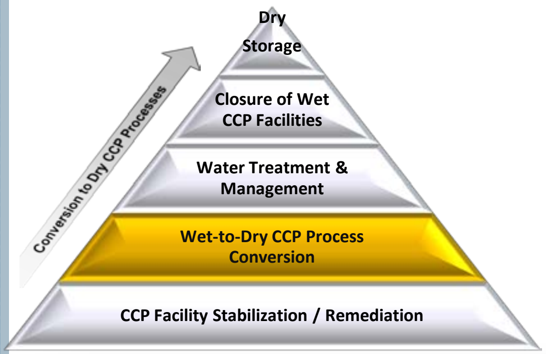
- 307 piezometers
- 82 slope inclinometers
- 10 weather stations
- 8 River Level Gauges
- 13 Pond Level Gauges

Manual Instrumentation – Quality Control

- 707 Piezometers
- Variable Monitoring for QC of Automated Instrumentation.

Notification Alerts – Automated Email

CCR Dewatering Facilities



DFA Conversion

- Completed KIF & BRF
- PAF U3 in Planning

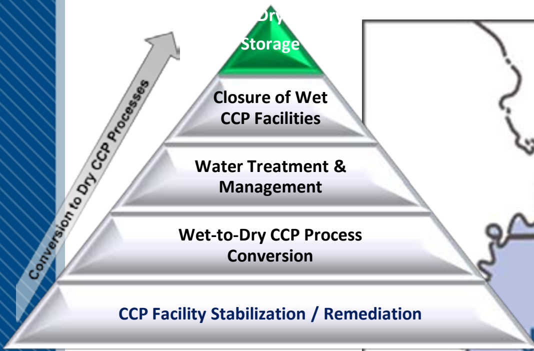
Gypsum Dewater

- Completed KIF & BRF
- PAF U3 in Planning

Bottom Ash Dewatering

- Completed Bull Run
- In Design/Planning:
  - Kingston
  - Gallatin
  - Shawnee
  - Cumberland
  - Paradise

CCR Landfills - New



CCR Landfills – New

Gallatin Construction

Haul Road paving

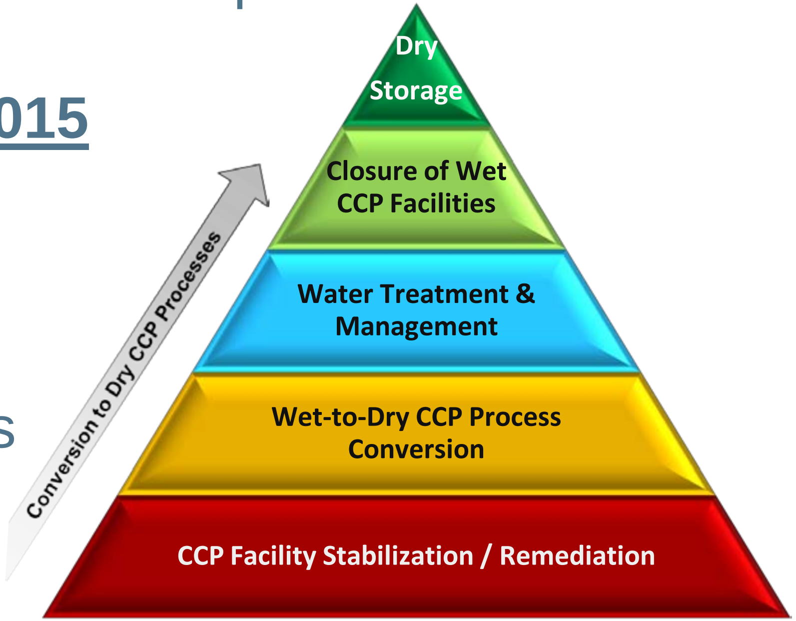
50% of Liner installed

Installation of Geocomposite

Placing Protective Cover

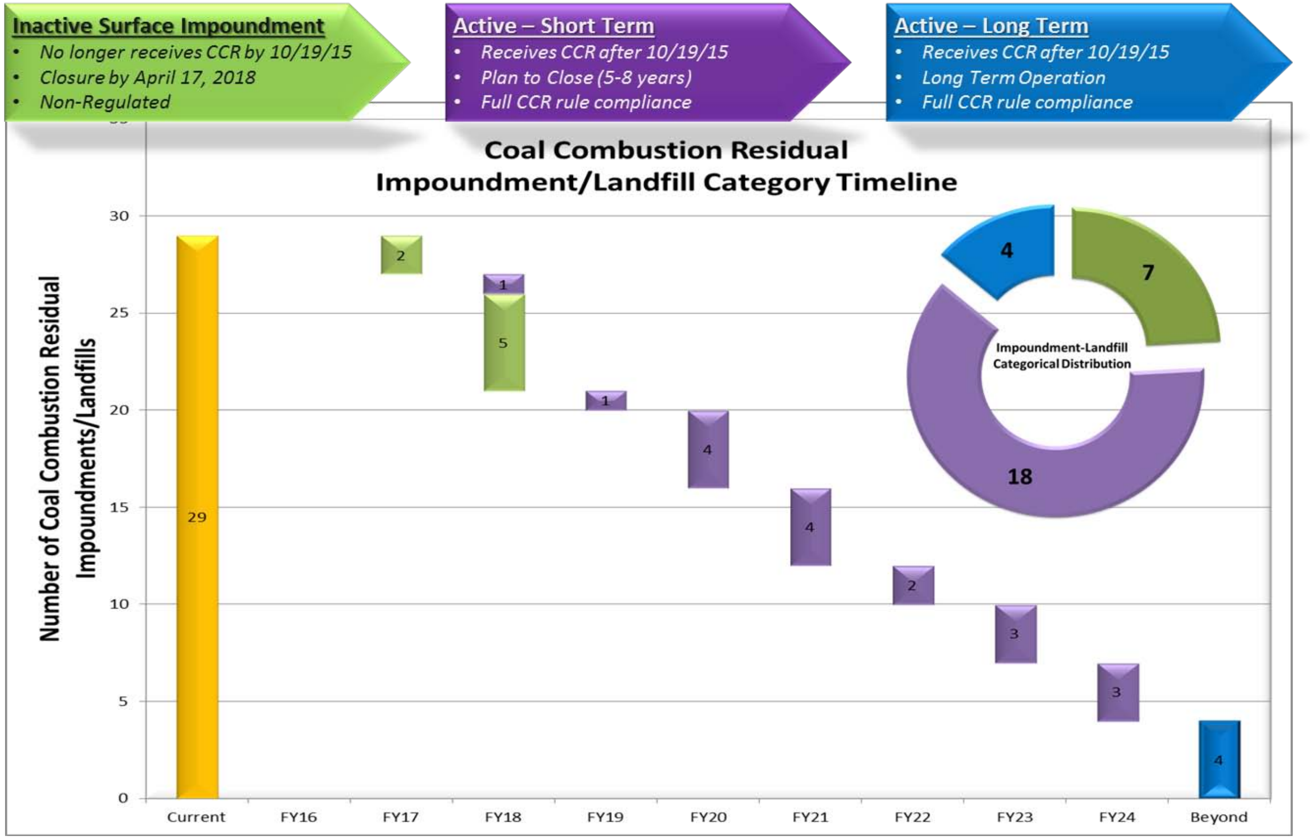
CCR Rule Overview

- TVA commits to convert to dry CCR process (2009)
- Establishes technical approach in anticipation of CCR Rule (2009-2015)
- Rule Effective: **October 19, 2015**
- Rule is "**Self-Implementing**"
  - State does not enforce
  - EPA does not enforce
  - Enforced: "Citizen" lawsuits
- **Subtitle-D Non-Hazardous**



Strategic Field Work Closure Timeline

CCR Rule Categorical Distribution



Allen Fossil Plant
CCR Rule Applicability

Inactive Surface Impoundment
- *No longer receives CCR by 10/19/15*
- *Closure by April 17, 2018*
- *Non-Regulated*

Active – Short Term
- *Receives CCR after 10/19/15*
- *Plan to Close (5-8 years)*
- *Full CCR rule compliance*

Active – Long Term
- *Receives CCR after 10/19/15*
- *Long Term Operation*
- *Full CCR rule compliance*

Bull Run Fossil Plant

CCR Rule Applicability

Inactive Surface Impoundment
- *No longer receives CCR by 10/19/15*
- *Closure by April 17, 2018*
- *Non-Regulated*

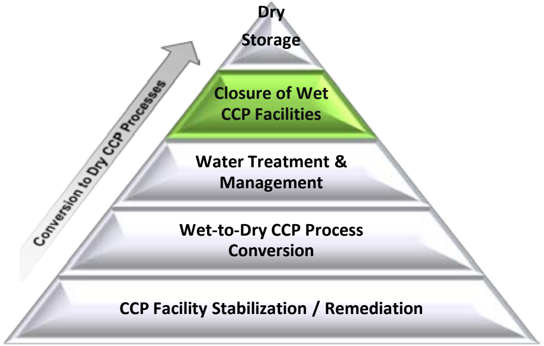
Active – Short Term
- *Receives CCR after 10/19/15*
- *Plan to Close (5-8 years)*
- *Full CCR rule compliance*

Active – Long Term
- *Receives CCR after 10/19/15*
- *Long Term Operation*
- *Full CCR rule compliance*

CCR Rule: Implementation Timeline

✔ 6 Months	Internet, Recordkeeping, Inspections, Air Criteria, Legacy Sites
✔ 8 Months	Impoundment Markers & Notice of Closure Intent
✔ 9 Months	Annual Inspections
18 Mon ths	Structural Integrity, H&H Analysis, & Closure Packages
24 Mon ths	Emergency Action Plans
30 Mon ths	Ground Water Monitoring & Corrective Action
42 Mon ths	Location Restrictions

CCR Closed Sites
Widows Creek Gypsum Stack



Questions?

Relative Impact Framework

Closure in Place vs Excavate & Redispose

Bruce Hensel
Senior Technical Leader

TVA Regional Energy Resource Council Meeting
January 20, 2016

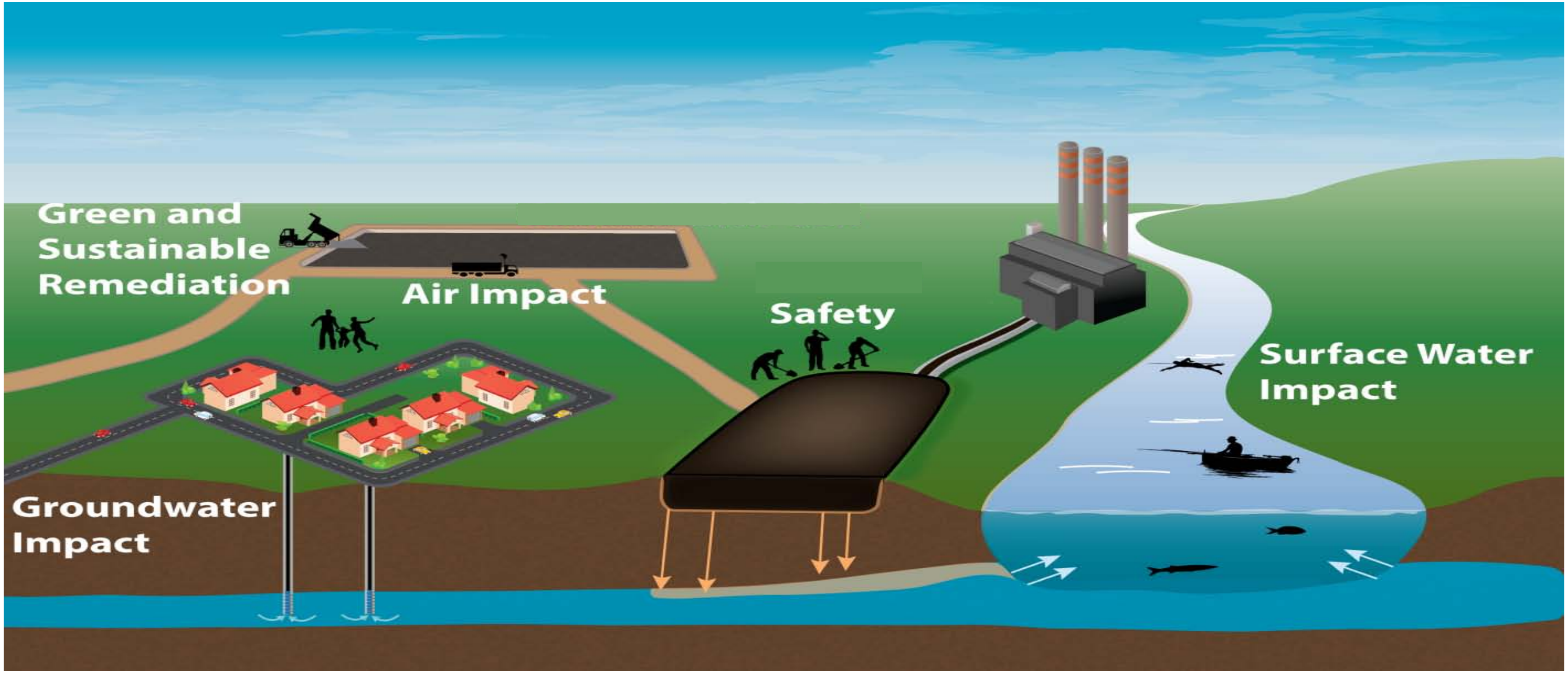
Agenda

Background

Relative Impact Framework Overview / Examples

Observations

Relative Impact of Closure Alternatives Based on Multiple Exposure Pathways



ELECTRIC POWER RESEARCH INSTITUTE

Approach

Scenarios
- Baseline
- Closure in Place
- Excavate & Redispose

Pathways
- Air
- Safety
- GW, SW, Etc.

Outcome Metrics
- Concentrations
- Accidents
- Material consumption

Model Approach
- Simple/analytical
- Advanced/numerical

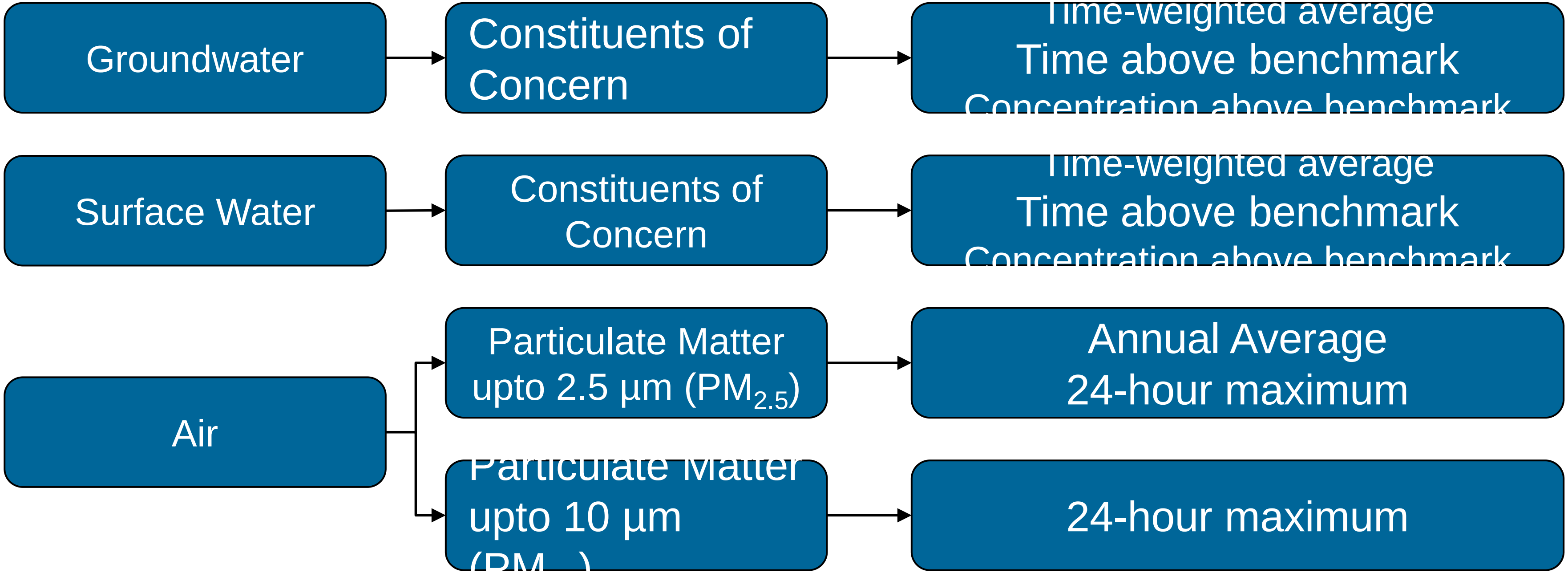
Data Assembly

Relative Impacts

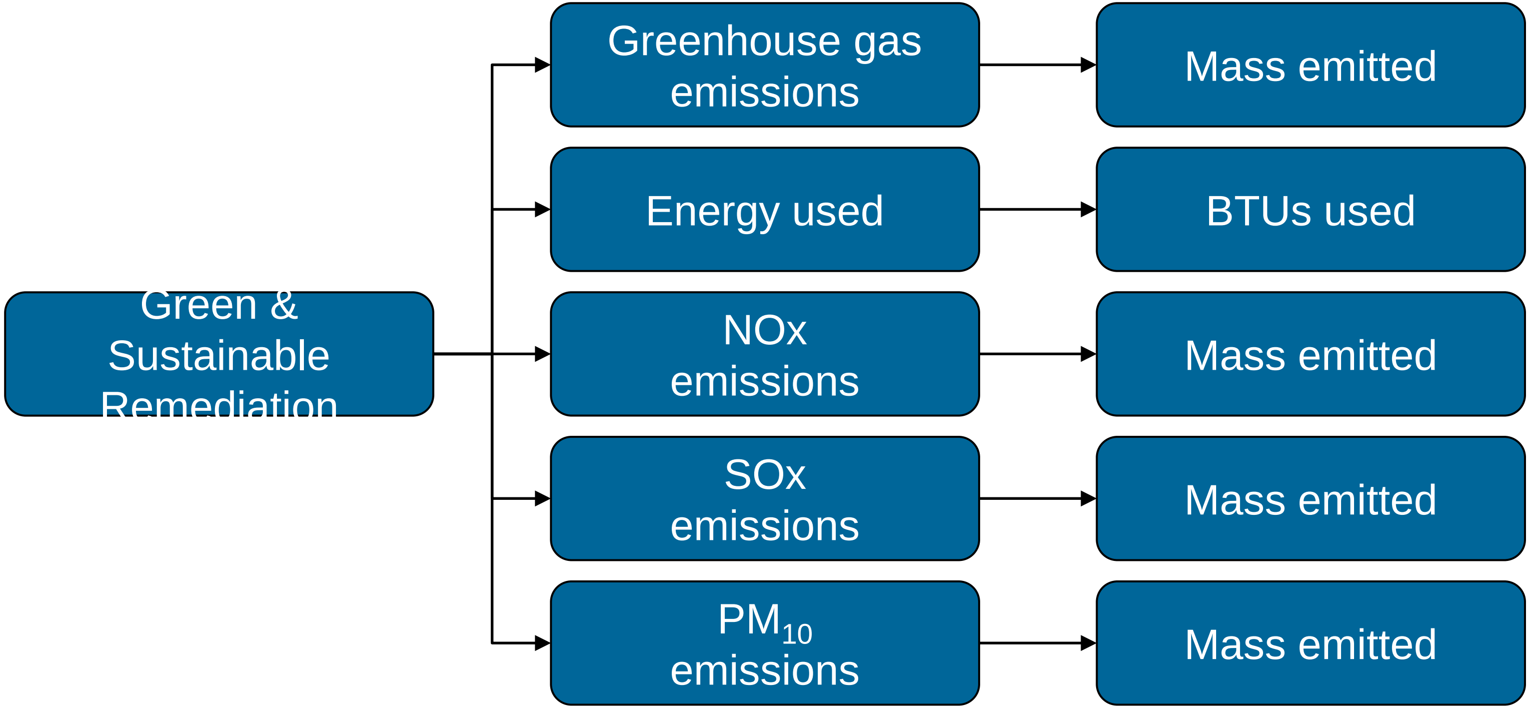
Integrate Results

Sensitivity Analysis

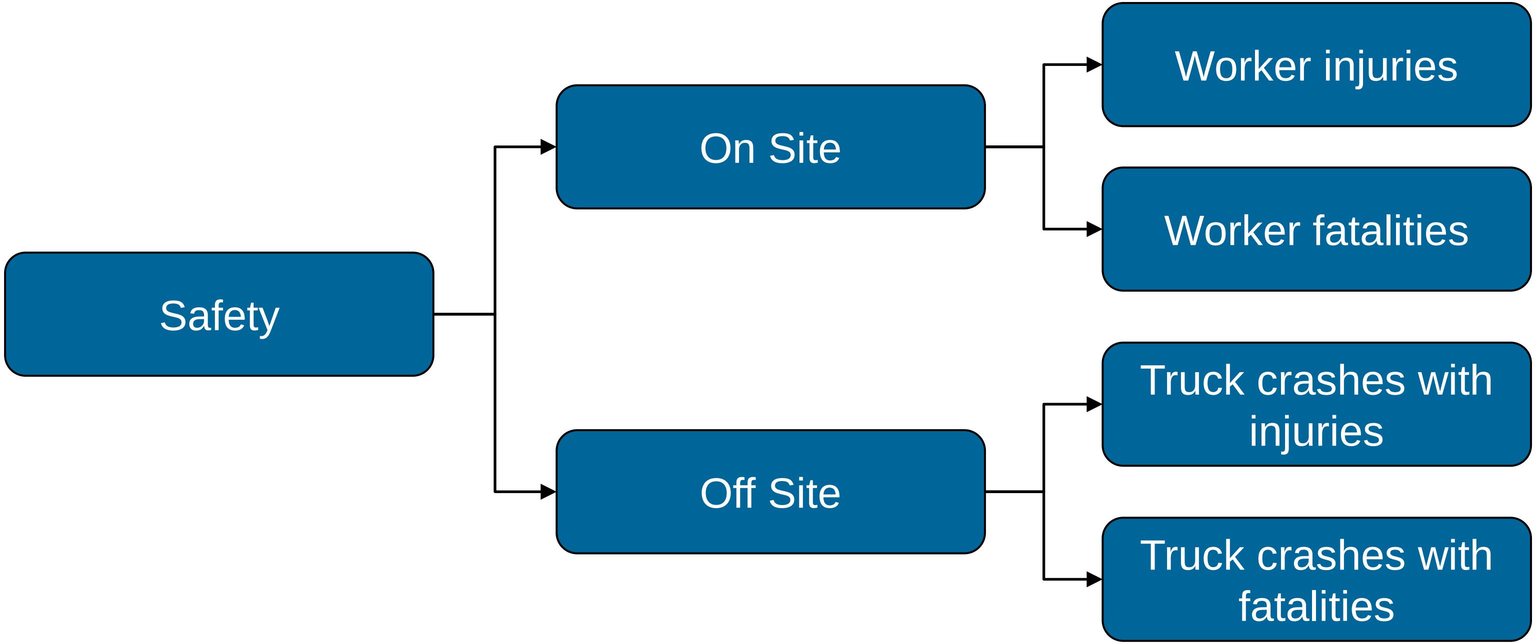
Pathways, Parameters, & Metrics



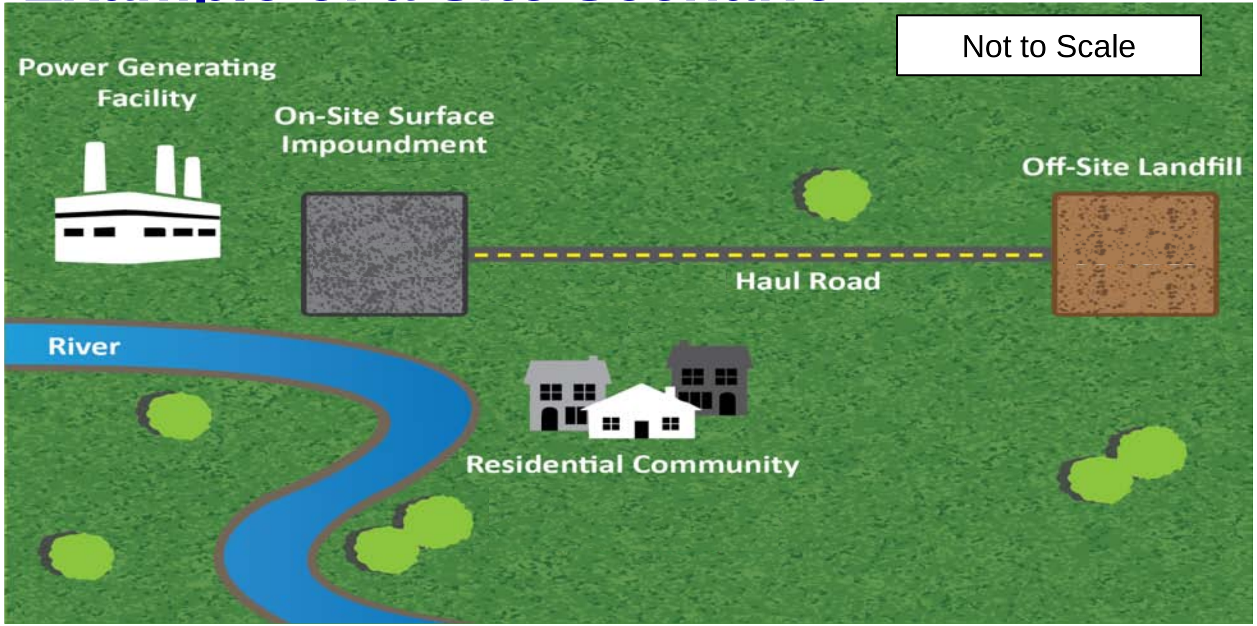
Pathways, Parameters, & Metrics (Continued)



Pathways & Metrics (Continued)

