1 Master Closure Strategy
   • What is a Master Closure Strategy?
   • What are the benefits of incorporating a Master Closure Strategy?
   • What are the elements of a successful Master Closure Strategy?

2 Implementing a Master Closure Strategy
   • Developing a Master Closure Strategy
   • Implementing a Master Closure Strategy

3 Significance of Master Closure Strategy

4 Summary
Master Closure Strategy

Definition

01 A Master Closure Strategy is an integrated plan for long-term management of Units at a Power Plant (Facility)
   - Long-term management may include closure of some or all Units (landfills and/or impoundments) or entire Facilities

02 A Master Closure Strategy should consider all aspects of long-term management.
   - Planning and Scheduling
   - Design
   - Construction
   - Compliance with new CCR Regulations

03 A Master Closure Strategy is a “living document” and should be updated as needed
A Master Closure Strategy can assist in complying with the new CCR Rules

- Highlight key closure dates for CCR Units
- Identify method of closure (closure in place, clean closure, retrofit)
- Identify