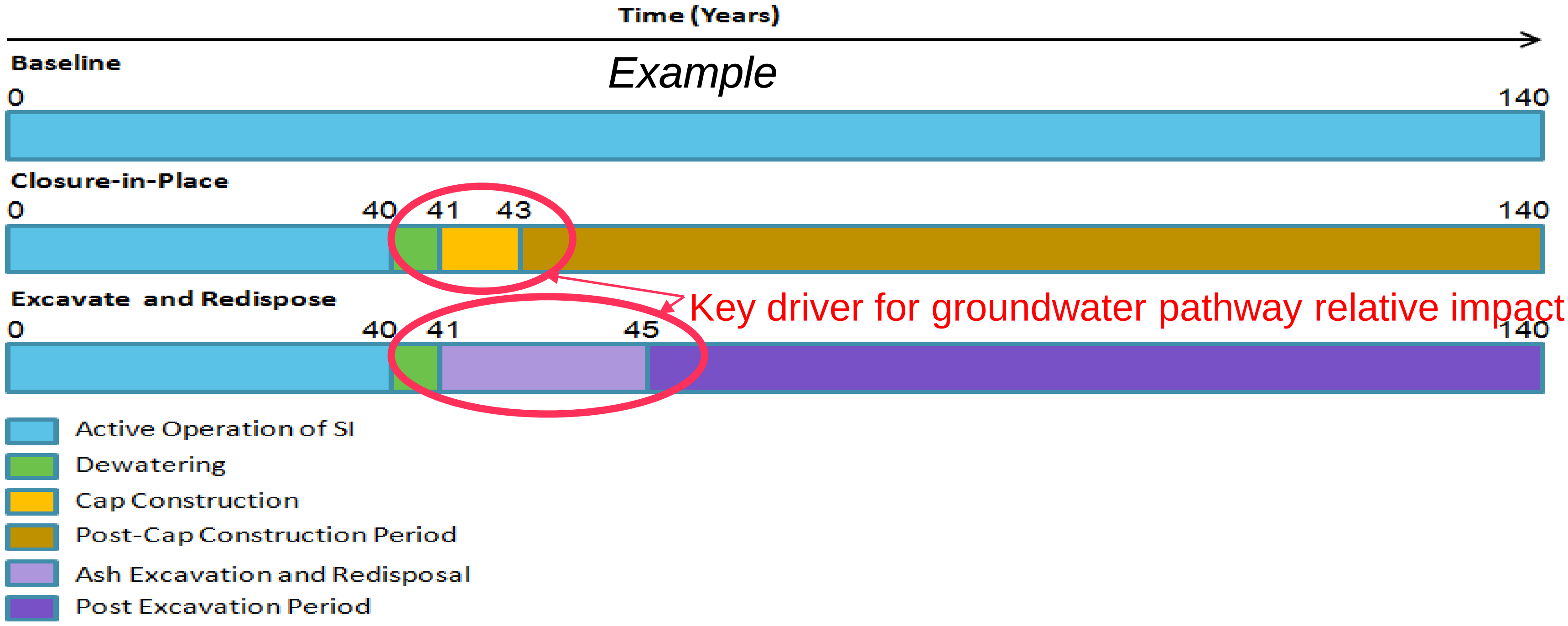


Example of a Site Scenario

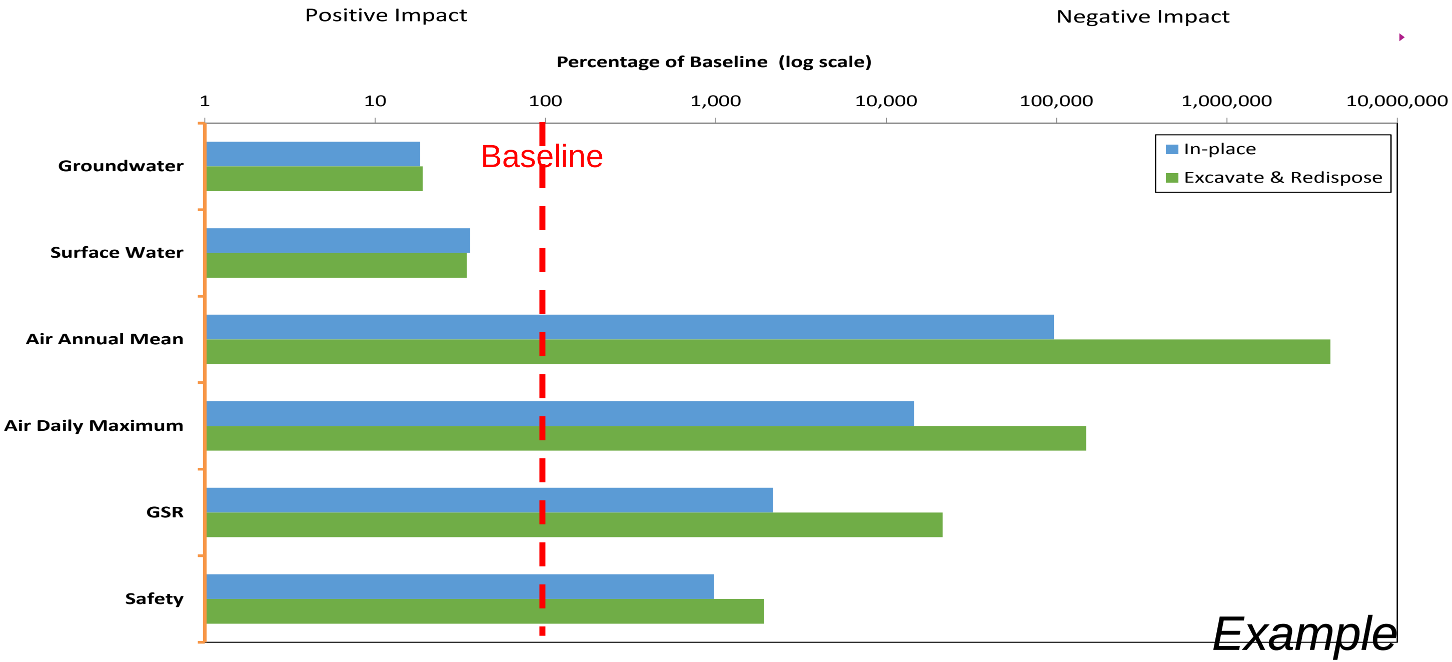


- Other Key Site Data
  - Surface impoundment area, volume
  - Length of time surface impoundment is in service
  - Aquifer dimensions, groundwater flow rate
  - River depth, discharge
  - Construction equipment, number of workers, distances for material transport

Time Frames Need to be Calculated



Example of Integrated Results

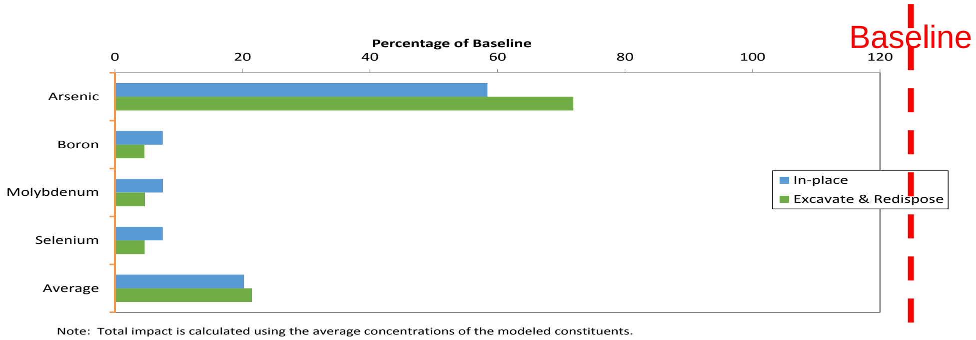


- Baseline = Current Conditions
- Positive Impact means calculated result is an improvement compared to current conditions
- Negative Impact means calculated result is a detriment compared to current conditions
- Difference between blue and green bars is the Relative Impact for that pathway

Groundwater Pathway Analysis

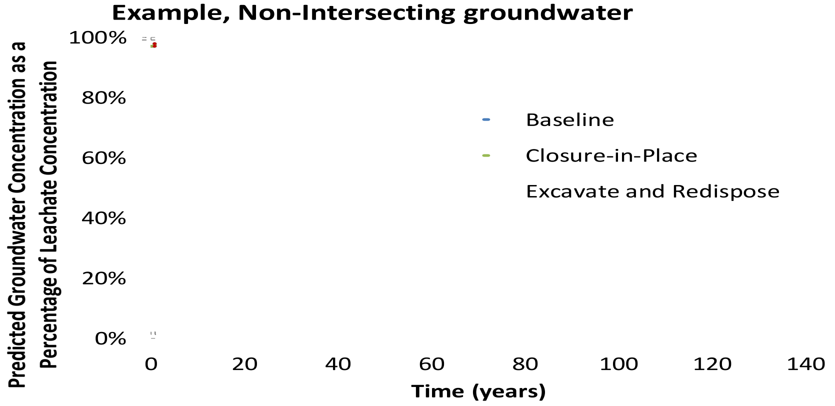
- Key parameters
  - Source concentration
  - Downward mass flux (infiltration)
  - Attenuation factor
  - Distance to receptor / monitoring
  - Time to excavate impoundment
- Analytical or numerical model

- Key alternatives
  - Constituents potentially released
  - Non-intersecting or intersecting groundwater
  - Type of cap for close-in-place
- Relative impact drivers:
  - Impoundment volume / time to excavate
  - Engineered or soil cap

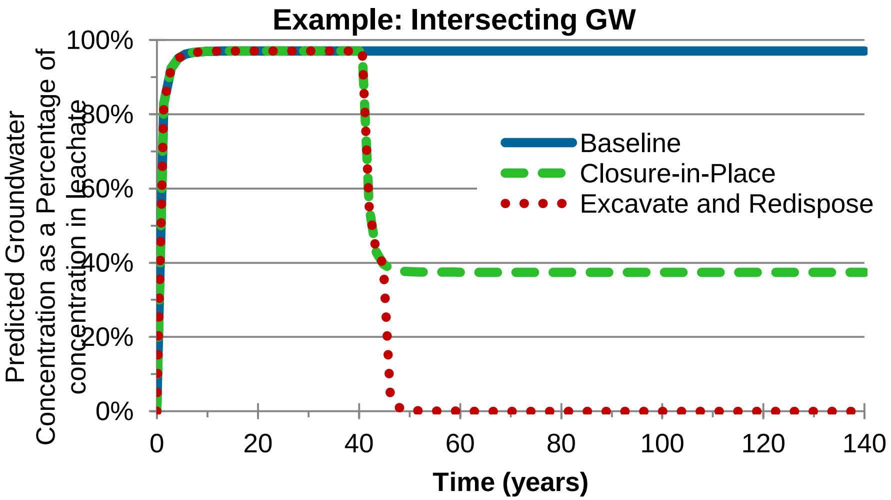


Example

Example Groundwater Model Results



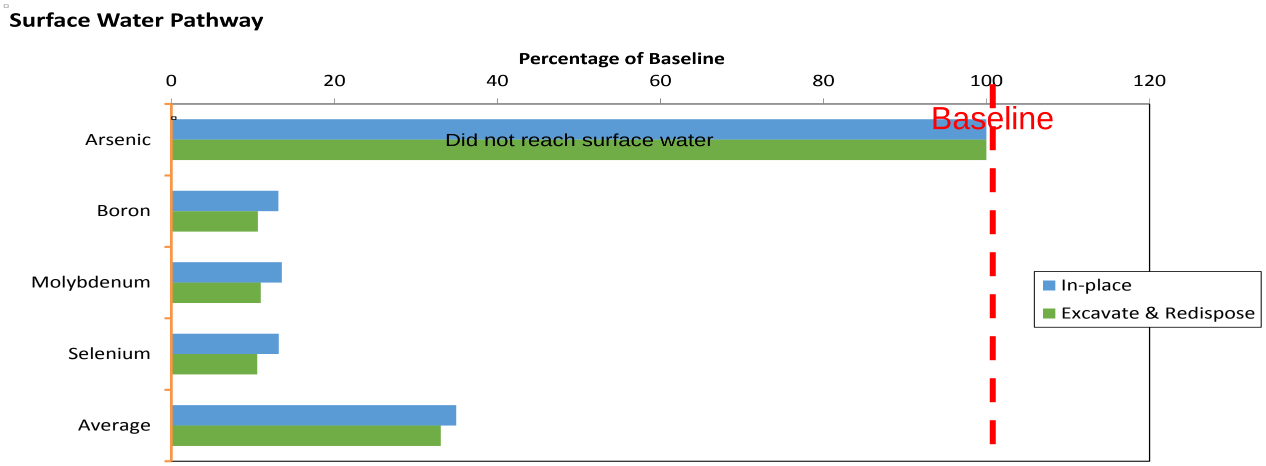
Examples



Surface Water Pathway Analysis

- Key parameters
  - Groundwater flux
  - River discharge
- Calculated using mixing equation or mass-balance approach

- Alternatives
  - Constituents
  - River or lake
- Relative impact drivers:
  - Impoundment volume / time to excavate



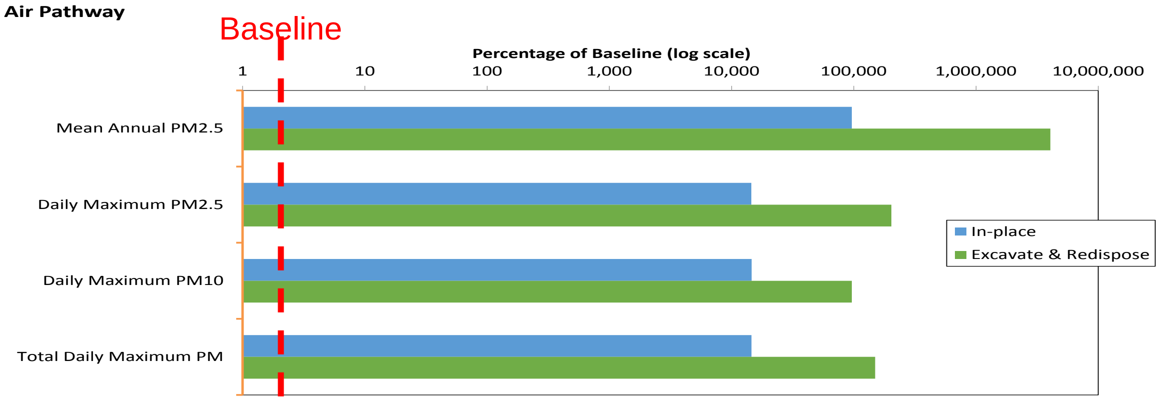
Note: Total impact is calculated using the average concentrations of the modeled constituents.

Example

Air Pathway Analysis

- Key parameters
  - Impoundment acreage / volume
  - Distance to receptor (from landfill, haul road, and impoundment)
  - Dust control measures
  - Volume / frequency of equipment traffic
- Calculated using air quality model

- Alternatives
  - Method / route of transportation
- Relative impact drivers
  - Trips per day between impoundment and landfill
  - Distance to receptor



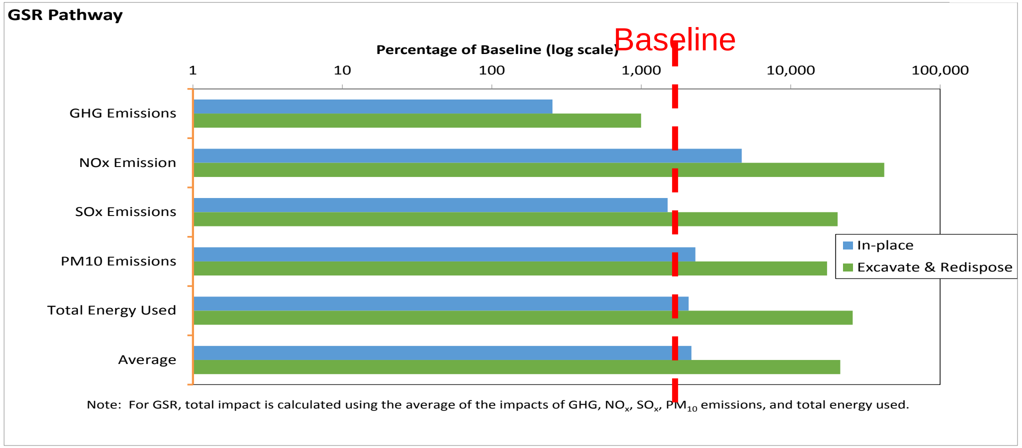
Note: For air, total impact is calculated using the average of mean annual concentrations for $PM_{2.5}$ and PM_{10}, and mean 24-hour maximum $PM_{2.5}$ and PM_{10}.

Example

Green & Sustainable Remediation Pathway Analysis

- Key parameters
  - Impoundment acreage / volume
  - Distance to landfill
  - Impoundment cap, landfill liner materials
- Moderate modeling effort using SiteWise™

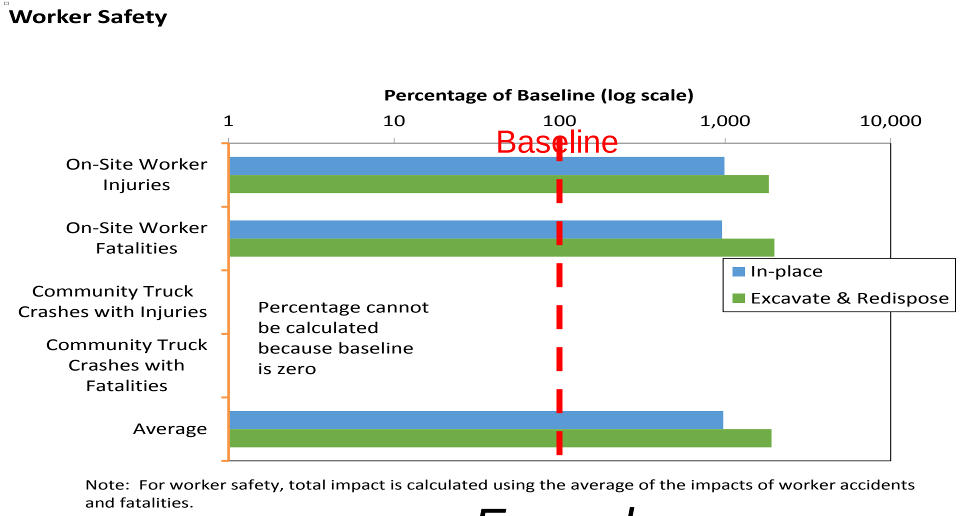
- Alternatives
  - Method / route of transportation
  - Type of cap
  - Type of landfill liner
- Relative impact drivers
  - Impoundment volume
  - Distance between impoundment and landfill
  - Distance of sourced materials to site



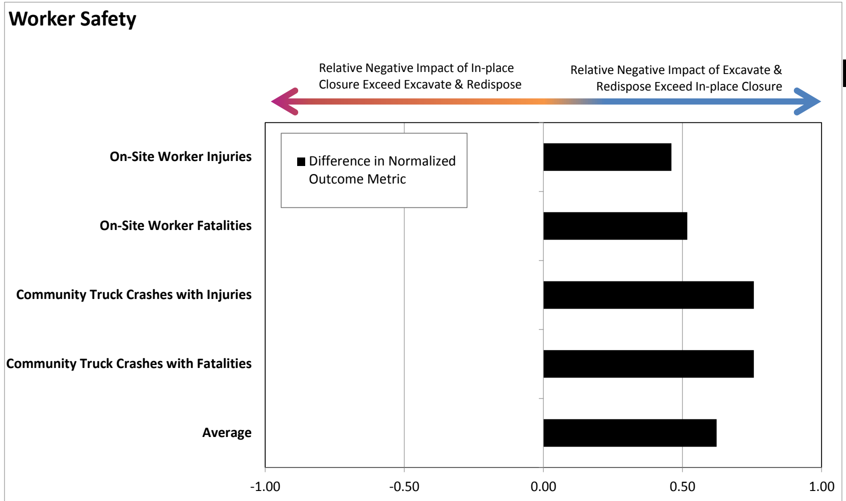
Example

Safety Pathway Analysis

- Key parameters
  - Impoundment acreage / volume
  - Distance to landfill
  - Distance of sourced material to site
- Moderate modeling effort using SiteWise™
- Alternatives
  - Method / route of transportation
- Relative impact drivers
  - Impoundment volume
  - Distance to landfill and construction material



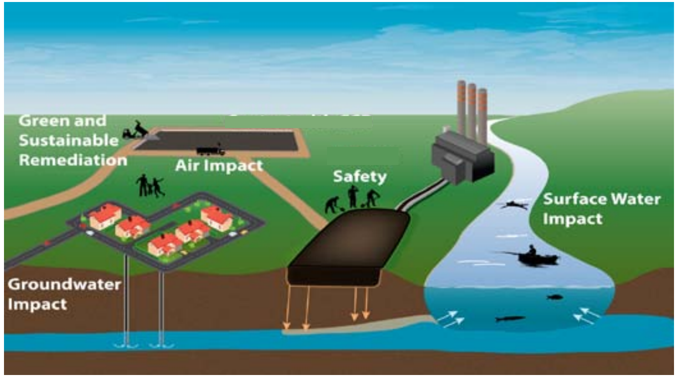
Example



Example

Framework Summary

- Evaluates relative impact of Closure In-Place versus Closure by Removal scenarios for multiple local pathways that may be affected. Pathways include:
  - Groundwater and surface water, typically assumed to be impacted
  - Air, green & sustainable remediation, and safety, typically assumed to begin with negligible impacts

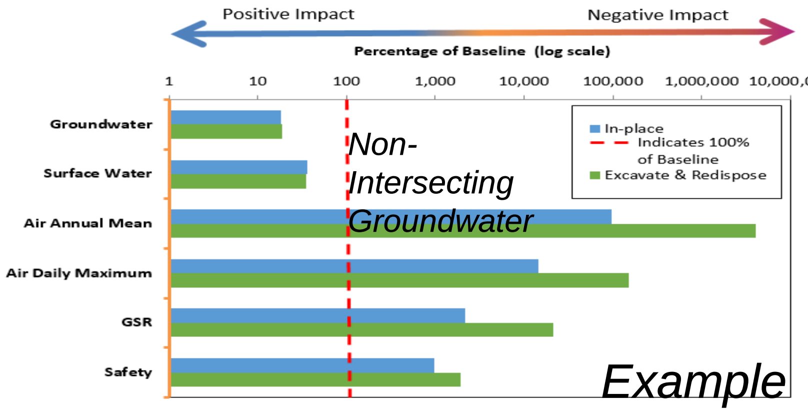


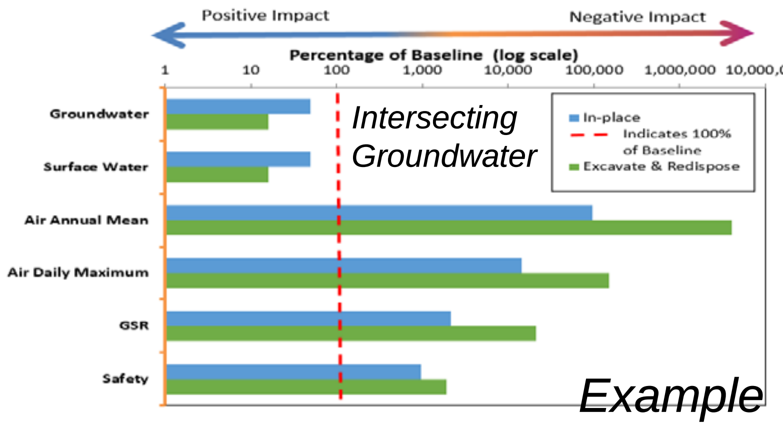
- Quantifies relative impacts for use in decision-making, but does not provide an absolute answer
  - Factors outside framework include cost and regulatory direction

EPRI | ELECTRIC POWER RESEARCH INSTITUTE

Observations from Framework Testing

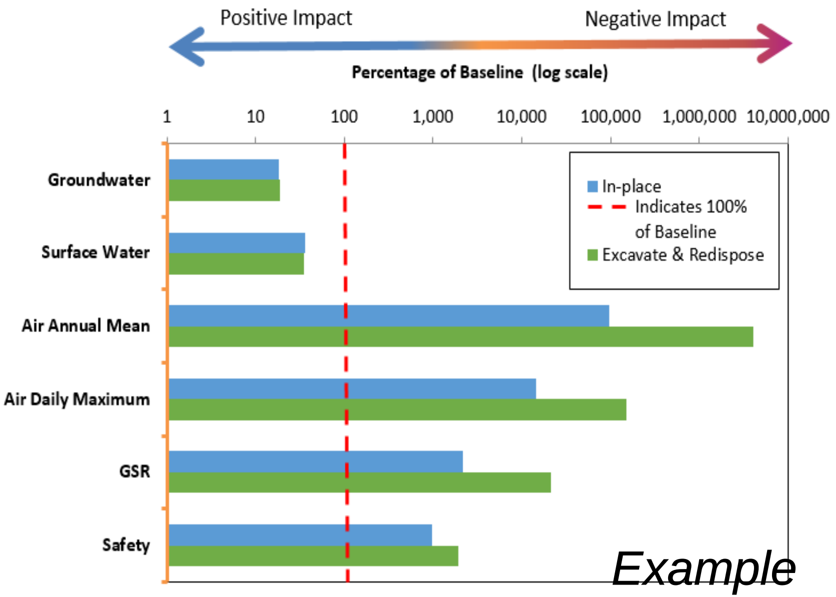
- Groundwater and surface water
  - Closure In-Place and Excavate & Redispose can both provide a benefit relative to an impacted current condition.
  - The benefit from Closure In-Place may be reduced if groundwater intersects the CCR in the impoundment after dewatering.
  - The type of cap planned for Closure In-Place, and the duration of excavation for the Excavate and Redispose scenario will also effect results for the groundwater and surface water pathways.





Observations from Framework Testing

- Air, Green & Sustainable Remediation, and Safety
  - Closure In-Place and Excavate & Redispose typically result in negative impacts to air quality and green & sustainable remediation, relative to baseline.
  - Both scenarios also increase the potential for worker and traffic-related risks including injuries and fatalities.
  - Impacts observed during testing to-date have been greater for Excavate & Redispose than for Closure In-Place because E&R:
    - Requires more material handling
    - Results in more truck traffic, and more miles traveled
    - Takes longer time to complete



Questions?

Together…Shaping the Future of Electricity

ELECTRIC POWER RESEARCH INSTITUTE

Coal Combustion Residual Impoundment Closure Draft EIS

Amy Henry

NEPA Program and Valley Projects Manager

CCR Impoundment Closure
Environmental Impact Statement (EIS)

Part I: Programmatic review of closure methods

- Closure-by-Removal
- Closure-in-Place
- No Action

Part II: Site-Specific reviews

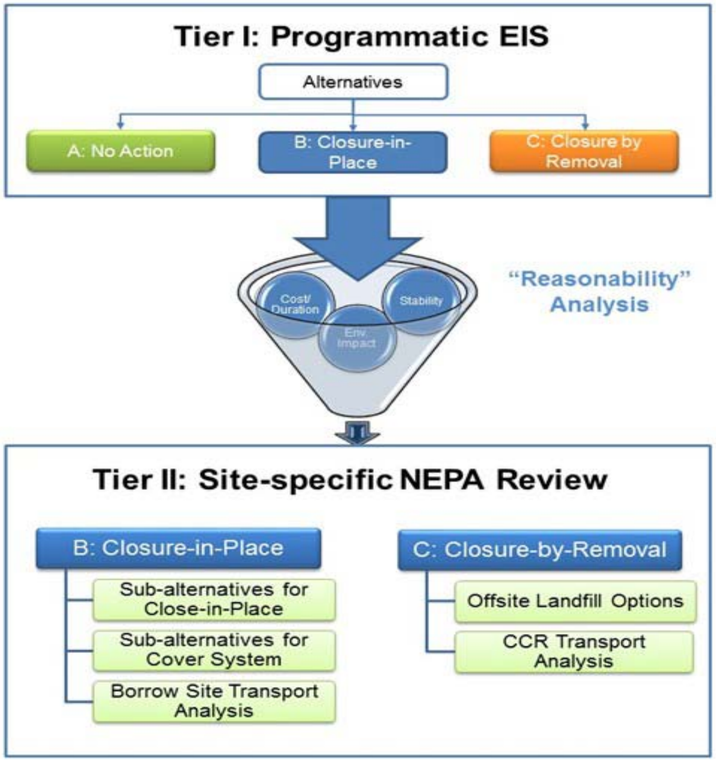
At 6 plants, TVA proposes to close 10 ponds by 2018

Allen	Bull Run	Colbert
John Sevier	Kingston	Widows Creek

Evaluation Criteria

- Volume of CCR materials
- Mode and duration of transport (borrow/fill) activities
- Schedule of closure
- Stability (static, seismic)
- Risk to human health & safety (workers, motorists)
- Effects to wetlands and adjacent environmental resources
- Environmental Justice
- Cost

Screening for Site-Specific Closure Alternatives



Draft EIS: Preliminary Results

- EPRI model an analytical tool
- Both closure methods protective of environment if done properly
- Depending on CCR volume, close-by-removal results in greater adverse impacts to some resources
- No significant impacts identified in site-specific reviews

Questions?

Coal Combustion Residual Impoundment Closure Draft EIS

Amy Henry

NEPA Program and Valley Projects Manager

Coal Combustion Residual (CCR) Impoundment Closure

TVA CCR impoundments in Kentucky, Tennessee, and Alabama.

2009 - TVA began to convert wet ash impoundments to dry storage.

2015 - EPA CCR Rule established national criteria and schedules for the manage-ment and closure of CCR facilities.

Consistent with the CCR Rule, TVA is proposing to close some impoundments rapidly, before April 2018.

TVA must decide how to close its wet CCR impoundments

Bottom ash impoundment
Bull Run Fossil Plant

West Ash Impoundment
Allen Fossil Plant

National Environmental Policy Act (NEPA)

Federal law that requires federal agencies to evaluate the potential environmental impacts of proposed actions, plans, and policies

Planning Process

- Alternatives
- Public Input

Analyze Potential Environmental Effects

Decision-making Tool

- NEPA does not require selection of the alternative with the most favorable environmental impacts
- The environmental review is one factor considered by TVA decision makers

CCR Impoundment Closure
Environmental Impact Statement (EIS)

Purpose and Need

- Address the potential impacts of closing CCR impoundments across the TVA system
- Assist TVA in complying with EPA's CCR Rule

Part I: Programmatic review of three alternatives

Part II: Site-specific review of 10 proposed pond closures

Evaluation Criteria

- Volume of CCR materials
- Mode and duration of transport (borrow/fill) activities
- Schedule of closure
- Stability (static, seismic)
- Risk to human health & safety (workers, motorists)
- Effects to wetlands and adjacent environmental resources
- Environmental Justice
- Cost

Draft EIS: Preliminary Results

- Both closure methods protective of environment if done properly
- Depending on CCR volume, close-by-removal results in greater adverse impacts to some resources

Resource	Close-in-Place	Close-by-Removal
Groundwater	↑	↑–↑↑
Transportation	↓	↓–↓↓↓
Public Health & Safety	↓	↓↓–↓↓↓
Cost	\$3.5M - \$150 M	\$15M - \$2.7B

Public Review of Draft EIS

Comment period Dec 30 – February 24

How to comment:

- TVA's website https://www.tva.com/nepa under "Open for Comment"
- Attend a public open house session:
  - 10 open house meetings in communities near TVA coal plants
  - January 12-February 10
- Email CCR@tva.gov
- US Mail

  Ashley Farless, PE, AICP
  NEPA Project Manager
  Tennessee Valley Authority
  1101 Market Street, BR 4A
  Chattanooga, Tennessee 37402

EIS Next Steps

- Collect public comments December 30, 2015 – February 24, 2016
- Evaluate and respond to comments in the Final EIS
- Issue Final EIS Spring 2016
- Issue TVA Record of Decision Summer 2016

Questions?

Wrap Up and Adjourn

Thank you and please travel safely!

Regional Energy Resource Council

January 20-21, 2016

Memphis, Tennessee

Term 2 RERC Members

Lance Brown
Partnership for Affordable Clean Energy

Anne Davis
Southern Environmental Law Center

Wayne Davis
University of Tennessee

John Evans
State of North Carolina

Catherine Glover
Chamber of Commerce and Industry

Rodney Goodman
Habitat for Humanity

Wes Kelley
Columbia (TN) Power & Water Systems

Pedro Mago
Mississippi State University

Peter J. Mattheis
Tennessee Valley Industrial Committee

Robert Martineau, Jr.
State of Tennessee

Alice Perry
State of Mississippi

Goodrich "Dus" Rogers*
Jackson County (AL) Economic Development Authority

Joe Satterfield
Blue Ridge Electric Members Cooperative (ret'd)

Jack Simmons
Tennessee Valley Public Power Association

Stephen Smith
Southern Alliance for Clean Energy

John Warren
Commonwealth of Virginia

Lloyd Webb
Olin Chlor Alkali

Susan R. Williams
SRW & Associates

* RERC Chair

Today’s Meeting

Meeting Purpose

- **Welcome New Term and FACA/RERC Orientation**
- **TVA Update and Policy Update**
- **Information and Advice on Coal Combustion Residuals Impoundment Closure Alternatives**
- **Public Input Listening Session**
- **Field Trip: Tour Allen Fossil Plant/impoundments**

Agenda – January 20, 2016

10:00	**Welcome and Introductions**	Dus Rogers, Chairman Joe Hoagland/ DFO Council Members
	Safety Moment	Jo Anne Lavender, Facilitator
10:15	**Meeting Purpose**	Hoagland
10:20	**Overview of Agenda**	Lavender
10:25	**FACA / RERC Orientation**	Kelly Love, OGC
10:30	**RERC and TVA Update**	Hoagland
10:45	*Break*	
11:00	**Policy Update**	Brenda Brickhouse
11:45	*Lunch*	
1:00	**Introduction of Advice Topic**	Lavender

Agenda – January 20, 2016 (cont'd)

1:10	**Orientation – Coal Combustion Residuals (CCR)**	Scott Turnbow
1:45	**Modeling Impoundment Closure Options: Electric Power Research Institute (EPRI)**	Bruce Hensel
2:30	*Break*	
2:45	**Overview: CCR Impoundment Closure Draft EIS**	Amy Henry
3:05	**Preliminary Discussion**	Council, Lavender
3:30 – 4:30	**Public Listening Session**	Lavender facilitate
4:30	**Wrap Up, Overview of Evening and Day 2**	Rogers/ Hoagland/ Lavender
5:30	**Reception and Dinner** *Special Recognition of Clifford Stockton*	

Agenda – January 21, 2016

7:30	*Breakfast*	
8:30	**Allen Fossil Plant Field Trip**	Council
11:30	*Lunch*	
12:30	**Welcome, Review of Day 1**	Hoagland/ Lavender
12:45	**CCR Impoundment Closure Draft EIS**	Henry
1:15	**CCR Discussion and Advice to TVA**	Council / Lavender facilitate
2:15	*Break*	
2:30	**CCR Discussion and Advice to TVA (cont.)**	Council / Lavender facilitate
3:30	**Summary, RERC Next Steps**	Lavender/ Rogers / Hoagland
3:45	**Adjourn**	

Introduce Advice Topic

Jo Anne Lavender

RERC Advice Topic

Coal Combustion Residuals (CCR) Impoundment Closure Alternatives

- CCR Overview
- EPRI: Modeling CCR Impoundment Closure Options
- CCR Impoundment Closure Draft EIS
- Allen Fossil Plant Tour

RERC Advice Questions

1. What do you think about TVA seeking public comment on these closure alternatives including holding meetings in communities near coal-fired plants?

2. TVA has evaluated multiple criteria (listed below) in the Draft EIS. Is there anything important that we missed?

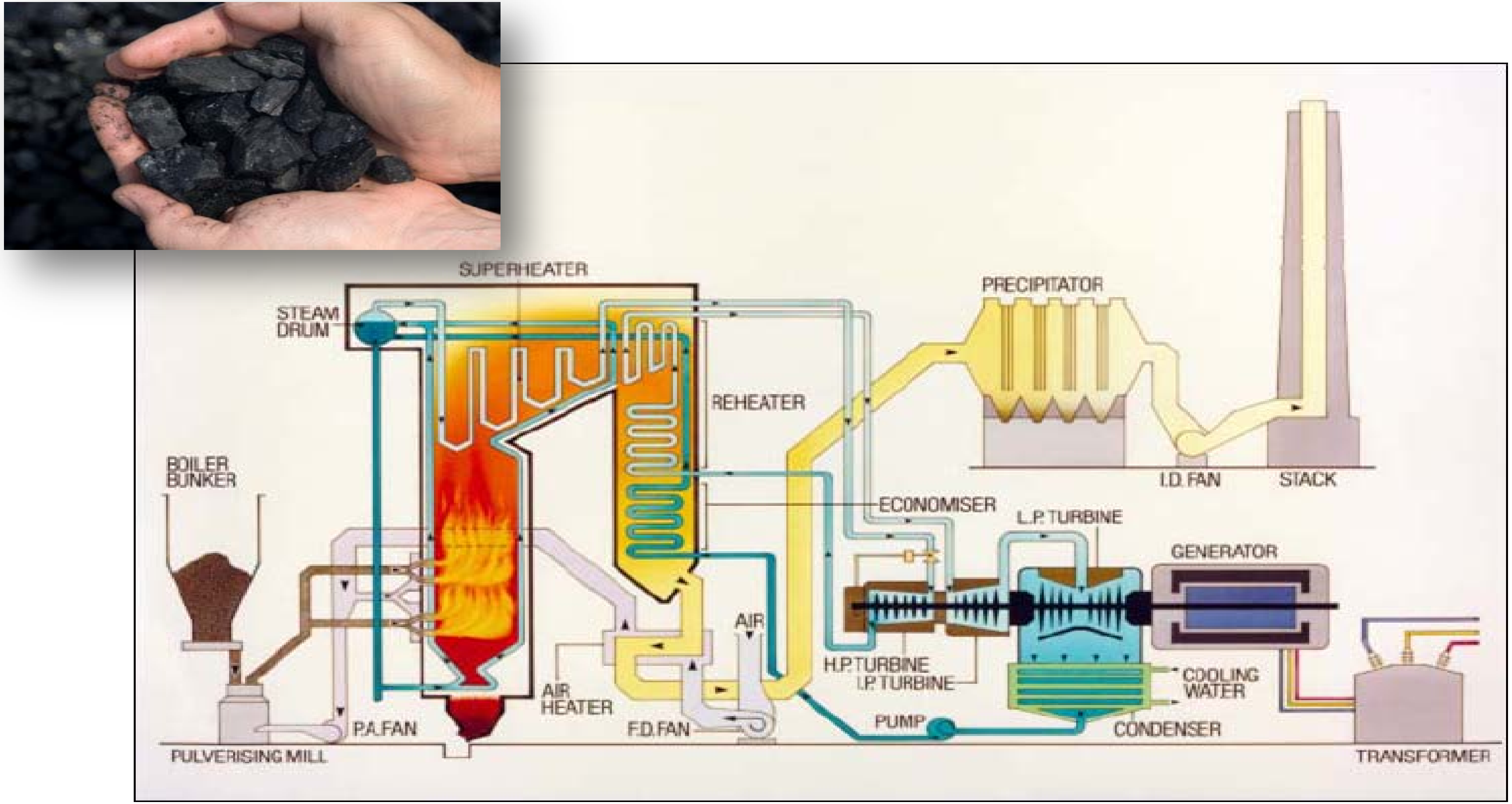
- Volume of CCR materials
- Mode and duration of transport (borrow/fill) activities
- Schedule of closure (milestones of CCR Rule)
- Impoundment Stability (static, seismic)
- Risk to human health & safety (workers, motorists)
- Effects to adjacent environmental resources (wetlands, groundwater, surface water, air, biota, historic resources)
- Environmental Justice
- Cost

3. From your perspective, what are the pros and cons for the closure in place alternative, and for the closure by removal alternative?

Overview
Coal Combustion Residuals

Scott Turnbow, General Manager
Strategy and Engineering
Civil Projects & CCP Management

CCR Overview



CCR Overview

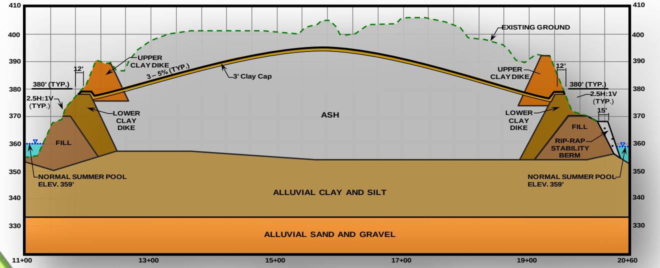
Wet Process

Dry Process

CCR Overview

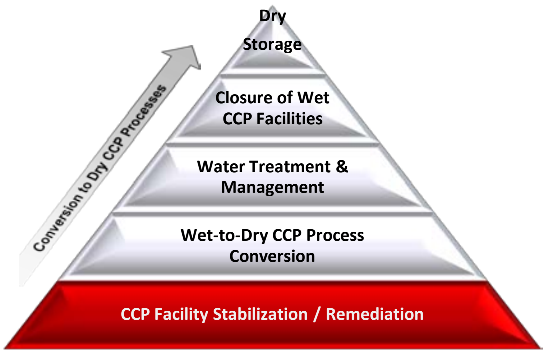
Conversion to Dry CCP Processes

- Dry Storage
- Closure of Wet CCP Facilities
- Water Treatment & Management
- Wet-to-Dry CCP Process Conversion
- CCP Facility Stabilization / Remediation



Typical Dike Section

Initial Programmatic Approach



Construction of Improvements at Bull Run

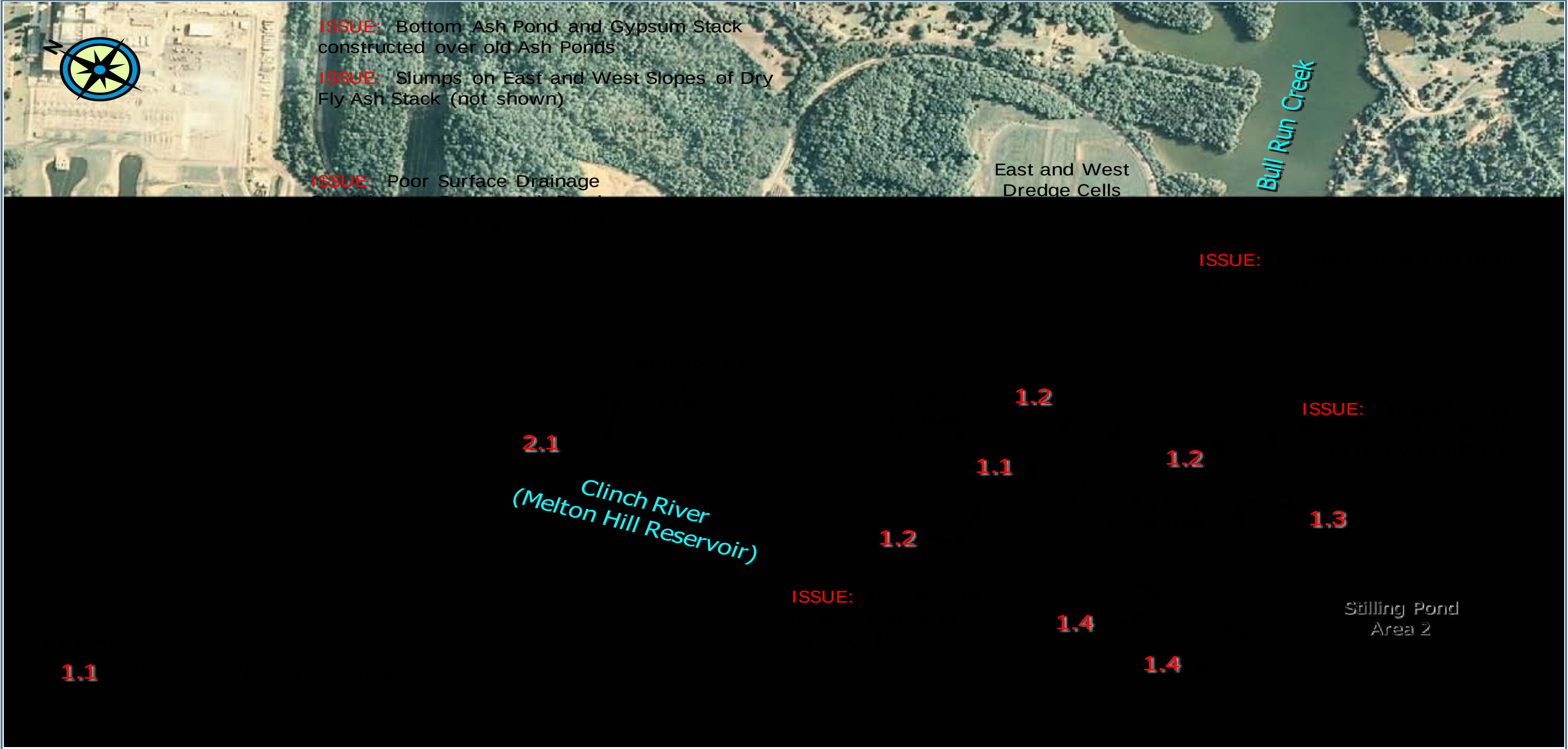
Phase 1 – Facility Review
- Records Review/Staff Interviews
- Site Condition Review
- Recommendations for Future Analysis, Studies, and Program Improvements
- Final Report Issued June 24, 2009

Phase 2 – Engineering Assessments
- Geotechnical Explorations
- Hydrologic and Hydraulic Analysis
- Dam Safety Hazard Classifications
- Piping/Spillway Inventories

Phase 3 – Remediation Design and Construction
- Structural Deficiencies
- Improve Freeboard (Storage)
- Risk Reduction (Spillways, Hazards Classification)

Phase 4 – Programmatic Improvements
- Dam Safety Inspection Training
- Programmatic Documents

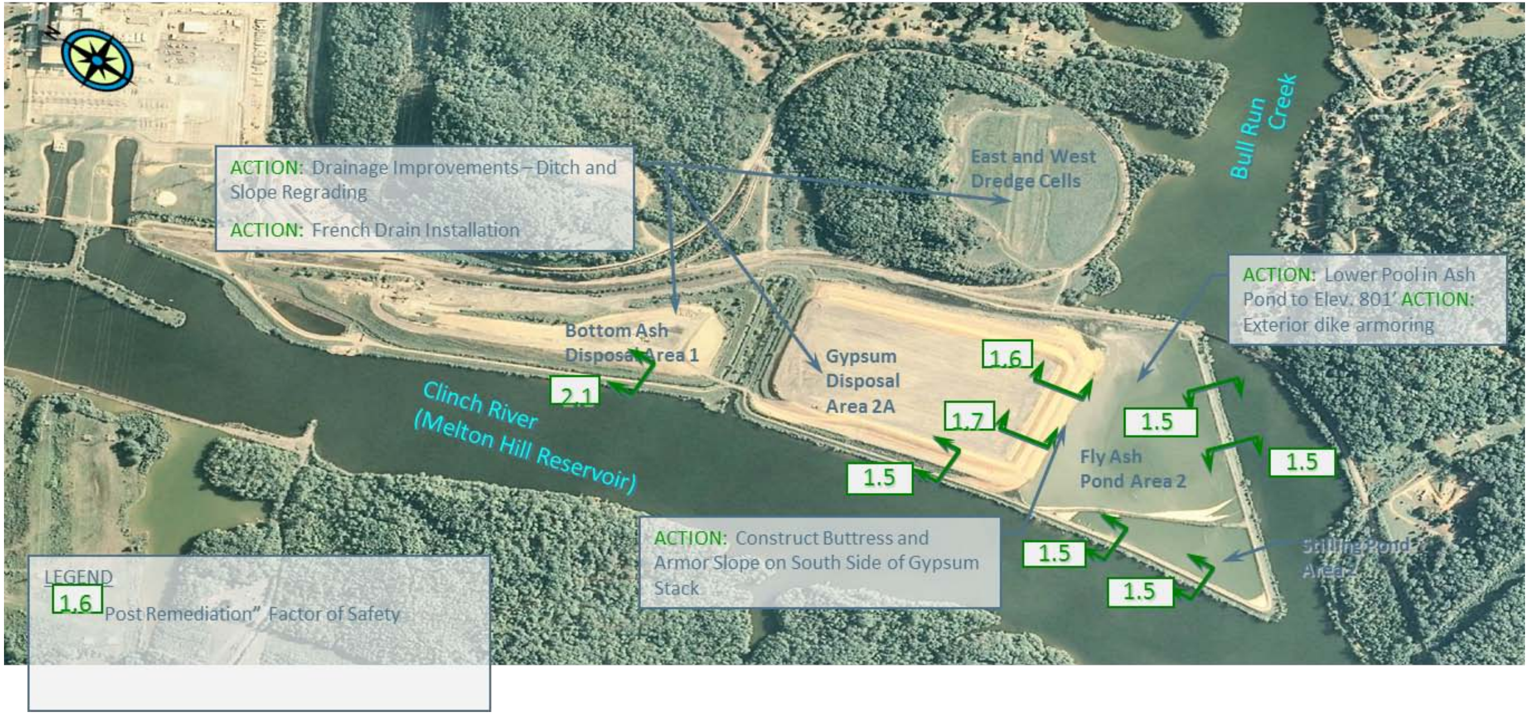
Bull Run: Phase 2 Assessment



As Found Stability Conditions

Bull Run: Gypsum Stack Toe (before)

Bull Run: Phase 3 Remediation



Bull Run: Gypsum Stack Toe (after)

Instrumentation Monitoring

Advanced Technology Impoundment Monitoring

- Monitors in real time, the health and stability of all TVA CCP facilities.
- The ATIM center provides multiple screens and computers for simultaneous analysis and risk management of CCP facilities.
- The ATIM center provides a location for emergency preparedness and monitoring off CCP facilities.

Instrumentation Monitoring

Advanced Technology Impoundment Monitoring

Instrumentation Monitoring

Advanced Technology Impoundment Monitoring

Instrumentation Automation

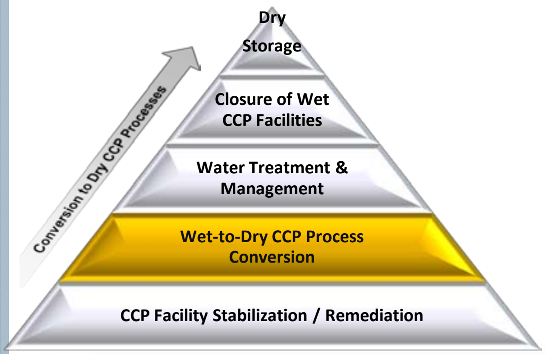
- 307 piezometers
- 82 slope inclinometers
- 10 weather stations
- 8 River Level Gauges
- 13 Pond Level Gauges

Manual Instrumentation – Quality Control

- 707 Piezometers
- Variable Monitoring for QC of Automated Instrumentation.

Notification Alerts – Automated Email

CCR Dewatering Facilities



DFA Conversion

- Completed KIF & BRF
- PAF U3 in Planning

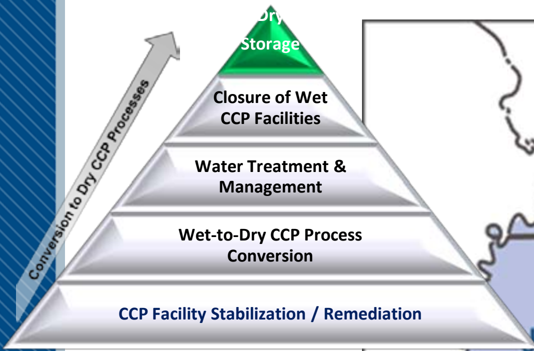
Gypsum Dewater

- Completed KIF & BRF
- PAF U3 in Planning

Bottom Ash Dewatering

- Completed Bull Run
- In Design/Planning:
  - Kingston
  - Gallatin
  - Shawnee
  - Cumberland
  - Paradise

CCR Landfills - New



CCR Landfills – New

Gallatin Construction

Haul Road paving

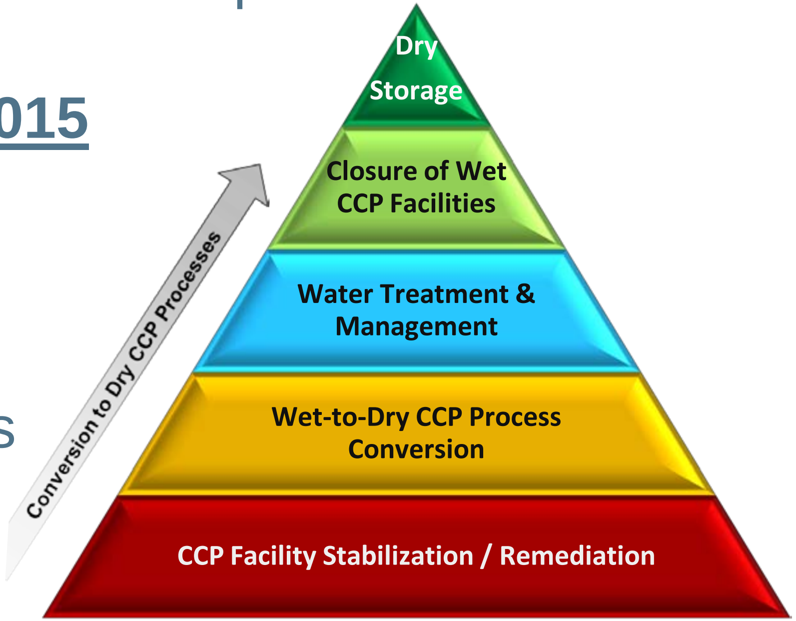
50% of Liner installed

Installation of Geocomposite

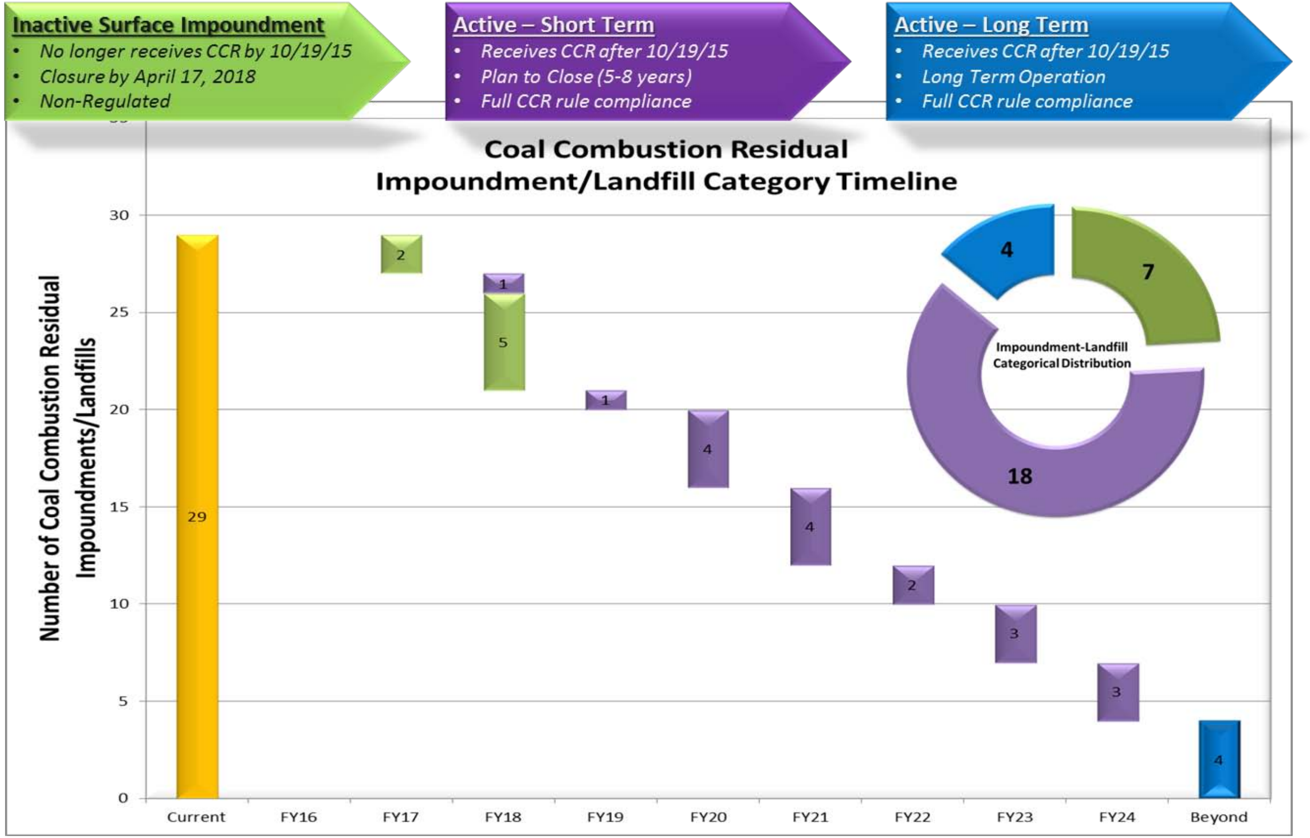
Placing Protective Cover

CCR Rule Overview

- TVA commits to convert to dry CCR process (2009)
- Establishes technical approach in anticipation of CCR Rule (2009-2015)
- Rule Effective: **October 19, 2015**
- Rule is "**Self-Implementing**"
  - State does not enforce
  - EPA does not enforce
  - Enforced: "Citizen" lawsuits
- **Subtitle-D Non-Hazardous**



Strategic Field Work Closure Timeline
CCR Rule Categorical Distribution



Allen Fossil Plant
CCR Rule Applicability

Inactive Surface Impoundment
- *No longer receives CCR by 10/19/15*
- *Closure by April 17, 2018*
- *Non-Regulated*

Active – Short Term
- *Receives CCR after 10/19/15*
- *Plan to Close (5-8 years)*
- *Full CCR rule compliance*

Active – Long Term
- *Receives CCR after 10/19/15*
- *Long Term Operation*
- *Full CCR rule compliance*

Bull Run Fossil Plant

CCR Rule Applicability

Inactive Surface Impoundment
- *No longer receives CCR by 10/19/15*
- *Closure by April 17, 2018*
- *Non-Regulated*

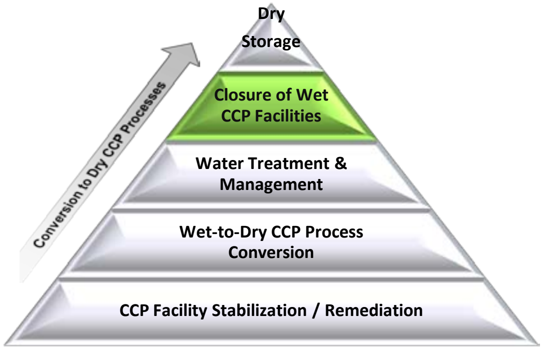
Active – Short Term
- *Receives CCR after 10/19/15*
- *Plan to Close (5-8 years)*
- *Full CCR rule compliance*

Active – Long Term
- *Receives CCR after 10/19/15*
- *Long Term Operation*
- *Full CCR rule compliance*

CCR Rule: Implementation Timeline

6 Months	Internet, Recordkeeping, Inspections, Air Criteria, Legacy Sites
8 Months	Impoundment Markers & Notice of Closure Intent
9 Months	Annual Inspections
18 Months	Structural Integrity, H&H Analysis, & Closure Packages
24 Months	Emergency Action Plans
30 Months	Ground Water Monitoring & Corrective Action
42 Months	Location Restrictions

CCR Closed Sites
Widows Creek Gypsum Stack



Questions?

Relative Impact Framework

Closure in Place vs Excavate & Redispose

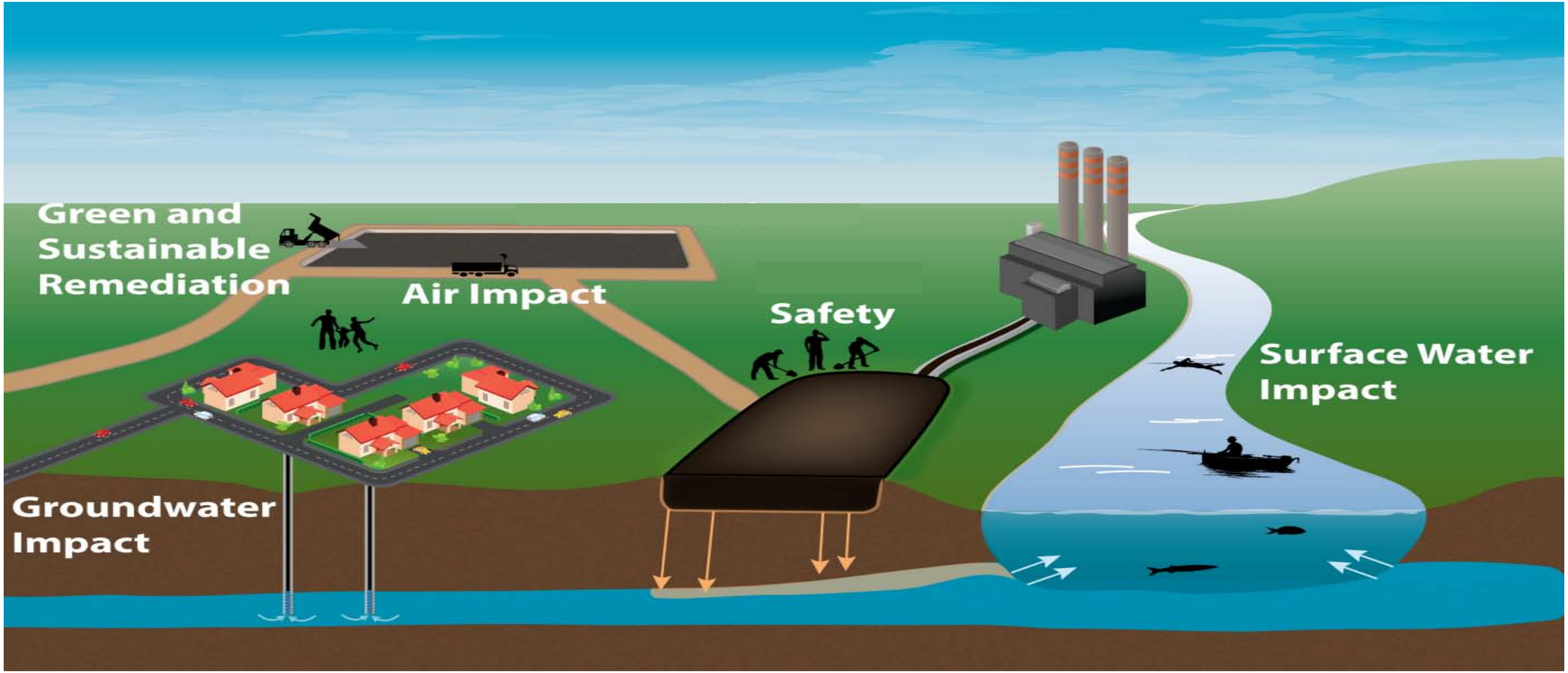
Bruce Hensel
Senior Technical Leader

TVA Regional Energy Resource Council Meeting
January 20, 2016

Agenda

- Background
- Relative Impact Framework Overview / Examples
- Observations

Relative Impact of Closure Alternatives Based on Multiple Exposure Pathways



Approach

Scenarios

- Baseline
- Closure in Place
- Excavate & Redispose

Pathways

- Air
- Safety
- GW, SW, Etc.

Outcome Metrics

- Concentrations
- Accidents
- Material consumption

Model Approach

- Simple/analytical
- Advanced/numerical

Data Assembly

Relative Impacts

Integrate Results

Sensitivity Analysis

Pathways, Parameters, & Metrics

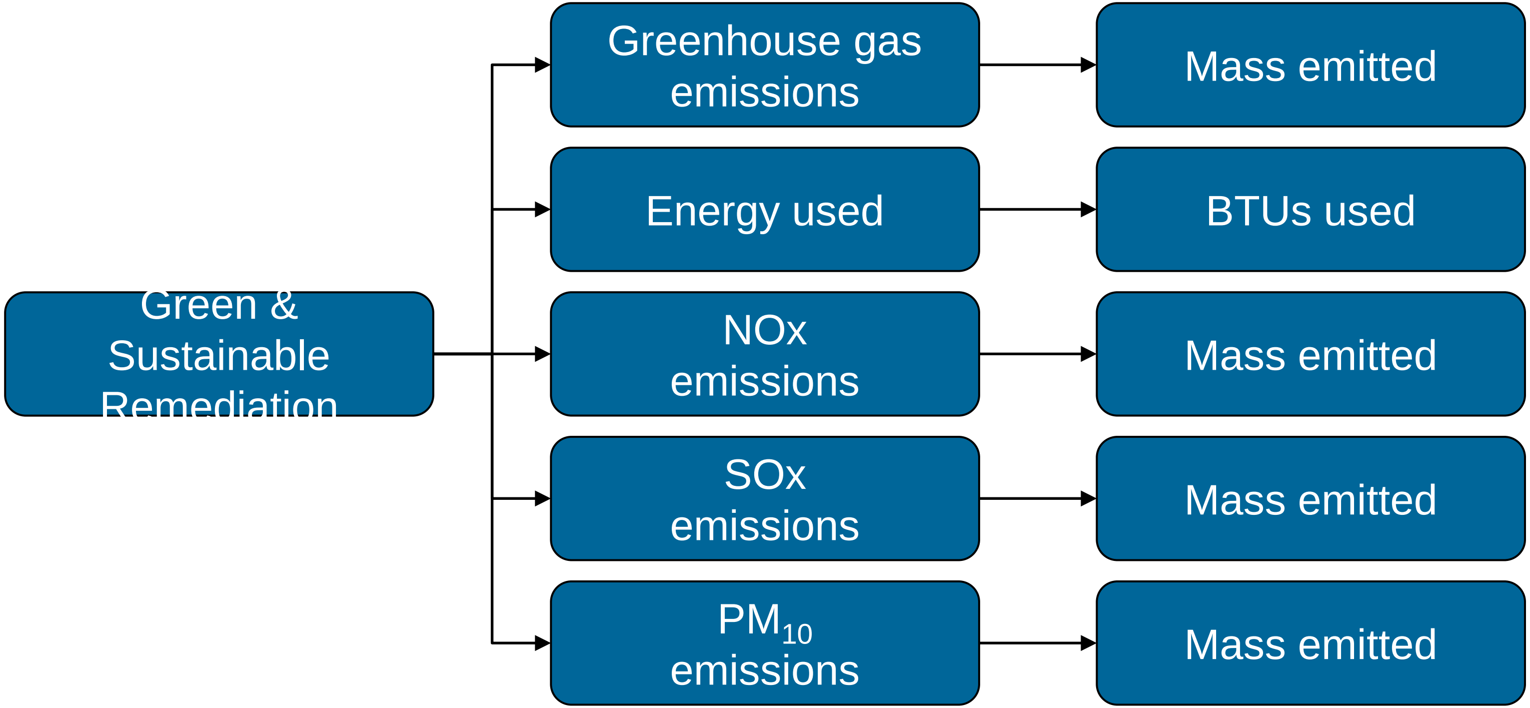
Groundwater → Constituents of Concern → Time-weighted average; Time above benchmark; Concentration above benchmark

Surface Water → Constituents of Concern → Time-weighted average; Time above benchmark; Concentration above benchmark

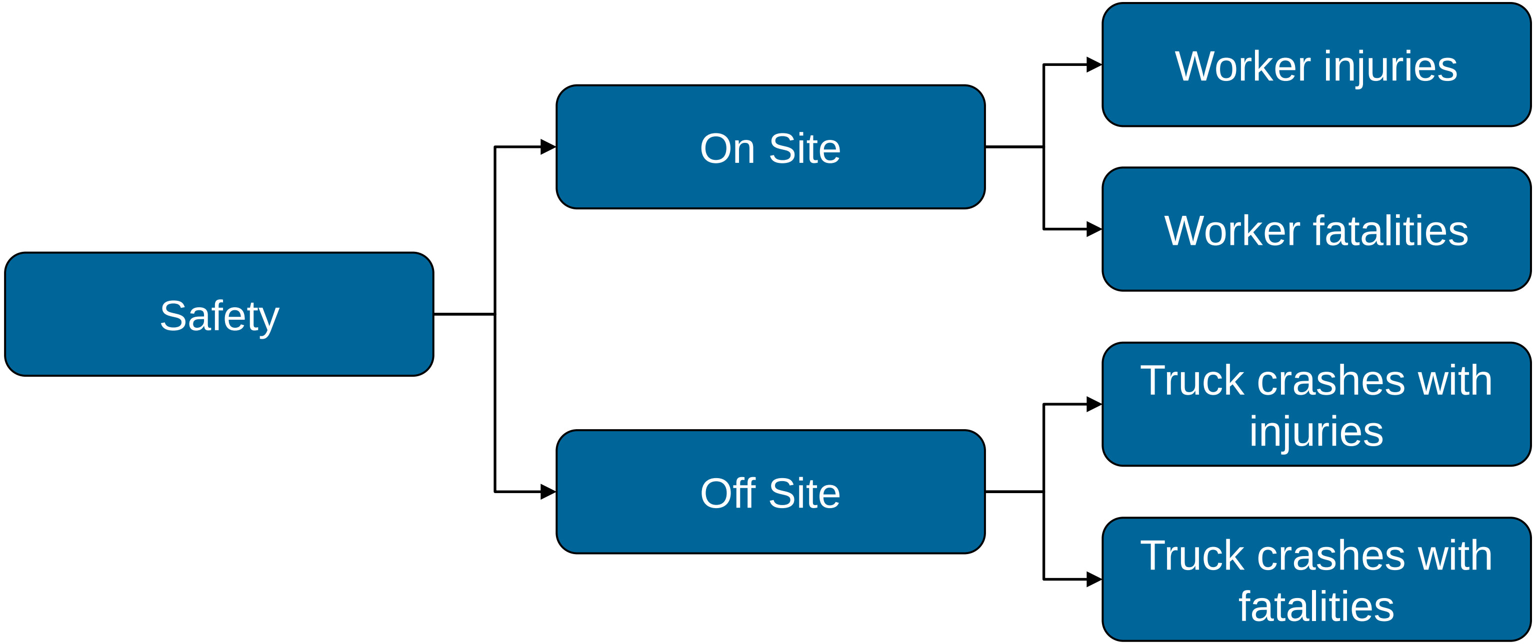
Air → Particulate Matter upto 2.5 µm ($PM_{2.5}$) → Annual Average; 24-hour maximum

Air → Particulate Matter upto 10 µm (PM_{10}) → 24-hour maximum

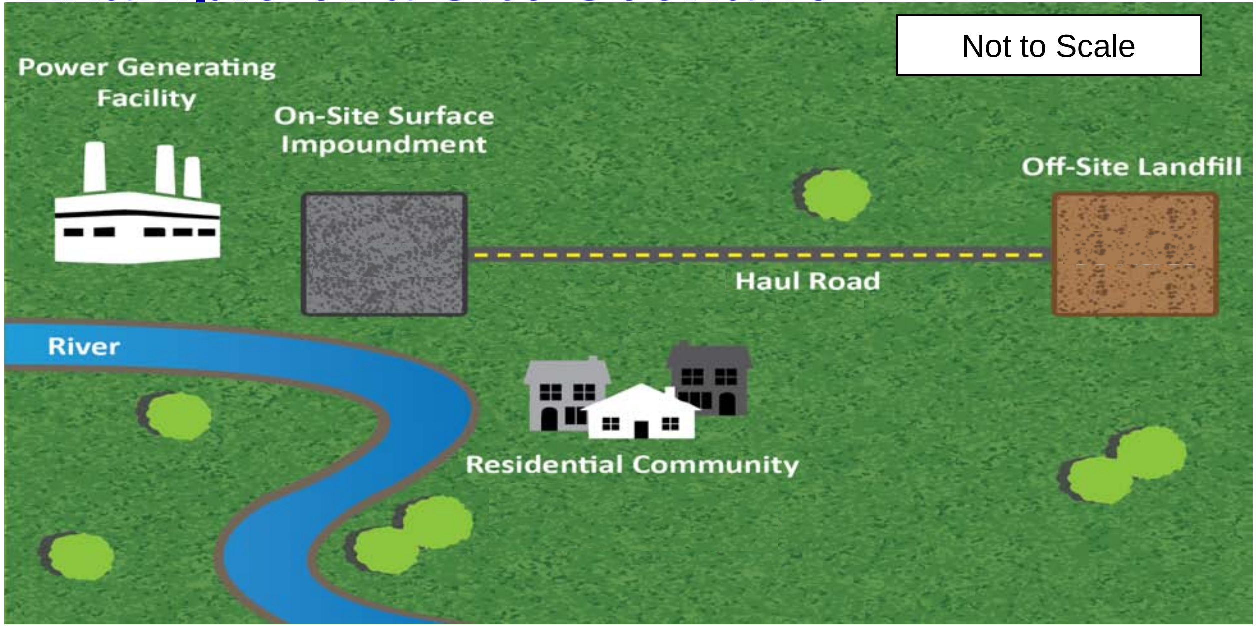
Pathways, Parameters, & Metrics (Continued)



Pathways & Metrics (Continued)

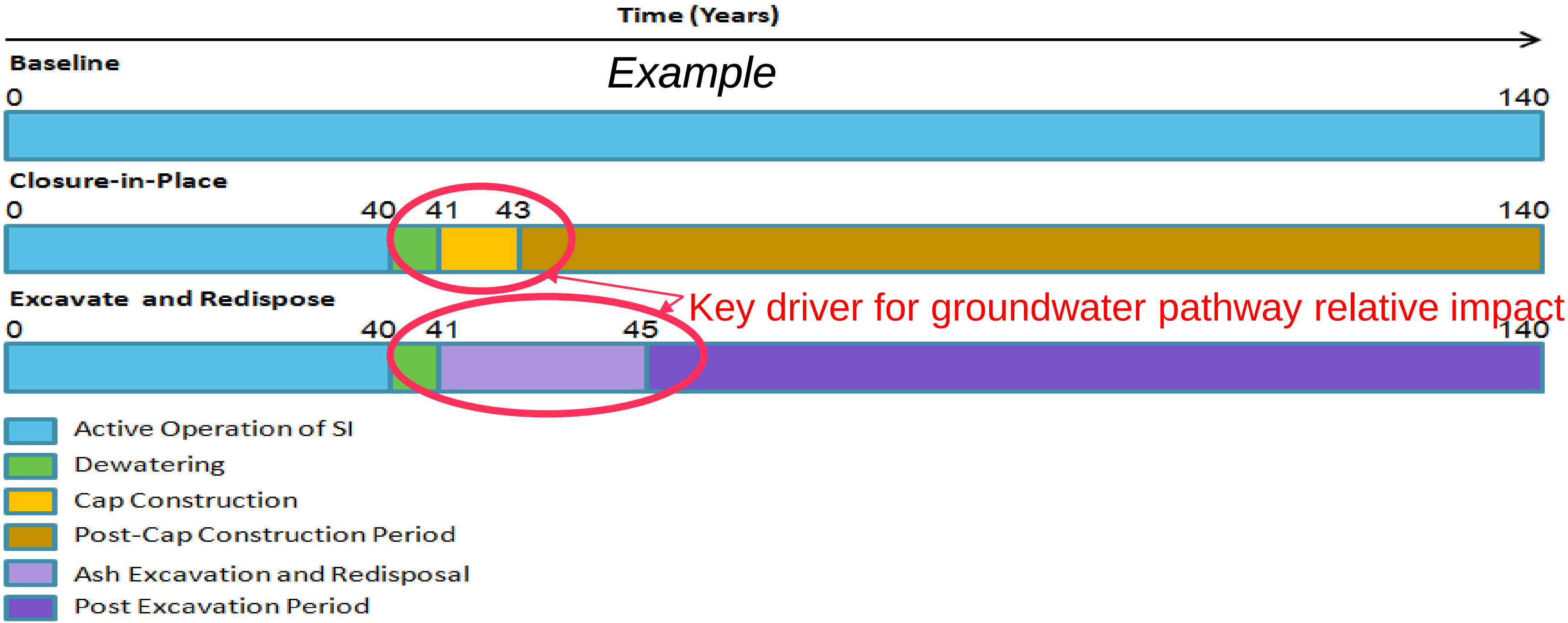


Example of a Site Scenario

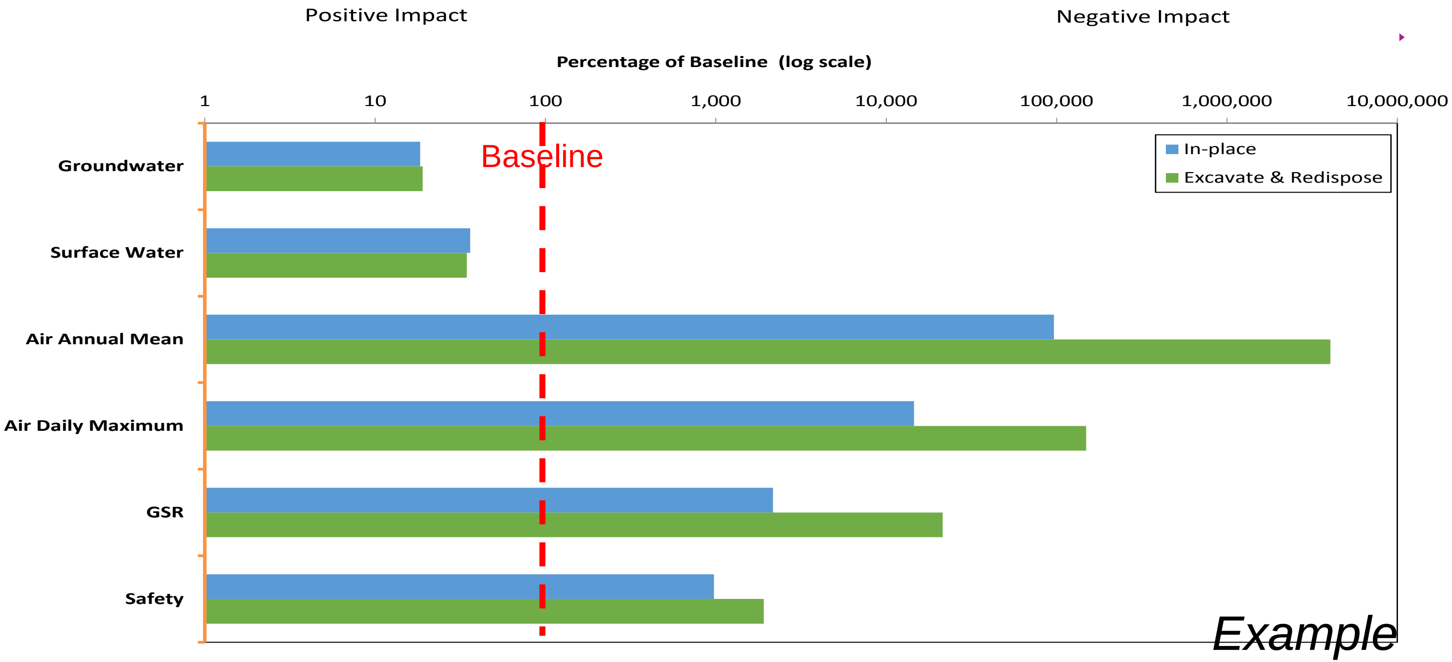


- Other Key Site Data
  - Surface impoundment area, volume
  - Length of time surface impoundment is in service
  - Aquifer dimensions, groundwater flow rate
  - River depth, discharge
  - Construction equipment, number of workers, distances for material transport

Time Frames Need to be Calculated



Example of Integrated Results

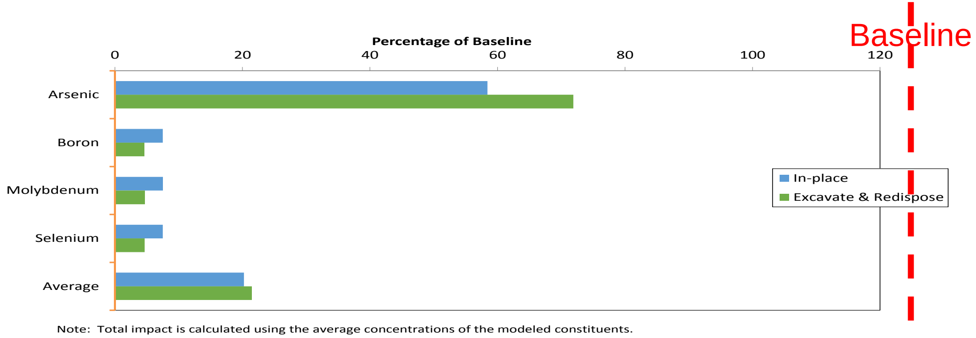


- Baseline = Current Conditions
- Positive Impact means calculated result is an improvement compared to current conditions
- Negative Impact means calculated result is a detriment compared to current conditions
- Difference between blue and green bars is the Relative Impact for that pathway

Groundwater Pathway Analysis

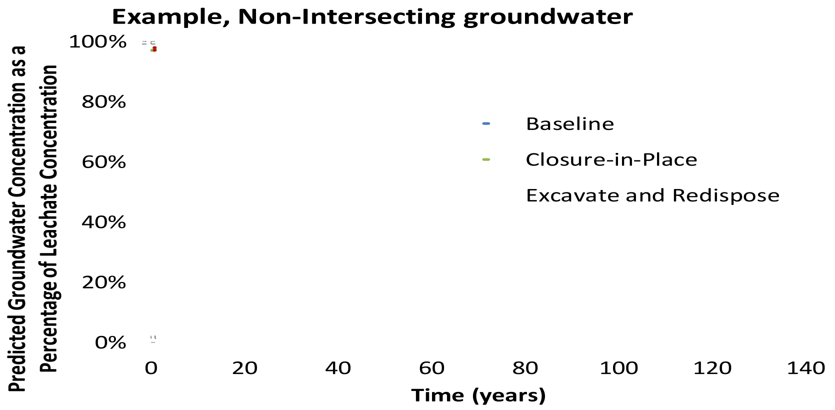
- Key parameters
  - Source concentration
  - Downward mass flux (infiltration)
  - Attenuation factor
  - Distance to receptor / monitoring
  - Time to excavate impoundment
- Analytical or numerical model

- Key alternatives
  - Constituents potentially released
  - Non-intersecting or intersecting groundwater
  - Type of cap for close-in-place
- Relative impact drivers:
  - Impoundment volume / time to excavate
  - Engineered or soil cap

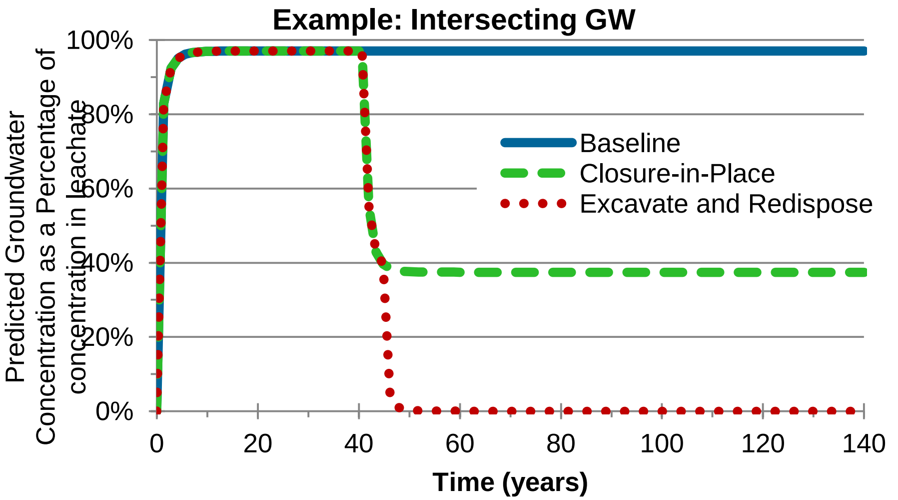


Example

Example Groundwater Model Results



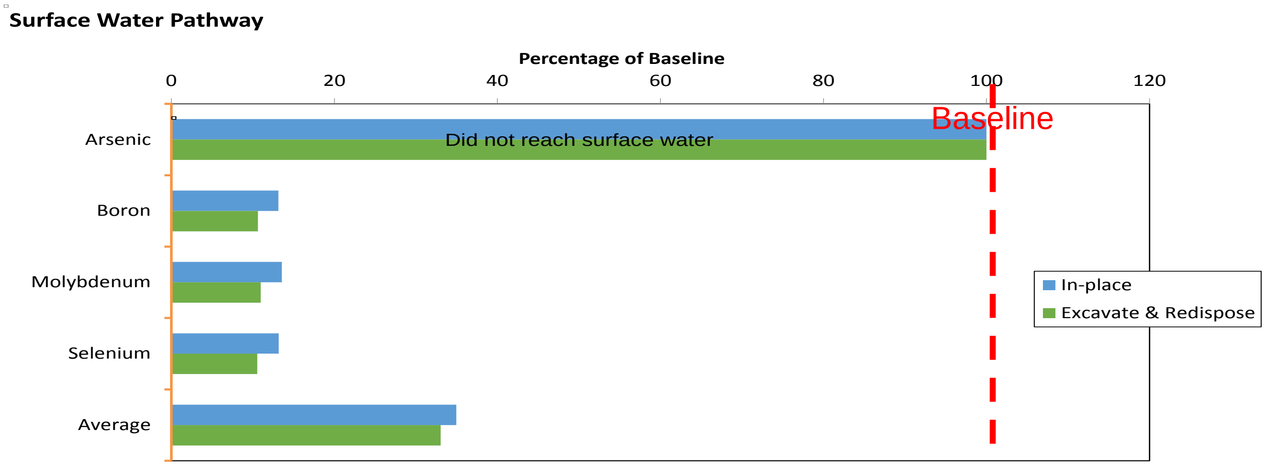
Examples



Surface Water Pathway Analysis

- Key parameters
  - Groundwater flux
  - River discharge
- Calculated using mixing equation or mass-balance approach

- Alternatives
  - Constituents
  - River or lake
- Relative impact drivers:
  - Impoundment volume / time to excavate

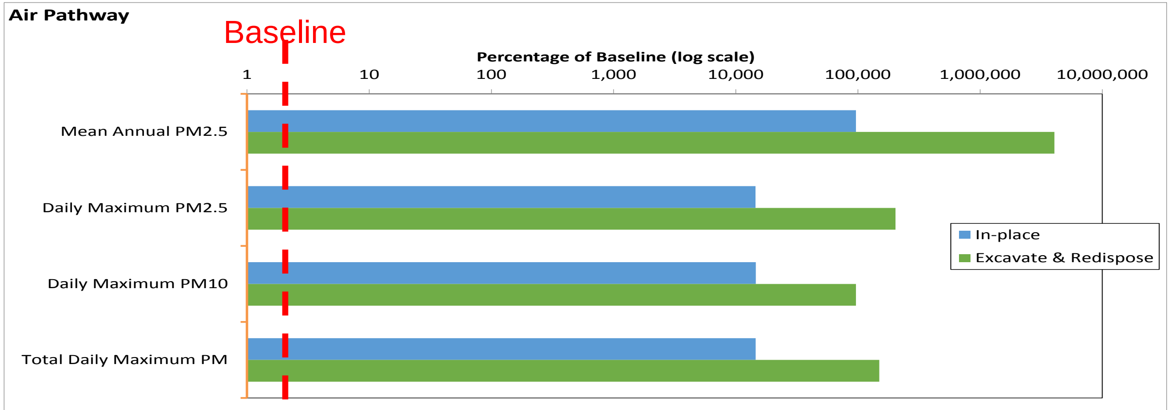


Note: Total impact is calculated using the average concentrations of the modeled constituents.

Example

Air Pathway Analysis

- Key parameters
  - Impoundment acreage / volume
  - Distance to receptor (from landfill, haul road, and impoundment)
  - Dust control measures
  - Volume / frequency of equipment traffic
- Calculated using air quality model
- Alternatives
  - Method / route of transportation
- Relative impact drivers
  - Trips per day between impoundment and landfill
  - Distance to receptor



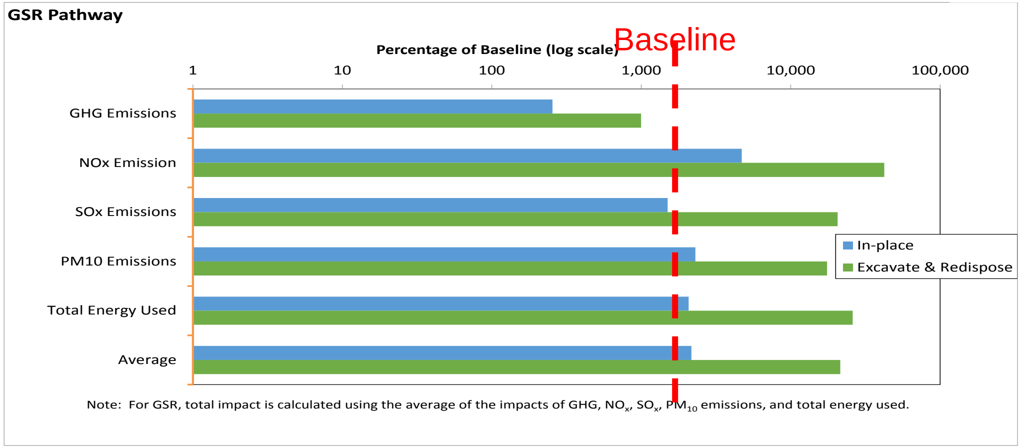
Note: For air, total impact is calculated using the average of mean annual concentrations for $PM_{2.5}$ and PM_{10}, and mean 24-hour maximum $PM_{2.5}$ and PM_{10}.

Example

Green & Sustainable Remediation Pathway Analysis

- Key parameters
  - Impoundment acreage / volume
  - Distance to landfill
  - Impoundment cap, landfill liner materials
- Moderate modeling effort using SiteWise™

- Alternatives
  - Method / route of transportation
  - Type of cap
  - Type of landfill liner
- Relative impact drivers
  - Impoundment volume
  - Distance between impoundment and landfill
  - Distance of sourced materials to site

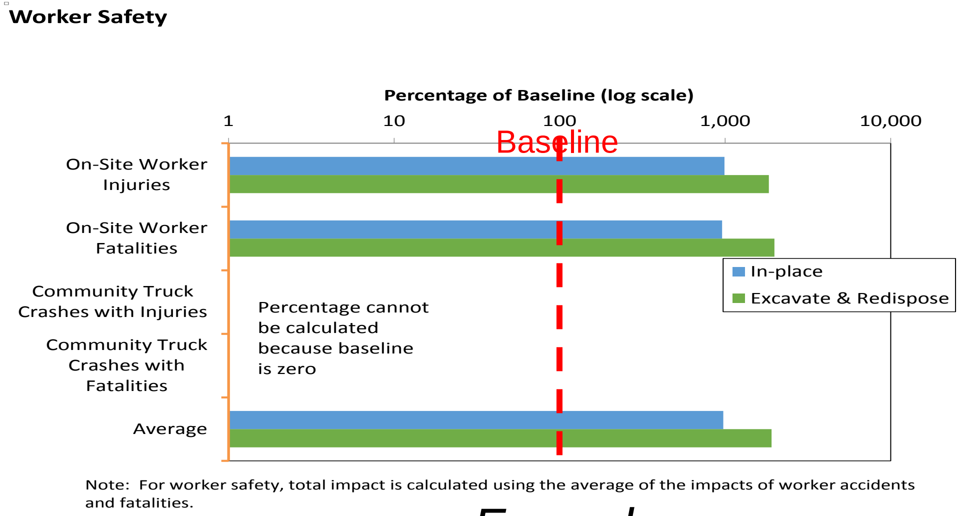


Example

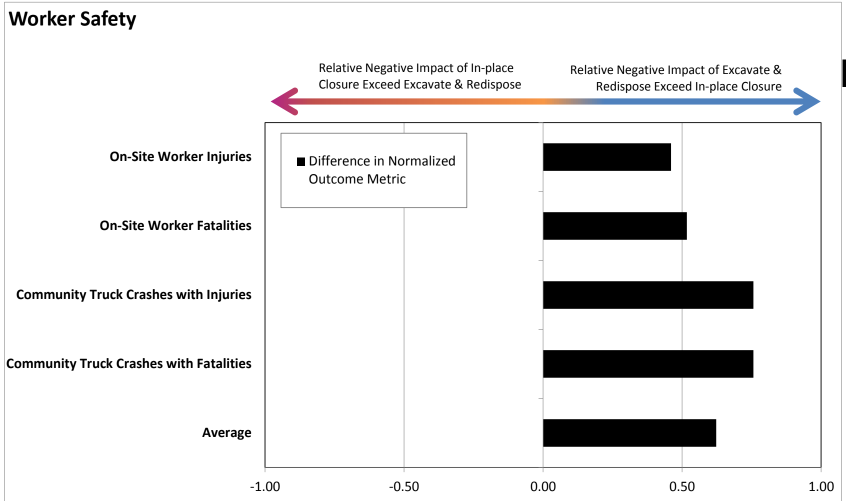
Safety Pathway Analysis

- Key parameters
  - Impoundment acreage / volume
  - Distance to landfill
  - Distance of sourced material to site
- Moderate modeling effort using SiteWise™

- Alternatives
  - Method / route of transportation
- Relative impact drivers
  - Impoundment volume
  - Distance to landfill and construction material



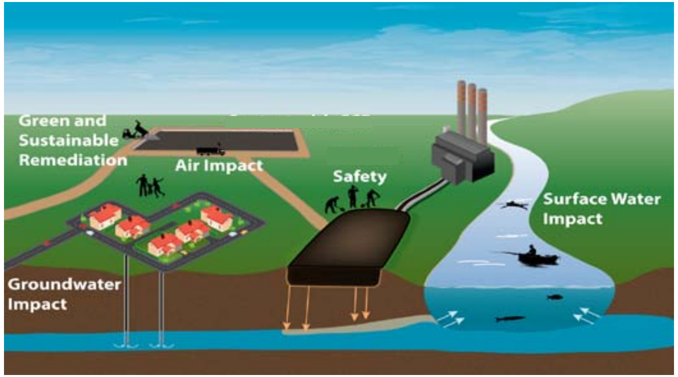
Example



Example

Framework Summary

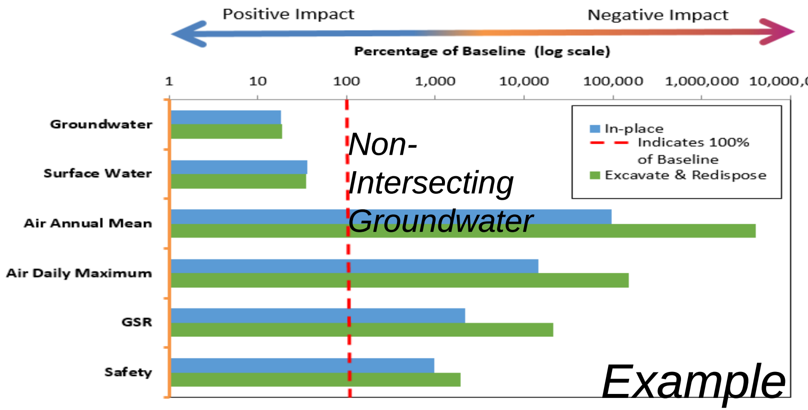
- Evaluates relative impact of Closure In-Place versus Closure by Removal scenarios for multiple local pathways that may be affected. Pathways include:
  - Groundwater and surface water, typically assumed to be impacted
  - Air, green & sustainable remediation, and safety, typically assumed to begin with negligible impacts

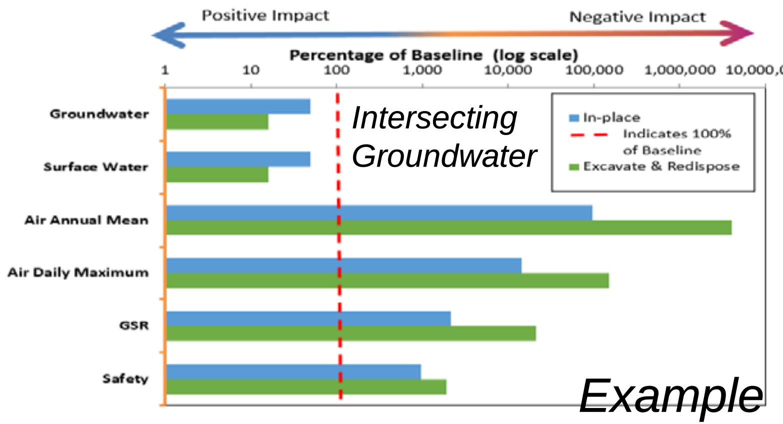


- Quantifies relative impacts for use in decision-making, but does not provide an absolute answer
  - Factors outside framework include cost and regulatory direction

Observations from Framework Testing

- Groundwater and surface water
  – Closure In-Place and Excavate & Redispose can both provide a benefit relative to an impacted current condition.
  – The benefit from Closure In-Place may be reduced if groundwater intersects the CCR in the impoundment after dewatering.
  – The type of cap planned for Closure In-Place, and the duration of excavation for the Excavate and Redispose scenario will also effect results for the groundwater and surface water pathways.

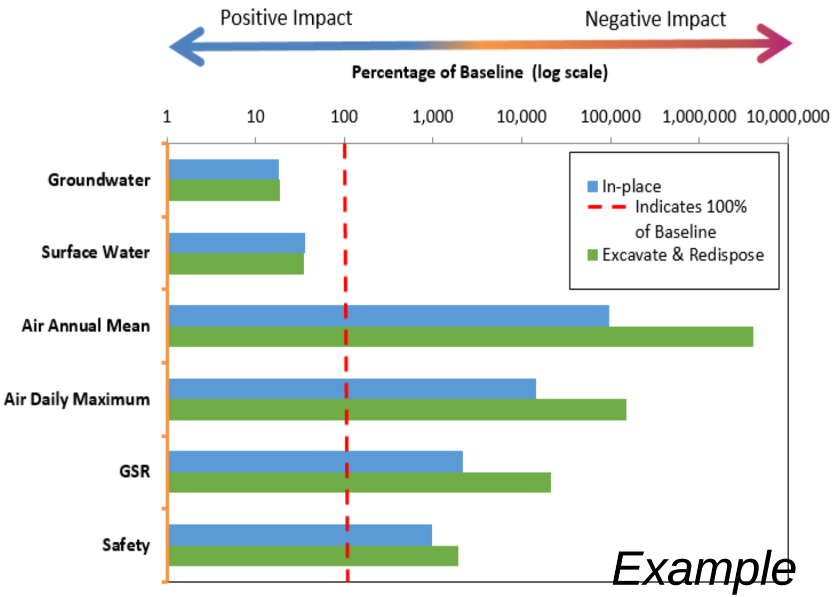




ELECTRIC POWER RESEARCH INSTITUTE

Observations from Framework Testing

- Air, Green & Sustainable Remediation, and Safety
  - Closure In-Place and Excavate & Redispose typically result in negative impacts to air quality and green & sustainable remediation, relative to baseline.
  - Both scenarios also increase the potential for worker and traffic-related risks including injuries and fatalities.
  - Impacts observed during testing to-date have been greater for Excavate & Redispose than for Closure In-Place because E&R:
    - Requires more material handling
    - Results in more truck traffic, and more miles traveled
    - Takes longer time to complete



Questions?

Together…Shaping the Future of Electricity

Coal Combustion Residual Impoundment Closure Draft EIS

Amy Henry

NEPA Program and Valley Projects Manager

CCR Impoundment Closure
Environmental Impact Statement (EIS)

Part I: Programmatic review of closure methods

- Closure-by-Removal
- Closure-in-Place
- No Action

Part II: Site-Specific reviews

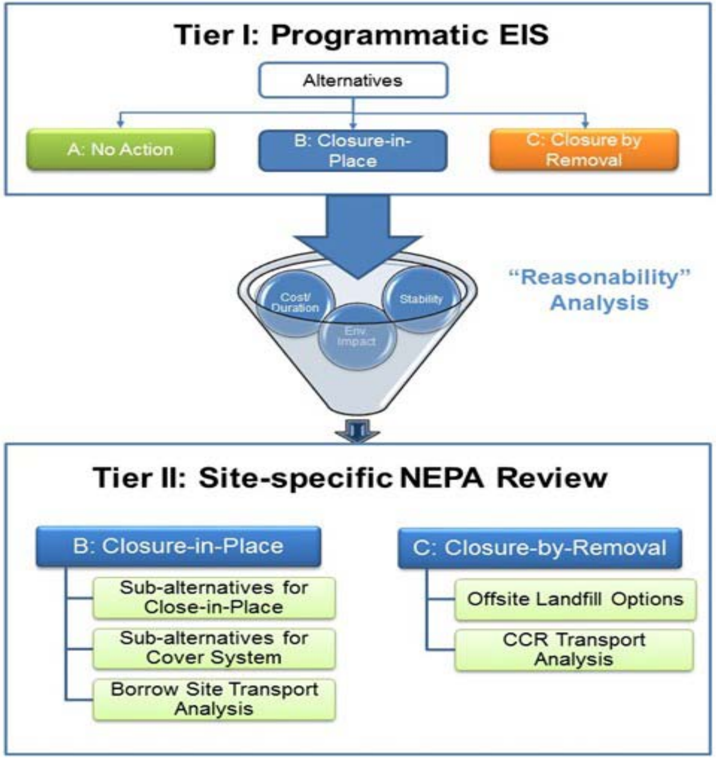
At 6 plants, TVA proposes to close 10 ponds by 2018

Allen	Bull Run	Colbert
John Sevier	Kingston	Widows Creek

Evaluation Criteria

- Volume of CCR materials
- Mode and duration of transport (borrow/fill) activities
- Schedule of closure
- Stability (static, seismic)
- Risk to human health & safety (workers, motorists)
- Effects to wetlands and adjacent environmental resources
- Environmental Justice
- Cost

Screening for Site-Specific Closure Alternatives



Draft EIS: Preliminary Results

- EPRI model an analytical tool
- Both closure methods protective of environment if done properly
- Depending on CCR volume, close-by-removal results in greater adverse impacts to some resources
- No significant impacts identified in site-specific reviews

Questions?

Coal Combustion Residual Impoundment Closure Draft EIS

Amy Henry

NEPA Program and Valley Projects Manager

Coal Combustion Residual (CCR) Impoundment Closure

TVA CCR impoundments in Kentucky, Tennessee, and Alabama.

2009 - TVA began to convert wet ash impoundments to dry storage.

2015 - EPA CCR Rule established national criteria and schedules for the manage-ment and closure of CCR facilities.

Consistent with the CCR Rule, TVA is proposing to close some impoundments rapidly, before April 2018.

TVA must decide how to close its wet CCR impoundments

Bottom ash impoundment
Bull Run Fossil Plant

West Ash Impoundment
Allen Fossil Plant

National Environmental Policy Act (NEPA)

Federal law that requires federal agencies to evaluate the potential environmental impacts of proposed actions, plans, and policies

Planning Process

- Alternatives
- Public Input

Analyze Potential Environmental Effects

Decision-making Tool

- NEPA does not require selection of the alternative with the most favorable environmental impacts
- The environmental review is one factor considered by TVA decision makers

CCR Impoundment Closure

Environmental Impact Statement (EIS)

Purpose and Need

- Address the potential impacts of closing CCR impoundments across the TVA system
- Assist TVA in complying with EPA's CCR Rule

Part I: Programmatic review of three alternatives

Part II: Site-specific review of 10 proposed pond closures

Evaluation Criteria

- Volume of CCR materials
- Mode and duration of transport (borrow/fill) activities
- Schedule of closure
- Stability (static, seismic)
- Risk to human health & safety (workers, motorists)
- Effects to wetlands and adjacent environmental resources
- Environmental Justice
- Cost

Draft EIS: Preliminary Results

- Both closure methods protective of environment if done properly
- Depending on CCR volume, close-by-removal results in greater adverse impacts to some resources

Resource	Close-in-Place	Close-by-Removal
Groundwater	↑	↑–↑↑
Transportation	↓	↓–↓↓↓
Public Health & Safety	↓	↓↓–↓↓↓
Cost	\$3.5M - \$150 M	\$15M - \$2.7B

Public Review of Draft EIS

Comment period Dec 30 – February 24

How to comment:

- TVA's website https://www.tva.com/nepa under "Open for Comment"
- Attend a public open house session:
  - 10 open house meetings in communities near TVA coal plants
  - January 12-February 10
- Email CCR@tva.gov
- US Mail

  Ashley Farless, PE, AICP
  NEPA Project Manager
  Tennessee Valley Authority
  1101 Market Street, BR 4A
  Chattanooga, Tennessee 37402

EIS Next Steps

- Collect public comments December 30, 2015 – February 24, 2016
- Evaluate and respond to comments in the Final EIS
- Issue Final EIS Spring 2016
- Issue TVA Record of Decision Summer 2016

Questions?

Wrap Up and Adjourn

Thank you and please travel safely!

Appendix C – Agency Correspondence

List of Agencies

Received from	Date	Regarding
Federal		
U.S. Department of the Interior, Fish and Wildlife Service	2016-09-22	FWS 2015-B-0179; ER 15-0467p Notice of Intent to Prepare an EIS, TVA for the CCR Impoundments, AL, KY, TN
U.S. Department of the Interior, Office of the Secretary	2016-02-22	Comments for the Notice of Availability of Draft PEIS for the Closure of CCR Impoundments by the TVA
USEPA, Region 4	2016-03-07	Draft PEIS for Ash Impoundment Closure (Part 1 – Programmatic NEPA Review; ERP TVA-E09819-00; CEQ No: 20150369
State		
Alabama Historical Commission	2016-04-29	AHC 16-075, Ash Impoundment Closures, Colbert and Jackson Counties
Kentucky Department for Local Government, Office of the Governor	2015-11-04	EIS – Closure of CCR Impoundments, SAI#KY20151002-1235
Tennessee Department of Environment and Conservation	2015-09-29	Comments on the Notice of Intent
Tennessee Department of Environment and Conservation	2016-03-08	Comments on the TVA Draft PEIS
Tennessee Historical Commission, State Historic Preservation Office	2016-04-18	TVA, Ash Impoundment Closures, Unincorporated, Multi County
Tribes		
Absentee Shawnee Tribe of Oklahoma Alabama-Quassarte Tribal Town of the Creek Nation of Oklahoma Alabama-Coushatta Tribe of Texas Cherokee Nation of Oklahoma Chickasaw Nation Choctaw Nation of Oklahoma Coushatta Tribe of Louisiana Eastern Band of Cherokee Indians Eastern Shawnee Tribe of Oklahoma Jena Band of Choctaw Indians Kialegee Tribal Town Mississippi Band of Choctaw Indians Muscogee Creek Nation Poarch Band of Creek Indians Seminole Nation of Oklahoma Shawnee Tribe Thlopthlocco Tribal Town United Keetoowah Band of Cherokee Indians in Oklahoma	2016-04-18	TVA Native American Consultation letter on Ash Impoundment Closures

STATE OF ALABAMA
ALABAMA HISTORICAL COMMISSION
468 SOUTH PERRY STREET
MONTGOMERY, ALABAMA 36130-0900

April 29, 2016

LISA D. JONES
ACTING EXECUTIVE DIRECTOR
STATE HISTORIC PRESERVATION OFFICER

TEL: 334-242-3184
FAX: 334-240-3477

Clinton E. Jones
TVA
400 West Summit Hill Drive
Knoxville, TN 37902

Re: AHC 16-0750
Ash Impoundment closures
Colbert and Jackson Counties

Dear Mr. Jones:

Upon review of the above-referenced project forwarded by your office, we have determined that project activities will have no effect on any cultural resources listed on or eligible for the National Register of Historic Places Therefore, we concur with the proposed project activities.

However, should artifacts or archaeological features be encountered during project activities, work shall cease and our office shall be consulted immediately. Artifacts are objects made, used or modified by humans. They include but are not excluded to arrowheads, broken pieces of pottery or glass, stone implements, metal fasteners or tools, etc. Archaeological features are stains in the soil that indicate disturbance by human activity. Some examples are post holes, building foundations, trash pits and even human burials. **This stipulation shall be placed on the construction plans to insure contractors are aware of it.**

We appreciate your commitment to helping us preserve Alabama's historic archaeological and architectural resources. Should you have any questions, please contact Amanda McBride at 334.230.2692 or Amanda.McBride@preserveala.org. Have the AHC tracking number referenced above available and include it with any future correspondence.

Sincerely,

Lee Anne Wofford

Lee Anne Wofford
Deputy State Historic Preservation Officer

LAW/EDS/amh

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Kentucky Ecological Services Field Office
330 West Broadway, Suite 265
Frankfort, Kentucky 40601
(502) 695-0468

September 22, 2015

Ms. Ashley Farless
Tennessee Valley Authority
1101 Market Street, BR4A
Chattanooga, TN 37402

Subject: FWS 2015-B-0179; ER 15-0467; Notice of Intent to Prepare an Environmental Impact Assessment, Tennessee Valley Authority for the Closure of Coal Combustion Residuals Impoundments, AL, KY, TN

Dear Ms. Farless:

The U.S. Fish and Wildlife Service (Service) has reviewed the Tennessee Valley Authority's (TVA) Notice of Intent (NOI) to prepare an Environmental Impact Statement (EIS) to address the closure of coal combustion residual (CCR) impoundments at its coal-fired power plants in Alabama, Kentucky, and Tennessee to facilitate TVA's compliance with the CCR Rule that the U.S. Environmental Protection Agency (EPA) issued on April 17, 2015. According to the Federal Register Notice (80 FR 52079), the draft EIS will programmatically consider the impacts of the primary closure methods: (1) Closure in-place and (2) Closure-by-removal. It will also consider the site-specific impacts of closing 11 of TVA's impoundments within three years. We offer the following comments for your consideration:

The Service recommends that TVA work with each local field office in Tennessee, Alabama, and Kentucky while drafting the EIS to ensure that the most-recent information on federally-listed species and designated critical habitats is assessed. The EIS should include a thorough evaluation of the potential direct, indirect, and cumulative impacts that could occur on federally listed species and their habitats. If adverse effects to federally listed species are likely to occur, consultation under section 7(a)(2) of the Endangered Species Act will likely be necessary.

We recommend that the applicant also continue to consult with the State and federal resource agencies as the project plans progress. After TVA has conducted the necessary studies, the resource agencies should again be consulted for their recommendations on measures needed to mitigate adverse impacts and compensate for unavoidable losses of fish and wildlife values. Please note, because project-specific information is incomplete at this time, our comments are general in nature and are intended primarily to assist TVA in properly assessing the potential environmental impacts resulting from the proposed action.

We appreciate the early opportunity to provide technical assistance on the proposed action. If you have any questions, please contact Carrie Allison, Kentucky Field Office, at 502-695-0468, extension 103.

Sincerely,

Virgil Lee Andrews, Jr.
Field Supervisor

United States Department of the Interior

OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
Richard B. Russell Federal Building
75 Ted Turner Drive, S.W., Suite 1144
Atlanta, Georgia 30303

ER 16/0008
9043.1

February 22, 2016

Ashley Farless
NEPA Compliance
Tennessee Valley Authority
1101 Market Street, BR 4A
Chattanooga, TN 37402

Re: Comments for the Notice of Availability of Draft Programmatic Environmental Impact Statement (DPEIS) for the Closure of Coal Combustion Residual Impoundments by the Tennessee Valley Authority (TVA)

Dear Ms. Farless:

The U.S. Department of the Interior (Department) has reviewed the Notice of Availability of Draft Programmatic Environmental Impact Statement for the Closure of Coal Combustion Residual Impoundments by the TVA. The purpose of the DPEIS is to ensure TVA compliance with the Coal Combustion Residual (CCR) Rule issued by the United States Environmental Protection Agency on April 17, 2015 (80 FR 21302). CCRs are by-products produced from burning coal and include fly ash, bottom ash, boiler slag, and flue gas desulfurization materials.

After the TVA Kingston Fossil Plant CCR impoundment failure in 2008, TVA also outlined a plan to eliminate wet storage of CCRs at its plants and convert all wet fly ash, bottom ash, and gypsum operations to dry storage. The DPEIS evaluates those CCR impoundment closure actions that are consistent with TVA's overall plan to eliminate wet storage of CCRs at its facilities. TVA is considering three alternatives to address existing CCR impoundments at coal-combustion power plants within their power generation service area: no action, closure-in-place, and closure-by-removal.

The coal combustion power plants in TVA's power generation service area include Allen, Johnsonville, Cumberland, Gallatin, Bull Run, Kingston, and John Sevier in Tennessee; Widows Creek and Colbert in Alabama; and Paradise and Shawnee in Kentucky (Figure 1). Several impoundments at existing TVA coal combustion power plants in Tennessee were not specifically addressed in Part II of this DPEIS as either site-specific NEPA documents for closure and removal activities have been previously completed or site characterization activities are not yet complete.

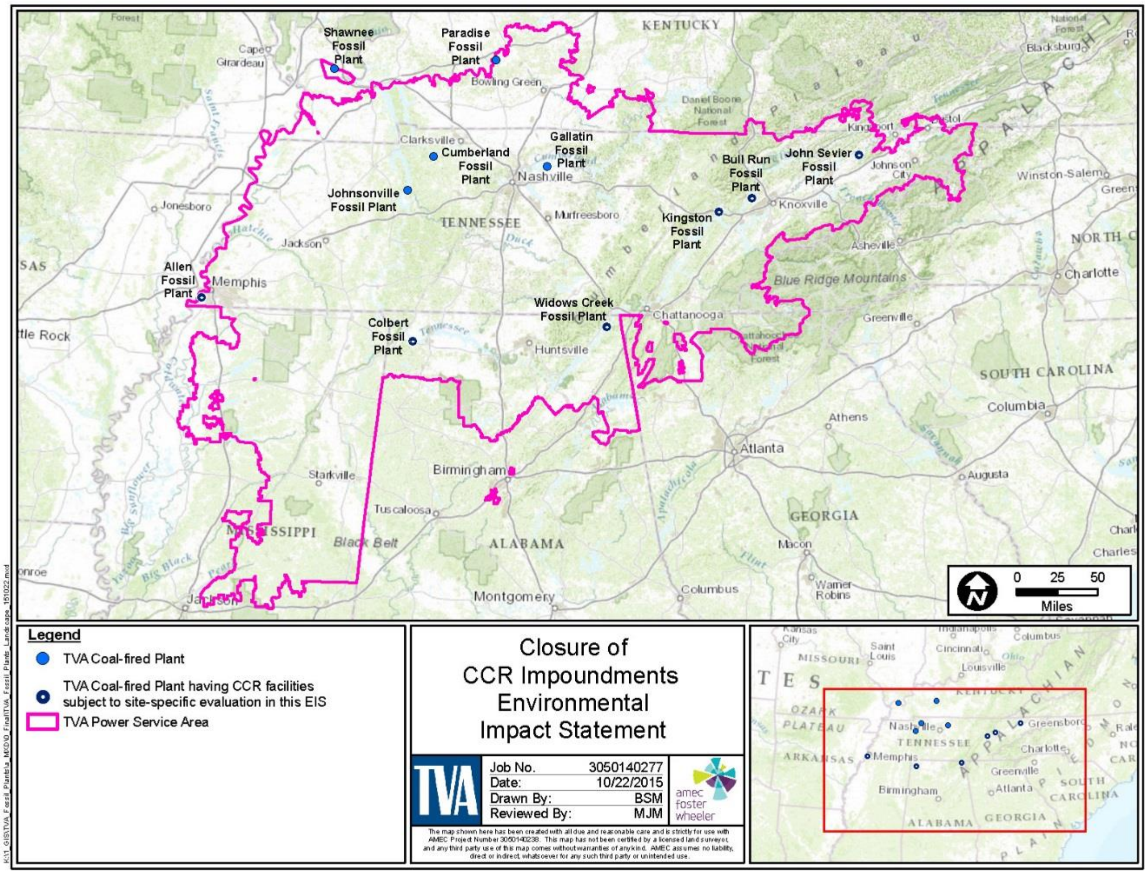


Figure 1. TVA Ash Impoundment Closure EIS; Project Number: 2015-312015

We strongly support TVA's transition to dry ash storage at its coal combustion power plants. Once the preferred alternative for a site-specific CCR impoundment is selected, the Department will further consult with TVA to address site-specific endangered species and migratory bird concerns. We provide the following federally listed species and migratory bird habitat information to further inform TVA in their site-specific determinations and CCR impoundment closure alternative selections for Tennessee and Kentucky.

Tennessee

Indiana bat (*Myotis sodalis*)

Many of the CCR impoundments are located in or adjacent to known habitats for the federally-endangered Indiana bat. The species utilizes a wide array of forested habitats, including riparian forests, bottomlands, and uplands for both foraging and roosting. The DPEIS indicates that there may be forested habitat removal associated with the temporary laydown areas. Section 3.12.2 of the DPEIS expresses TVA's intent to consult with the Department if trees are planned to be removed. The Department is available to assist TVA and provide options for addressing the Indiana bat at CCR impoundment closure project sites.

Northern long-eared bat (*Myotis septentrionalis*)
Many of the CCR impoundments are located in or adjacent to known habitats for the federally-threatened northern long-eared bat. The species utilizes a wide array of forested habitats, including riparian forests, bottomlands, and uplands for both foraging and roosting. The DPEIS indicates that there may be forested habitat removal associated with the temporary laydown areas. Projects involving the removal of trees that could provide roosting and foraging habitat for the northern long-eared bat have the potential to result in incidental take of the species, as defined in the Endangered Species Act. The Department published a final 4(d) rule for the northern long-eared bat on January 14, 2016. This 4(d) rule identifies certain types of take that are prohibited and establishes specific conservation measures for tree removal activities that, if adhered to, would not result in prohibited incidental take. Based on the information provided in the DPEIS, our species occurrence records support that work at CCR impoundment closure sites would be in compliance with these conservation measures. Per the Biological Opinion that supports the 4(d) Rule, the action agency of federal projects, in coordination with the Department, must make a determination as to whether their activity is excepted from the incidental take prohibitions in the final 4(d) Rule. This determination should be provided to the Department at least 30 days in advance of the action agency's funding, authorization, or carrying out of an action. The Department is available to assist TVA and provide options for addressing the northern long-eared bat at CCR impoundment closure project sites.

Federally-listed mussel species
Many of the CCR impoundments have known groundwater contamination and discharge directly to or are located within and adjacent to large rivers that support a number of federally-listed mussel species. The reach of the Ohio River near the Shawnee Station Fossil Plant in McCracken County, Kentucky, is federally designated critical habitat (80 CFR 24692 – 24774) for the endangered rabbitsfoot (*Quadrula cylindrica cylindrica*).

Freshwater mussels are one of the most imperiled groups of animals in North America. As filter feeders, mussels are sensitive to contaminants and function as indicators of water quality. The potential for water quality degradation resulting from the release of contamination from the CCR impoundments should be addressed to determine if federally-listed mussel species would be directly or indirectly affected by CCR impoundment closure activities.

Bald eagle (*Haliaeetus leucocephalus*)
The bald eagle was officially removed from the List of Endangered and Threatened Species on August 8, 2007, but the species continues to be protected under the Migratory Bird Treaty Act (MBTA) and the Bald and the Golden Eagle Protection Act (BGEPA). According to our database, several bald eagle nests are located near CCR impoundments s in the TVA power generation service area, and it is possible that there are also new or previously unidentified nests in the vicinity. BGEPA prohibits disturbing nesting eagles and destroying active or inactive nests.

The Department developed the National Bald Eagle Management (NBEM) Guidelines to provide landowners, land managers, and others with information and recommendations to minimize potential project impacts to bald eagles, particularly where such impacts may constitute "disturbance," which is prohibited by the BGEPA. The NBEM Guidelines are available at: http://www.fws.gov/migratorybirds/BaldEagle.htm. Those guidelines recommend: (1) maintaining a specified distance between the activity and the nest (buffer area); (2) maintaining natural areas (preferably forested) between the activity and nest trees (landscape buffers); and (3) avoiding certain activities during the breeding season. On-site personnel should be informed of the possible presence of bald eagle nests within the vicinity of the project area and should identify, avoid, and immediately report any such nests to the Department. If a bald eagle nest is discovered, an evaluation should be performed to determine if the project is likely to disturb nesting bald eagles. That evaluation may be conducted on-line at: http://www.fws.gov/southeast/es/baldeagle/. Following completion of the evaluation, that website will provide a determination of whether additional consultation is necessary.

Least tern (*Sterna antillarum*)
The federally endangered least tern may utilize CCR impoundment habitats adjacent to the lower Mississippi and Ohio Rivers for nesting and foraging when water levels in these rivers are high. As discussed in the DPEIS, this species has nested at the Allen Fossil Plant in Shelby County, Tennessee. If you have any questions regarding Tennessee's species, please contact Steve Alexander at (931) 528-6481 (ext. 210) or via e-mail at *steven_alexander@fws.gov*.

Kentucky

Indiana bat (Myotis sodalis)
The Shawnee Station Fossil Plant site is located in known habitat for the federally-endangered Indiana bat and the species potentially occurs at the Paradise Fossil Plant site. The species utilizes a wide array of forested habitats, including riparian forests, bottomlands, and uplands for both foraging and roosting. The DPEIS indicates that there may be forested habitat removal associated with the temporary laydown areas. Section 3.12.2 of the DPEIS expresses TVA's intent to consult with the Department if trees are planned to be removed.

Northern long-eared bat (Myotis septentrionalis)
The Shawnee Station Fossil Plant site is located in known habitat for the federally-threatened northern long-eared bat and the species potentially occurs at the Paradise Fossil Plant site. The species utilizes a wide array of forested habitats, including riparian forests, bottomlands, and uplands for both foraging and roosting. The DPEIS indicates that there may be forested habitat removal associated with the temporary laydown areas. Projects involving the removal of trees that could provide roosting and foraging habitat for the northern long-eared bat have the potential to result in incidental take of the species, as defined in the ESA. The Department published a final 4(d) Rule for the northern long-eared bat on January 14, 2016. This 4(d) Rule identifies certain types of take that are prohibited and establishes specific conservation measures for tree removal activities that, if adhered to, would not result in prohibited incidental take. Based on the information provided in your correspondence, our species occurrence records support that work at these two proposed project sites in Kentucky would be in compliance with these conservation measures. Per the Biological Opinion that supports the 4(d) Rule, the action agency of federal

projects, in coordination with the Department, must make a determination as to whether their activity is excepted from the incidental take prohibitions in the final 4(d) Rule. This determination should be provided to our office at least 30 days in advance of the action agency's funding, authorization, or carrying out of an action. Contact our office for further assistance with the conservation measures or options available if the project design cannot incorporate these measures.

Federally-listed mussel species

The Shawnee Station Fossil Plant site is in a watershed that drains into the Ohio River, and the Paradise Fossil Plant site is in a watershed that drains into the Green River. A number of federally-listed mussel species are known to occur or have the potential to occur in these two rivers. Additionally, the section of the Ohio River near the Shawnee Station Fossil Plant is designated critical habitat for rabbitsfoot (Quadrula c. cylindrica). Freshwater mussels are one of the most imperiled groups of animals in North America. As filter feeders, mussels are sensitive to contaminants and function as indicators of water quality. The potential for water quality degradation in the Ohio and Green rivers resulting from contamination from the sites should be addressed to determine if federally-listed mussel species would be indirectly impacted from the proposed projects.

Bald eagle (Haliaeetus leucocephalus)

The bald eagle was officially removed from the List of Endangered and Threatened Species on August 8, 2007, but it continues to be protected under the Migratory Bird Treaty Act (MBTA) and the Bald and the Golden Eagle Protection Act (BGEPA). According to our database, several bald eagle nests are located 1-2 miles from the center of the Shawnee Station Fossil Plant and Paradise Fossil Plant sites in Kentucky, and it is possible that there are also new or previously unidentified nests in the vicinity. BGEPA prohibits disturbing nesting eagles and destroying active or inactive nests.

The Department developed the National Bald Eagle Management (NBEM) Guidelines to provide landowners, land managers, and others with information and recommendations to minimize potential project impacts to bald eagles, particularly where such impacts may constitute "disturbance," which is prohibited by the BGEPA. The NBEM Guidelines are available at: http://www.fws.gov/migratorybirds/BaldEagle.htm.Those guidelines recommend: (1) maintaining a specified distance between the activity and the nest (buffer area); (2) maintaining natural areas (preferably forested) between the activity and nest trees (landscape buffers); and (3) avoiding certain activities during the breeding season. On-site personnel should be informed of the possible presence of bald eagle nests within the vicinity of the project area and should identify, avoid, and immediately report any such nests to this office. If a bald eagle nest is discovered, an evaluation should be performed to determine if the project is likely to disturb nesting bald eagles. That evaluation may be conducted on-line at: http://www.fws.gov/ southeast/es/baldeagle/. Following completion of the evaluation, that website will provide a determination of whether additional consultation is necessary. Should you need further assistance interpreting the guidelines or performing an on-line project evaluation, please contact this office.

Thank you for the opportunity to provide comments. If you have questions regarding Kentucky's species, please contact Jennifer Garland on (502) 695-0468 or via email at Jennifer_garland@fws.gov. I can be reached on (404) 331-4524 or via email at joyce_stanley@ios.doi.gov.

Sincerely,

Joyce Stanley, MPA
Regional Environmental Protection Specialist

cc: Christine Willis – FWS
Gary LeGain - USGS
Anita Barnett – NPS
Robin Ferguson - OSMRE
OEPC – WASH

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
NASHVILLE, TENNESSEE 37243-0435

ROBERT J. MARTINEAU, JR.
COMMISSIONER

BILL HASLAM
GOVERNOR

September 29, 2015

Via First Class and Electronic Mail to CCR@tva.gov
Ashley Farless
Tennessee Valley Authority
1101 Market St. BR4A
Chattanooga Tennessee 37402

Dear Ashley Farless:

The Tennessee Department of Environment and Conservation (TDEC) appreciates the opportunity to provide comments on the Tennessee Valley Authority (TVA) Notice of Intent to prepare a Draft Environmental Impact Statement (EIS) to address the closure of coal combustion residual (CCR) impoundments at its coal-fired power plants. TVA is considering the impacts of two primary closure methods for CCR impoundments: (1) Closure-in-Place and (2) Closure-by-Removal as well as the site-specific impacts of closing 11 of TVA's impoundments within three years.

TDEC's **Division of Air Pollution Control (APC)** has considered the notice of intent to prepare a Draft EIS and provides the following comments regarding preparation of the Draft EIS:

- If the removal of CCR material or contaminated soils to an offsite location will be employed as part of the process, APC recommends that TVA consider air quality impacts and how they will be monitored[1] at the TVA CCR disposal site and also at the location(s) selected to receive the CCR materials to be disposed of. Similarly, APC recommends that TVA consider air quality impacts, specifically potential particulate or dust impacts[2] and any environmental or health exposure associated with any proposed actions involving movement or relocation of CCR material or contaminated soils, and how they will be monitored.
- APC recommends that TVA address how it will respond to any air quality monitoring indicating that National Ambient Air Quality Standards (NAAQS) or other accepted exposure levels are nearing exceedance so as to prevent actual exceedance or unacceptable exposures both on and off site.[3]

TDEC's **Division of Solid Waste Management (DSWM)** has considered the notice of intent to prepare a Draft EIS and provided the following comments regarding preparation of the Draft EIS:

- TVA is currently using temporary storage of CCR as an interim management method pending construction of new CCR facilities. DSWM recommends that TVA consider in the Draft EIS the extent

[1] It is further recommended that any air monitoring employed be selected based on the composition of the CCR involved and any toxicity associated with the components. At minimum this should include an evaluation for metals and particulates in the PM2.5 or smaller size range.
[2] Specifically, it is recommended that TVA consider how it will mitigate site-specific fugitive dust, including but not limited to mechanisms designed to prevent "track out" on heavy truck bodies/truck under carriages and/or wheel assemblies as they leave the site, application of dust suppressing agents or water and the use of temporary covering agents, and strategies for mitigating drying and consequent wind erosion and transport.
[3] It is further recommended that TVA consider incorporating an air monitoring action plan within the Draft EIS.

to which this technique could be used to remove CCR, in phases, from an impoundment in regions where markets exist for beneficial use, and associated environmental impacts from this approach.[4]

- DSWM recommends that TVA consider in the Draft EIS strategies for mitigating certain stability or groundwater contamination issues, such as solidification/treatment of in place CCR in an impoundment, which would be a subset of closure in place.
- DSWM recommends that TVA consider in the Draft EIS converting holes created from the removal of CCR into wetlands and/or flood storage.

TDEC's **Division of Water Resources (DWR)** has considered the notice of intent to prepare a Draft EIS and provided the following comments regarding preparation of the Draft EIS:

- DWR supports TVA's development of a plan for the closure of CCR impoundments, but is concerned with what will be done with CCR that will be produced following the closure of the existing impoundments. The continued disposal of CCR entails potentially substantial changes in wastewater discharges from ongoing fossil plant operations. DWR recommends that the Draft EIS address mitigation of potential CCR-related impacts to surface waters at each fossil plant.
- DWR notes that both of the suggested closure methods would require dewatering. Because ash pond dewatering measures potentially exhibit the presence of substances that are bioaccumulative and/or toxic to aquatic organisms, DWR recommends that the Draft EIS include a detailed discussion of the chemical constituents of the slurry pond water and how it would be rendered safe for disposal or how it would be disposed of in the event that safe processing is not possible. DWR also recommends that TVA keep in mind that avoidance and minimization are the preferred design criteria when considering alternatives.
- DWR recommends that the Draft EIS specifically address the characterization of groundwater flow directions/paths. The level of water in the ash ponds represents high head conditions that currently influence groundwater flow and the dewatering of these ponds will influence flow conditions.
- DWR recommends that the Draft EIS specifically address wastewater treatment requirements for the remainder-of-plant functions needed prior to ash pond closure. TVA's operation, maintenance, and/or closure of CCR impoundments may affect the quality of surface waters receiving discharges from these sites. More specifically, DWR comments that TVA currently relies on these existing impoundments to provide wastewater treatment for ash sluice wastewater and multiple other wastewater sources.[5] The closure of these impoundments will require that TVA provide alternative uninterrupted wastewater treatment equivalent to the existing treatment prior to elimination of the existing impoundment. Existing NPDES permit limitations also require notification to TDEC prior to significant changes or increases the quantity of pollutants discharged.
- DWR recommends that the Draft EIS identify all actions required to obtain proper permits and a timeline for obtaining these permits.

The following TDEC program units have reviewed the notice of intent to prepare a Draft EIS and have no specific comments regarding the preparation of the Draft EIS at this time.

- Division of Archaeology (DoA)

[4] The removed material could be prepared for end use and stored until shipped off-site for reuse.

[5] These other wastewater sources include all or some of the following at each plant: coal pile runoff and coal conveyor drainage, filtrate from existing and proposed dewatering systems for flue gas desulfurization and bottom ash, red water seep discharges, precipitator area washdown and roof drains, boiler leakage, laboratory and analytical process wastewater, boiler blowdown, miscellaneous equipment cooling and lubrication water, floor washing wastes, air conditioning cooling water, ash system leakage and boiler bottom overflow, ammonia storage runoff, inactive ash pond leachate, chemical and nonchemical metal cleaning wastewaters, water treatment plant backwash, main station sump drainage, demineralizer reject waters, condensate, fire protection flushes, groundwater, and stormwater.

- Tennessee Geological Survey (TGS)
- Division of Remediation (DoR)
- Division of Radiological Health (DRH)
- Tennessee State Parks and Real Property Management
- Division of Underground Storage Tanks (UST)
- Division of Natural Areas (DNA)

Lastly, TDEC would like to reiterate the points it addressed in the Commissioner's Order issued to TVA on August 6, 2015. The Order is intended to establish a transparent, comprehensive process for the investigation, assessment, and remediation of unacceptable risks, resulting from the management and disposal of CCR at TVA's coal-fired power plants in Tennessee and to establish a process whereby TDEC will oversee TVA's implementation of the federal CCR rule to insure coordination and compliance with Tennessee laws and regulations governing the management and disposal of CCR.

TDEC appreciates the opportunity to comment on the notice of intent to prepare a Draft EIS. Please note that these comments are not indicative of approval or disapproval of the proposed action or its alternatives, nor should they be interpreted as an indication of all necessary permits that may be required from TDEC should action be taken. Please contact me should you have any questions regarding these comments.

Sincerely,

Michelle Walker Owenby
Assistant Commissioner of Policy and Planning
Phone: (615) 532-9668

cc: Chuck Head, TDEC, Senior Advisor, BOE
Joseph Sanders, TDEC, General Counsel
Lacey Hardin, TDEC, APC
Ron Zurawski, TDEC, TGS
Mark Norton, TDEC, DoA
Barry Brawley, TDEC, DoR
Jerry Bingaman, TDEC, DRH
Lisa Hughey, TDEC, DSWM
Bill Avant, TDEC, TSP
Michelle Pruett, TDEC, UST
Stephanie Williams, TDEC, DNA
Jim Sutherland, TDEC, DWR

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
NASHVILLE, TENNESSEE 37243-0435

ROBERT J. MARTINEAU, JR.
COMMISSIONER

BILL HASLAM
GOVERNOR

March 8, 2016

<u>Via First Class and Electronic Mail to arfarless@tva.gov</u>
Ashley Farless, PE, AICP
NEPA Compliance
Tennessee Valley Authority
1101 Market Street, BR4A
Chattanooga, TN 27402

Dear Ashley Farless:

The Tennessee Department of Environment and Conservation (TDEC) appreciates the opportunity to provide comments on the Tennessee Valley Authority (TVA) *Draft Programmatic Environmental Impact Statement for Ash Impoundment Closure* (Draft PEIS). The applicant, TVA, has prepared this Draft PEIS to address the closure of coal combustion residual (CCR) impoundments at its coal-fired power plants. In April 2015, the U.S. Environmental Protection Agency (EPA) established national criteria and schedules for the management and closure of CCR facilities. EPA purposefully structured its CCR Rule to encourage regulated entities to accelerate the closure of CCR impoundments because of the decrease in groundwater risk and increased structural stability that results from eliminating the hydraulic head of ponded water. TVA identified impoundments to close prior to the April 17, 2018 deadline. TVA has committed to managing all of its future CCR production in dry storage landfills, closing its existing wet CCR impoundments, and complying with the CCR Rule. The purpose of the PEIS is to address the potential impacts of closing CCR impoundments across the TVA system.

On August 6, 2015, the Tennessee Department of Environment and Conservation issued a Commissioner's Order (the Order) to the TVA directing the investigation, assessment and remediation of all coal ash disposal sites across Tennessee. The requirements of that Order are supplemental to the CCR rule. The Department recognized that TVA may, in compliance with the federal CCR rule requirements, elect to close CCR surface impoundments and/or landfills before the full extent of contamination at a site has been determined. However, the Department's Order made it clear that if TVA elects to do so, it may later be required by the Department's Order to take other and further remedial actions. The Department's review and comment on TVA's Draft PEIS shall not be deemed as an approval of actions required under the Order or as a waiver of any requirement of the Order.

Actions considered in detail within the Draft PEIS include:

- Alternative A – No Action Alternative[1] – Under the No Action Alternative, TVA will not close any of the ash impoundments at its coal fired power plants. The impoundments would continue to receive storm water and other process wastewaters. TVA will continue safety inspections of structural elements to maintain stability, and all impoundments will be subject to continued care and maintenance activities.
- Alternative B – Closure-in-Place – TVA would stabilize the CCR in place and install a cover system. It would take 10 to 95 months to close an impoundment in place, depending on its size, the distance to the cover system borrow area location, and the condition of the road network between the borrow location and impoundment being closed. Closure-in-Place involves a range of individual component actions that must be considered as part of the impact assessment process, including ensuring berm stability; considering opportunities for beneficial use of ash; lowering ash impoundment water levels; identifying temporary laydown areas and borrow areas; grading to consolidate CCR, reduce footprint, and promote site drainage; installing a cover system; installing or expanding a groundwater monitoring system; closure documentation; and post-closure care.
- Alternative C – Closure-by-Removal – TVA would excavate and relocate the CCRs from the ash impoundment in accordance with federal and state requirements to an approved on-site or off-site disposal facility. The duration of Closure-by-Removal projects will depend on a number of factors including, primarily, the amount of CCR material that will have to be removed from the impoundment and the amount of borrow material that will have to be moved to the site to fill in the excavated hole. TVA estimates that these projects would take 12 months to approximately 70 years to complete.

TDEC distributed the Draft PEIS across the department for review and comment. After review by the Bureau of Environment, the Bureau of Parks & Conservation, the Department has the following comments:

1. Air Pollution

- In Part I 3.1.2 "Environmental Consequences," of the Draft PEIS, TVA describes the potential for the proposed action and its alternatives to contribute to ambient particulate concentrations in areas where ambient concentrations of particulates are currently approaching the National Ambient Air Quality Standards (NAAQS). TDEC recommends TVA take all precautions to limit increasing particulate concentrations in order to prevent any possible threat to the particulate NAAQS.[2]
- TDEC recommends that TVA consider air quality impacts, specifically potential particulate or dust impacts,[3] associated with the proposed actions involving movement or relocation of CCR material or contaminated soils in the Final PEIS.
- TDEC recommends that TVA carefully monitor ambient air quality using existing nearby monitors and restrict certain activities or implement additional safeguards when monitoring indicates that NAAQS or

[1] TVA notes that the No Action Alternative is inconsistent with EPA's CCR Rule and TVA's plans to convert all of its wet CCR systems to dry systems.
[2] This might include additional measures beyond the BMPs mentioned in the Draft PEIS.
[3] It is further recommended that any air monitoring employed be selected based on the composition of the CCR involved and any toxicity associated with the components. At minimum this should include an evaluation for metals and particulates in the PM2.5 or smaller size range.

other accepted exposure levels are nearing exceedance levels. TVA can use this data to prevent actual exceedance or unacceptable exposures due to particulate matter both on and off site its CCR sites.[4]

- TDEC recommends that TVA place greater emphasis on the use of on-site air monitoring to confirm minimal air impacts anticipated or identified as likely to occur in the context of the proposed actions in the Final PEIS.[5]

2. Solid Waste Management

- TDEC notes that various waste materials may be generated from the use of onsite equipment during construction activities. This will occur for both closure of CCR sites in place and closure of CCR sites by removal. When solid waste is generated during closure activities, per TDEC regulations, TVA will be required to characterize the type of waste (solid waste or hazardous waste) to ensure the wastes are properly disposed or recycled in accordance with TDEC regulations. Additionally, in the event of any spills (fuel, lubricating oils, solvents or any other liquid waste), the contractor shall characterize the type of liquid spilled, report the spill to TDEC, and propose collection and cleanup of the liquid as required by TDEC regulations.
- In Part I, Table 1-2 "TVA Fleet-wide Coal-Fired Power Plants," the John Sevier Fossil Plant ash impoundment is identified as active. TDEC received a Notice of Intent (NOI) from TVA to begin closure of the impoundment, identifying the impoundment as currently inactive. TVA shall clarify the status of this impoundment in the Final PEIS.
- In Part I, Table 1-4 "Summary of CCR Impoundments Evaluated in Part II," TDEC observed that the Bull Run Fossil Plant and the Kingston Fossil Plant each have two impoundments with one impoundment at each plant smaller in size and volume than the other. For the purpose of completing a more comprehensive assessment, TDEC recommends that TVA consider the option of closure-by-removal of the smaller impoundment and closure- in-place of the larger impoundment at each CCR site in the context of the proposed actions in the Final PEIS.
- In Part I, Table 3-18 "Coal Combustion Residuals Generated by TVA from 2010-2013," TDEC recommends that TVA add 2014 data to the table, if available.
- In Part II, Table 2-1, "Summary and Comparison of Alternatives by Resource Area," TDEC recommends that TVA include additional information in Alternative C, closure-by-removal, for the Solid and Hazardous Wastes for the proposed actions for Allen Fossil Plant, John Sevier Fossil Plant, Bull Run Fossil Plant, and Kingston Fossil Plant in the Final PEIS. Alternative C would require off-site disposal at a regulated facility and both proposed facilities are located in Tennessee. TDEC recommends that TVA discuss disposal capacity, site tonnage caps (if applicable), and permitted hours of operation in the Final PEIS.
- In Part II, Table 1-1 "Summary of West Ash Impoundment Characteristics," for Allen Fossil Plant and John Sevier Fossil Plant, TDEC recommends that TVA include an explanation of why the two facilities require the same amount of Borrow Material, 15,000 yd., in the Final PEIS. The Allen Fossil Plant is 22

[4] Specifically, it is recommended that TVA consider how it will mitigate site-specific fugitive dust, including but not limited to mechanisms designed to prevent "track out" on heavy truck bodies/truck under carriages and/or wheel assemblies as they leave the site; application of dust suppressing agents or water and the use of temporary covering agents, and strategies for mitigating drying and consequent wind erosion and transport.
[5] The NAAQS criteria pollutants are referenced and should serve as a guide for comparison to any projected air quality impacts.

acres in size and the John Sevier Fossil Plant is 42 acres in size.[6] Given the size of the two plants, the amount of cover material proposed suggests the depth of soil cover at the John Sevier Fossil Plant site is significantly less.

- TVA is currently using temporary storage of CCR as an interim management method pending construction of new CCR facilities. TDEC recommends that TVA consider in the context of Alternative B, closure-in-place, in the Final PEIS the potential for beneficial reuse of CCR materials. Temporarily stored CCR material removed from an impoundment could be beneficially reused in regions where markets exist. The removed material could be prepared for end use and stored temporarily until shipped offsite for reuse. TVA should also document associated environmental impacts using this approach.
- TDEC recommends that TVA include strategies for mitigating subsurface geologic stability concerns such as solidification and treatment in place for groundwater contamination when closing a surface impoundment in place in Alternative B of the Final PEIS. Solidification could increase stability and create a better foundation for close-in-place components and increase construction loads during closure activities.
- TDEC recommends that TVA consider converting the excavations created by CCR removal into wetlands and/or flood storage in Alternative C, closure-by-removal, of the Final PEIS.

3. Water Resources

- TDEC believes that wastewater treatment will be required for all alternatives considered in the Draft PEIS. TVA should include general information about wastewater treatment and NPDES permitting requirements[7] when describing the proposed actions in the Final PEIS.

4. U.S. EPA CCR Regulation and TDEC Enforcement Action Overlap at TVA Fossil Plants

The CCR Closure requirements that TVA is required to meet to comply with the U.S. EPA CCR regulations overlaps with the responsibilities TVA must meet as a part of the Davidson County Chancery Court Action for the TVA Gallatin site and the TDEC/TVA Commissioner's Order for all other TVA Fossil Plants in Tennessee. The TVA Draft PEIS for Ash Impoundment Closure is designed to meet the EPA regulations while the TDEC enforcement orders require TVA to:

- Determine the areal and vertical extent of CCR material at each TVA Fossil Plant;
- Determine the extent of soil, surface water and ground water contamination associated with the CCR material at each TVA Fossil plant;
- Determine any environmental and/or public health threats posed by the CCR materials; and
- Develop and implement a Remedial Action and Risk Assessment Plan for each TVA Fossil Plant that resolves the environmental and public health threats the CCR material may pose.

[6] The relationship between size of the facility (acres) and borrow material required (cubic yards) is depth of soil cover; a component of the closure profile.
[7] General information could include: 1) TVA is drafting renewal applications for NPDES permits that will address wastewater treatment for the entire plant site and discharges during pond closure. 2) These permit renewals will focus in greater detail on wastewater discharges than is in the Draft PEIS, which focuses only on pond closure methodologies.

TVA may choose pursue CCR impoundment closure-in-place at any of its Fossil Plants. However, should TVA begin CCR surface impoundment closures at any of its Tennessee Fossil Plants and TDEC subsequently determines based on soil, surface water, ground water and/or geologic instability that closure is place is not protective of public health and/or the environment, then TDEC shall require TVA to commence appropriate corrective action including removal of CCR surface impoundments where TVA has begun or completed closure-in-place.

TDEC appreciates the opportunity to comment on this Draft PEIS. Please note that these comments are not indicative of approval or disapproval of the proposed action or its alternatives, nor should they be interpreted as an indication regarding future permitting decisions by TDEC. Please contact me should you have any questions regarding these comments.

Sincerely,

Dr. Kendra Abkowitz
Director of Policy and Planning
Phone: (615)-532-8689

cc: Barry Brawley, TDEC, DoR
Jerry Bingaman, TDEC, DRH
Michelle Pruett, TDEC, UST
Stephanie A. Williams, TDEC, DNA
Mark Norton, TDEC, DoA
Ron Zurawski, TDEC, TGS
Bill Avant, TDEC, TSP
Lacey Hardin, TDEC, APC
Chuck Head, TDEC, BOE
Lisa Hughey, TDEC, DSWM
Joseph Sanders, TDEC, OGC
James Sutherland, TDEC, DWR
Barry Turner, Environmental Division, Office of the Attorney General
Emily Vann, Environmental Division, Office of the Attorney General

TENNESSEE HISTORICAL COMMISSION
STATE HISTORIC PRESERVATION OFFICE
2941 LEBANON ROAD
NASHVILLE, TENNESSEE 37243-0442
OFFICE: (615) 532-1550
www.tnhistoricalcommission.org

Received 4/22/16

April 18, 2016

Mr. Clinton Jones
Tennessee Valley Authority
400 West Summit Hill Drive
Knoxville, Tennessee 37902

RE: TVA, ASH IMPOUNDMENT CLOSURES, UNINCORPORATED, MULTI COUNTY

Dear Mr. Jones:

The Tennessee State Historic Preservation Office has reviewed the above-referenced undertaking for compliance by the participating federal agency or applicant for federal assistance with Section 106 of the National Historic Preservation Act. The Procedures for implementing Section 106 of the Act are codified at 36 CFR 800 (Federal Register, December 12, 2000, 77698-77739).

After considering the documentation submitted, we concur that there are no National Register of Historic Places listed or eligible properties affected by this undertaking. This determination is made either because of the location, scope and/or nature of the undertaking, and/or because of the size of the area of potential effect; or because no listed or eligible properties exist in the area of potential effect; or because the undertaking will not alter any characteristics of an identified eligible or listed property that qualify the property for listing in the National Register or alter such property's location, setting or use. Therefore, this office has no objections to your proceeding with the project.

If your agency proposes any modifications in current project plans or discovers any archaeological remains during the ground disturbance or construction phase, please contact this office to determine what further action, if any, will be necessary to comply with Section 106 of the National Historic Preservation Act. You may direct questions or comments to Jennifer M. Barnett (615) 741-1588, ext. 105. This office appreciates your cooperation.

Sincerely,

E. Patrick McIntyre, Jr.
Executive Director and
State Historic Preservation Officer

EPM/jmb

Dudley, Cynthia S

From:	Shuler, Marianne M
Sent:	Thursday, April 28, 2016 3:36 PM
To:	'sheila-bird@cherokee.org'; 'Eric Oosahwee-voss'; 'Tyler B. Howe (tylehowe@nc-cherokee.com)'; 'HPO@chickasaw.net'; 'Llangley@coushatta.org'; 'AQhpo@mail.com'; 'celestine.bryant@actribe.org'; 'Section106'; 'dc13.dc4@gmail.com'; 'thpo@tttown.org'; 'Thrower, Robert (rthrower@pci-nsn.gov)'; 'Ken Blanchard (kblanchard@astribe.com)'; 'Robin Dushane (RDushane@estoo.net)'; 'Kim Jumper (kim.jumper@shawnee-tribe.com)'; 'Natalie Harjo (harjo.n@sno-nsn.gov)'
Cc:	Ezzell, Patricia Bernard; 'Russell Townsend (RussellT@nc-cherokee.com)'; 'Leonard Longhorn (llonghorn@astribe.com)'; 'Dee Gardner (dgardner@estoo.net)'
Subject:	TVA-Ash Impoundment Closures Colbert & Jackson Co, AL 4-28-16
Attachments:	TVA-Alabama EIS Ash Impoundment; Colbert and Jackson Co AL 20160428.pdf

Good Afternoon
By this email, I am sending the attached letter regarding TVA's proposal to close coal combustion residual (CCR) impoundments in Colbert and Jackson Co, Alabama (Colbert and Widows Creek Fossil Plants).

TVA has also prepared a draft Ash Impoundment Closure Environmental Impact Statement (EIS) that can be viewed at:
https://www.tva.com/Environment/Environmental-Stewardship/Environmental-Reviews/Closure-of-Coal-Combustion-Residual-Impoundments

Please let me know if you have any questions or comments by May 28th, 2016.

Thanks
Marianne

Marianne Shuler
Archaeologist
TVA Biological & Cultural Compliance
865-632-2464
mmshuler@tva.gov

Tennessee Valley Authority, 400 West Summit Hill Drive, Knoxville, TN 37902

April 28, 2016

To Those Listed:

TENNESSEE VALLEY AUTHORITY (TVA) ASH IMPOUNDMENT CLOSURES IN COLBERT AND JACKSON COUNTIES, ALABAMA.

The Tennessee Valley Authority (TVA) proposes to close coal combustion residual (CCR) impoundments at six of its coal-fired power plants (John Sevier Fossil Plant (JSF), Bull Run Fossil Plant (BRF), Widows Creek Fossil Plant (WCF), Colbert Fossil Plant (COF), Allen Fossil Plant (ALF), and Kingston (KIF) (Undertaking) to assist TVA in complying with the CCR Rule issued by the United States Environmental Protection Agency on April 17, 2015 (80 Federal Register 21302) (Undertaking) and in keeping with TVA's 2009 outlined plan to eliminate wet storage of CCRs at its plants and convert all wet fly ash, bottom ash, and gypsum operations to dry storage (Figure 1). TVA is considering two alternatives: Closure in Place and Closure by Removal. For both alternatives, TVA determined the area of potential effects (APE) to be limited to the area of disturbance, including the impoundment area and any associated laydown areas. For Closure in Place, all fill will come from an existing commercial source. For Closure by Removal, the CCR removed will be placed in an existing permitted landfill. All access roads associated with the Undertaking are existing roads. The proposed undertaking would have no visual changes to the landscape and therefore would have no visual effect.

TVA has also prepared a draft Ash Impoundment Closure Environmental Impact Statement (EIS) that can be viewed at:

https://www.tva.com/Environment/Environmental-Stewardship/Environmental-Reviews/Closure-of-Coal-Combustion-Residual-Impoundments.

The ash impoundments themselves have not been considered individually eligible for listing on the NRHP, since being less than 50 years in age or as contributing elements for those plants considered eligible for listing on the NRHP. All work associated with the undertaking would be confined to the impoundment areas themselves and in selected temporary laydown areas. The laydown areas for the two fossil plants are located in areas that are previously surveyed or are in previously disturbed areas.

- **WCF** (85°45'38.883"W 34°53'25.436"N) (Figures 2 and 3)
  Laydown area will be located within the footprint of previously disturbed Ash Impoundment Complex, and no historic properties would be affected.

- **COF** (87°51'15.885"W 34°44'5.94"N) (Figures 3 and 4)

Tennessee Valley Archaeological Research is currently conducting a Phase I archaeological project for TVA for the proposed COF Decommissioning project and future Section 106 consultation. The proposed laydown area is located within this larger APE. The report for the larger Phase I survey is currently being drafted. Two shovel tests were placed within the laydown area (STP565 and STP569). ST569 was terminated at 54 cmbs surface and characterized by 7.5YR 2.5/1 black, sandy, loam soils. The shovel test was terminated due to hitting the water table. STP565 was excavated until hitting subsoil at 20 cmbs and was characterized as 7.5 YR 3/4 dark, brown, silty clay (0-7 cmbs) and 5 YR 4/6 yellowish, red clay. The rest of the laydown area was not shovel tested, due to obvious grading and disturbance associated with the construction of the ash impoundment. All work will be confined to previously disturbed or surveyed areas, where no historic properties were identified. TVA finds that the Undertaking would have no effect on historic properties.

Pursuant to 36 C.F.R. Part 800.3(f)(2), TVA is consulting with the following federally recognized Indian tribes regarding historic properties within the proposed project's APE that may be of religious and cultural significance and are eligible for the NRHP: Cherokee Nation, Eastern Band of Cherokee Indians, United Keetoowah Band of Cherokee Indians, Chickasaw Nation, Coushatta Tribe of Louisiana, Alabama-Quassarte Tribal Town, Alabama Coushatta Tribe of Texas, Muscogee (Creek) Nation of Oklahoma, Kialegee Tribal Town, Thlopthlocco Tribal Town, Poarch Band of Creek Indians, Absentee Shawnee Tribe of Oklahoma, Eastern Shawnee Tribe of Oklahoma, Shawnee Tribe and the Seminole Nation of Oklahoma.

By this letter, TVA is providing notification of these findings and is seeking your comments regarding any properties that may be of religious and cultural significance and may be eligible for listing in the NRHP pursuant to 36CFR § 800.2 (c)(2)(ii), 800.3 (f)(2), and 800.4 (a)(4)(b).

Please respond by May 28th, 2016, if you have any comments on the proposed undertaking. If you have any questions, please contact me at (865)632-6461 or by email at pbezzell@tva.gov.

Sincerely,

Pat Bernard Ezzell

Patricia Bernard Ezzell
Senior Program Manager
Tribal Relations and Corporate Historian
Communications
WT 7D-K

MMS:CSD

IDENTICAL LETTER MAILED TO THE FOLLOWING ON APRIL 28, 2016:

Ms. Sheila Bird
Cherokee Nation
Post Office Box 948
Tahlequah, Oklahoma 74465

Mr. Ken Blanchard
Tribal Historic Preservation Officer
Absentee Shawnee Tribe of Oklahoma
2025 S. Gordon Cooper
Shawnee, Oklahoma 74801

cc: Mr. Leonard Longhorn
Absentee Shawnee Tribe of Oklahoma
2025 S. Gordon Cooper
Shawnee, Oklahoma 74801

Ms. Karen Brunso
Tribal Historic Preservation Officer
Division of Historic Preservation
Department of Culture & Humanities
The Chickasaw Nation
Post Office Box 1548
Ada, Oklahoma 74821-1548

Ms. RaeLynn Butler
Tribal Historic Preservation Officer
Muscogee (Creek) Nation
P.O. Box 580
Okmulgee, Oklahoma 74447

Mr. Bryant Celestine
Tribal Historic Preservation Officer
Alabama-Coushatta Tribe of Texas
571 State Park Rd. 56
Livingston, Texas 77351

Mr. David Cook
Tribal Administrator
Kialegee Tribal Town
Post Office Box 332
Wetumka, Oklahoma 74883

Ms. Robin DuShane
Tribal Historic Preservation Officer
Eastern Shawnee Tribe of Oklahoma
127 West Oneida
Seneca, Missouri 64865

cc: Ms. Dee Gardner
NAGPRA/Cell Tower Coordinator
Eastern Shawnee Tribe of Oklahoma
127 West Oneida
Seneca, Missouri 64865

Ms. Natalie Harjo
Tribal Historic Preservation Officer
Seminole Nation of Oklahoma
Post Office Box 1498
Wewoka, Oklahoma 74884

Mr. Tyler Howe
Tribal Historic Preservation Specialist
Historic Preservation Specialist
Eastern Band of Cherokee Indians
Post Office Box 455
Cherokee, North Carolina 28719

cc: Mr. Russell Townsend
Tribal Historic Preservation Officer
Eastern Band of Cherokee Indians
Post Office Box 455
Cherokee, North Carolina 28719

Ms. Kim Jumper
Tribal Historic Preservation Officer
Shawnee Tribe
Post Office Box 189
Miami, Oklahoma 74355

Dr. Linda Langley
Tribal Historic Preservation Officer
Coushatta Tribe of Louisiana
P.O. Box 10
Elton, Louisiana 70532

Eric Oosahwee-Voss
Tribal Historic Preservation Officer
United Keetoowah Band of Cherokee Indians in Oklahoma
Post Office Box 1245
Tahlequah, Oklahoma 74465

cc: Karen Pritchett
United Keetoowah Band of Cherokee Indians in Oklahoma
Post Office Box 1245
Tahlequah, Oklahoma 74465

Ms. Samantha Robison
Tribal Historic Preservation Officer
Alabama-Quassarte Tribal Town
PO Box 187
101 East Broadway
Wetumka, OK 74883

Mr. Emman Spain
Thlopthlocco Tribal Town
Tribal Historic Preservation Officer
P.O. Box 188
Okemah, Oklahoma 74859

Mr. Robert Thrower
Tribal Historic Preservation Officer
Poarch Band of Creek Indians
5811 Jack Springs Road
Atmore, Alabama 36502

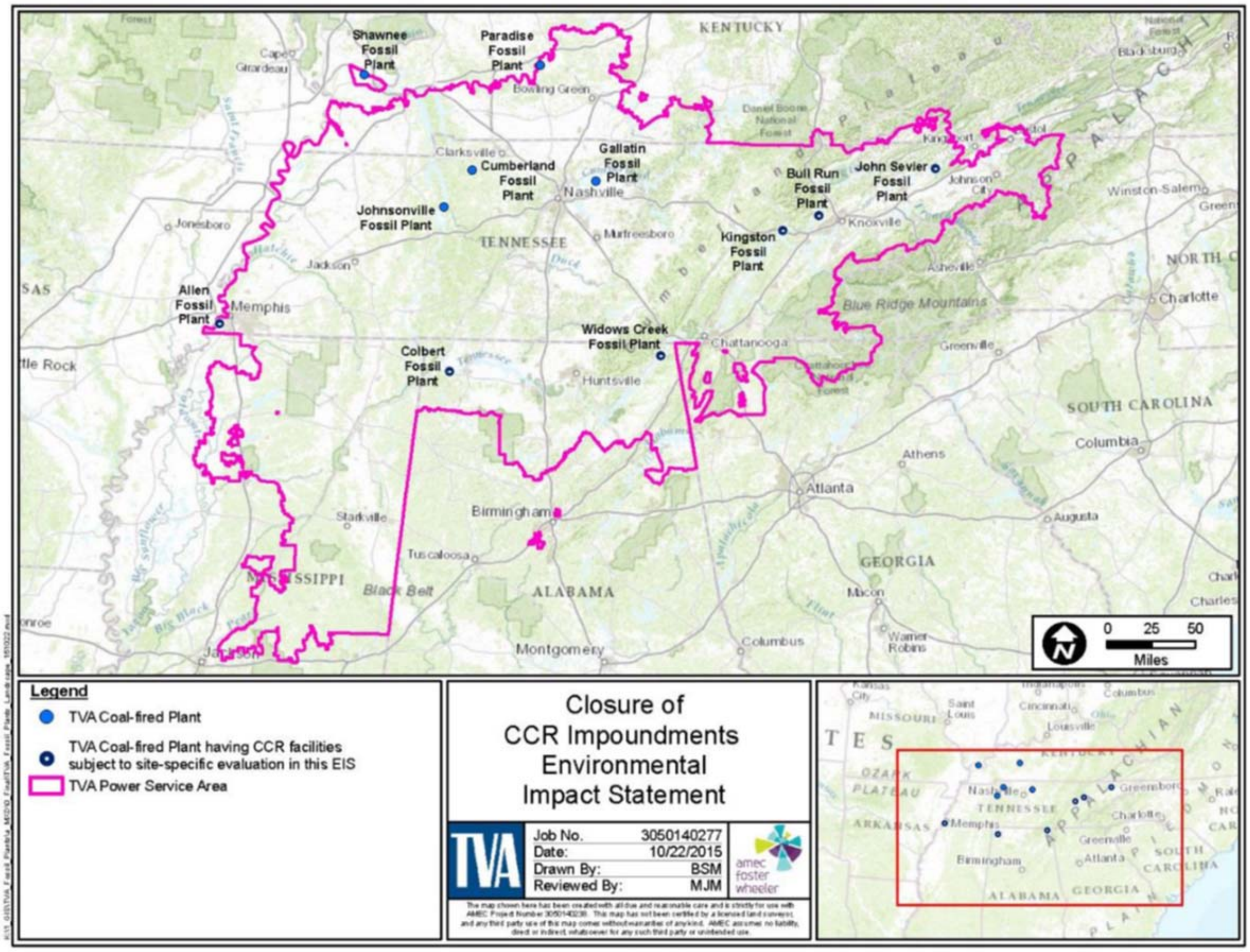


Figure 1: Location of the fossil plants subject to the CCR Impoundment EIS

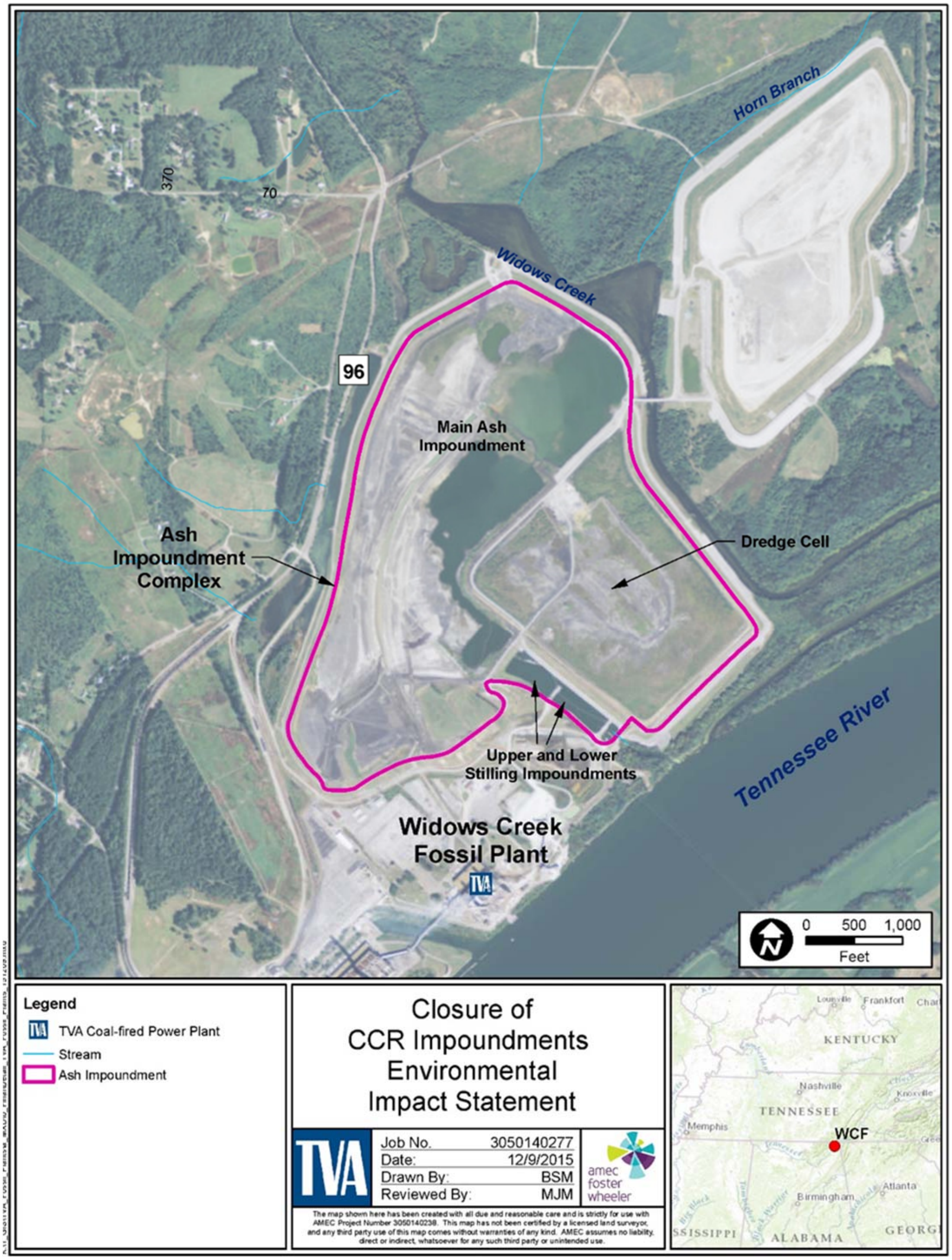


Figure 2: Aerial Photograph of Widows Creek Fossil Plant and Potential Laydown Area

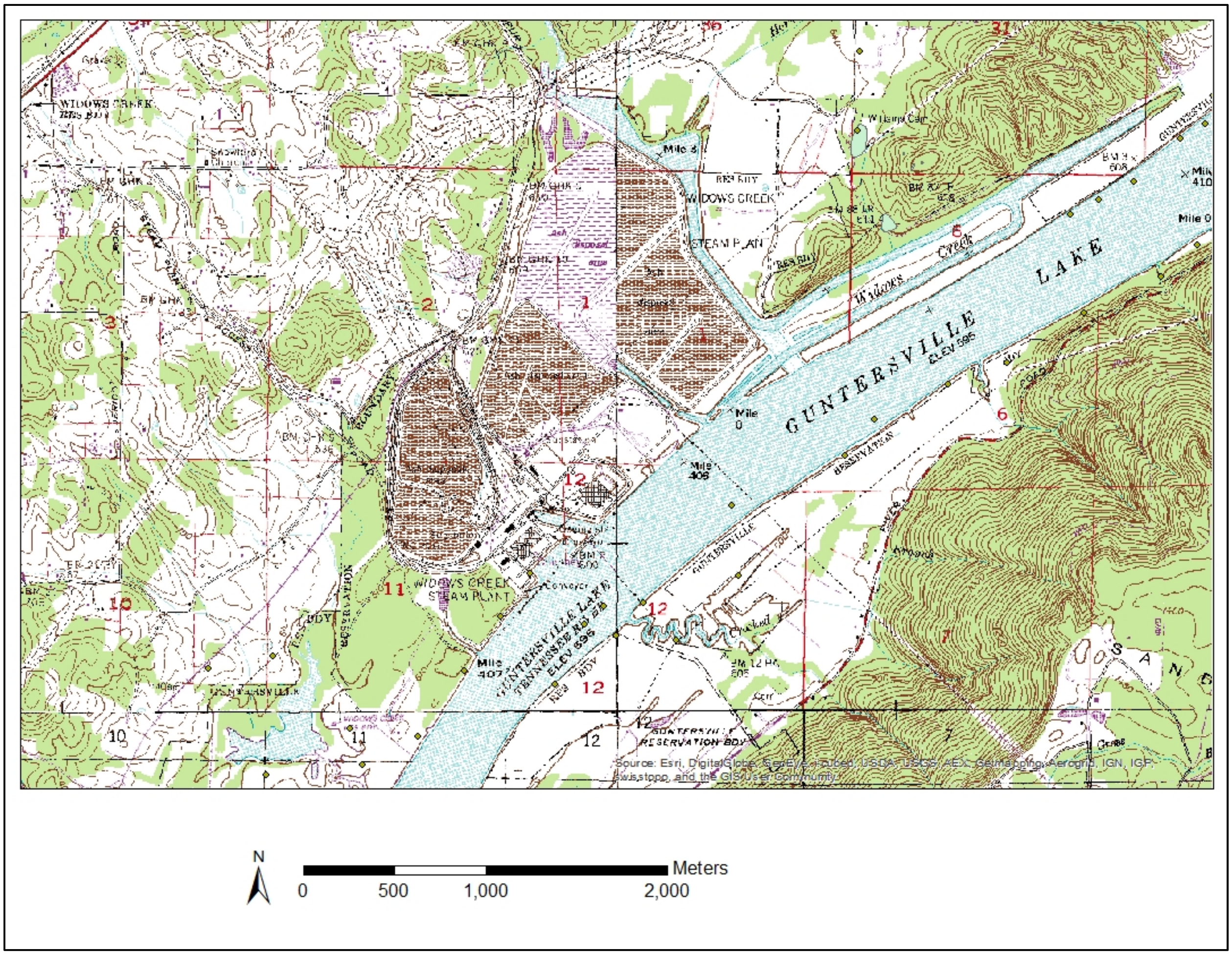


Figure 3: 7.5' Quadrangle depicting the WCF complex

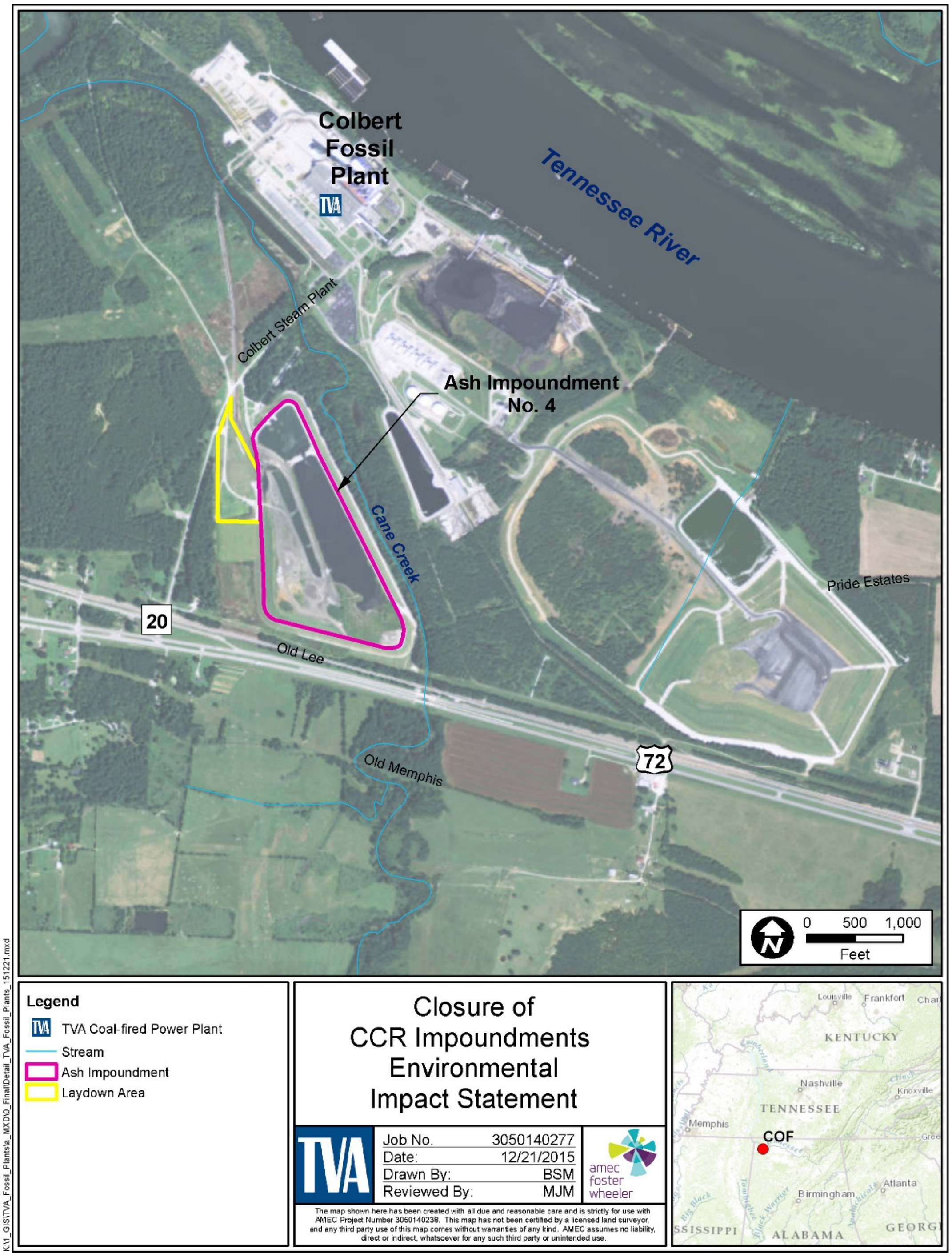


Figure 4: Aerial Photograph of Colbert Fossil Facility and Proposed Laydown Area

INTERNAL COPIES:

Michelle Cagley, KFP 1T-KST
Ashley Farless, BR 4A-C
Amy Henry, WT11D-K
Susan Jacks, WT11C-K
Skip Markham, BR 4A-C
Emily Willard, MR 4G-C
ECM, WT CA-K

UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET, S.W.
ATLANTA, GEORGIA 30303-8960

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE, $300

N METRO
GA 301
07 MAR '16
PM 2 1

U.S. POSTAGE PITNEY BOWES
ZIP 30303 $ 00
02 1W
0001387202 MAR

Ms. Amy B. Henry
Manager, NEPA & Valley Projects,
Environment
Tennessee Valley Authority
400 West Summit Hill Drive, WT11d
Knoxville, Tennessee 37902

37902141999

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

MAR 07 2016

Ms. Amy B. Henry
Manager, NEPA and Valley Projects, Environment
Tennessee Valley Authority
400 West Summit Hill Drive, WT11
Knoxville, Tennessee 37902

Re: Draft Programmatic Environmental Impact Statement (DPEIS) for Ash Impoundment Closure (Part 1- Programmatic NEPA Review); ERP TVA-E09819-00; CEQ No: 20150369

Dear Ms. Henry:

The U. S. Environmental Protection Agency has reviewed the referenced document in accordance with Section 309 of the Clean Air Act and Section 102(2)(C) of the National Environmental Policy Act (NEPA). The purpose of this Draft Programmatic Environmental Impact Statement (DPEIS) is to address the closure of coal combustion residuals (CCR) impoundments at the Tennessee Valley Authority's (TVA's) coal-fired power plants. Part II of the DPEIS consists of six site specific NEPA reviews and closure plans that involve the following fossil plant facilities: Widows Creek, John Sevier, Kingston, Colbert, Bull Run, and Allen. The Widows Creek Fossil Plant is located in Alabama and the other five facilities are located in Tennessee.

Coal combustion residuals (CCR) are byproducts produced from burning coal and include fly ash, bottom ash, boiler slag, and flue gas desulfurization materials. In 2009, the TVA outlined a plan to eliminate wet storage of CCR at its plants and convert all wet fly ash, bottom ash, and gypsum operations to dry storage. The EPA has reviewed both parts of the DPEIS including the site specific closure plans and is providing technical review comments on the potential environmental impacts of closing CCR impoundments across the TVA system and at the six specific fossil plants (See enclosure). For the six facilities that the DPEIS included specific NEPA reviews, the TVA has identified Alternative B, Closure-in-Place, as its preferred alternative.

The EPA has rated this DPEIS as "LO"– or Lack of Objections. The EPA has not identified any significant environmental impacts to the proposed action that would require substantive changes to the DPEIS or require the TVA's consideration of different alternatives for the site specific closure plans. The EPA has identified several issues from our review of the DPEIS including water discharges and water quality, environmental justice, climate change, and waste management. The EPA recommends that these issues be more fully explored in the Final PEIS (FPEIS) that could enhance the TVA's overall closure process.

The EPA also appreciates the opportunity provided by the TVA to meet and discuss the DPDEIS and the proposed closure projects on January 27, 2016. If you wish to discuss this matter further, please contact Larry O. Gissentanna at (404) 562-8248 or gissentanna.larry@epa.gov of the NEPA Program Office.

Sincerely,

Alan Farmer

G. Alan Farmer
Director
Resource Conservation and Restoration Division

Enclosure

Enclosure
Detailed Comments
Tennessee Valley Authority
Draft Programmatic Environmental Impact Statement (DPEIS) for Ash Impoundment Closure;
CEQ No: 20150369

Water Quality and Permitting:

The DPEIS should include a detailed description of the decanting operations that will occur prior to closure-in-place and closure-by-removal. Specifically, the document should address any applicable dam safety regulations to avoid instability during draw-down of the ash pond water. Decanting may not be appropriate under existing National Pollution Elimination Discharge System (NPDES) permits without complying with additional safeguards.

Recommendation: The TVA should consult with the State permitting authority prior to decanting to ensure that the proposed activities are compliant with NPDES requirements.

For those TVA facilities that will have closure by removal of the CCR, the final NEPA document should include a discussion regarding the management of leachate from the final disposal site (e.g., landfill).

Recommendation: If any leachate from the off-site landfill is to be collected and sent to a domestic wastewater treatment plant for treatment prior to discharge, the FPEIS should address the adequacy of treatment for dissolved metals at the receiving domestic treatment facility under this potential alternative.

The DPEIS generally discusses seepages from the coal ash impoundments (pages 66, 68, and 69).

Recommendation: The EPA suggests that the TVA provide a more detailed discussion on seepages from ash ponds that reach surface waters in the FPEIS. Specifically, the TVA should discuss how and what plans are being considered to eliminate or obtain permits for known or potential seepages of pollutants from the ash ponds under all the alternatives (i.e., No Action, Closure-in-Place, and Closure-by-Removal). For the Closure-in-Place and Closure-by-Removal alternatives, the FPEIS might also address potential seepages that occur prior to closure of the ash ponds and any potential seepages that will remain after the ash ponds are permanently closed.

Environmental Justice:

The EPA recognizes that the TVA is providing public meetings for residents that live near the actual power plants evaluated under the DPEIS.

Recommendation: The EPA suggests that the TVA also conduct public meetings for citizens that live in the areas near any final ash disposal sites under consideration.

The EPA notes that in Chapter 6 – EIS Recipients, Part I, some of the United South and Eastern Tribes, Inc. (USET) tribes in the Southeast have been included in the notifications from TVA and some other USET tribes may not have been notified.

Recommendation: The TVA might also consider including the USET tribal consortium (located in Nashville, Tennessee) in future notices of availability of EIS documents.

Climate Change and Greenhouse Gas (GHG) Emissions:

The EPA acknowledges that the TVA referenced a study to characterize potential emissions levels of greenhouse gases (GHG) relative to each of the alternatives. The TVA did not quantify the GHG emissions for activities associated with Alternative B, (Closure-in-Place) and Alternative C (Closure-by-Removal).

Recommendation: The EPA recommends that the FPEIS provide estimates of the GHG emissions associated with these alternatives and include an analysis of reasonable alternatives and/or practicable mitigation measures to reduce project-related GHG emissions. Example tools for estimating and quantifying GHG emissions can be found on Council of Environmental Quality's NEPA.gov website. The estimated GHG emissions can serve as a reasonable proxy for climate change impacts when comparing the proposal and the alternatives under consideration.

Waste Management:

The DPEIS references the CCR Rule in numerous places. The CCR constitutes a self-implementing program enforceable through the Resource Conservation and Recovery Act (RCRA) citizen suit provision and by States using their independent regulatory authority.

Recommendation: The EPA suggests that the public should be made aware and/or reminded of this issue via the TVA's planning documents and/or at appropriate future venues. The EPA also requests that a link be provided: e.g., http://www.ecfr.gov/cgi-bin/text-idx?SID=41b28bf16f6ebc9d2aa8e7dc2aaf2854&mc=true&node=pt40.25.257&rgn=div5, in the FPEIS, where appropriate. For future NEPA documents, the TVA may also wish to consider the inclusion of an appendix that summarizes the key provisions of the 40 CFR Part 257 regulations as it pertains to future TVA NEPA documents. Because the CCR Rule is fairly new (i.e., published in the Federal Register on April 17, 2015), the TVA may also wish to include additional information that can be used as a quick reference that is readily available for citizens, stakeholders, and other interested parties.

The TVA's descriptions of likely actions under Alternative C, Closure-by-Removal, seems to indicate that only RCRA Subtitle D Municipal Solid Waste Landfills (MSWLFs) would be considered by TVA as CCR disposal facilities. Recently, the EPA Region 4 office, has addressed issues in more than one southern State involving the potential conversion of (non-coal) mining pits and non-MSWLF state-permitted landfills into lined solid waste management units that could accept CCR. There has been some confusion on the part of citizens, local governments, and others pertaining to the specific requirements for these facilities.

Recommendation: For any facilities (excluding state-permitted MSWLFs), that intend to receive/dispose of CCR generated at the TVA facilities, in addition to meeting state requirements, the permittee would also be subject to the applicable provisions of the CCR Rule. The EPA understands that TVA is fully aware of the minimum criteria for siting, designing, constructing, reporting, and operating solid waste management facilities that can receive CCR. The TVA may wish to emphasis and disclose the additional requirements for non-MSWLFs receiving CCR in future NEPA documents so as to better inform the public and other stakeholders.

Recommendation: For any facilities (excluding state-permitted MSWLFs), that intend to receive/dispose of CCR generated at the TVA facilities, in addition to meeting state requirements, the permittee would also be subject to the applicable provisions of the CCR Rule. The EPA understands that TVA is fully aware of the minimum criteria for siting, designing, constructing, reporting, and operating solid waste management facilities that can receive CCR. The TVA may wish to emphasis and disclose the additional requirements for non-MSWLFs receiving CCR in future NEPA documents so as to better inform the public and other stakeholders.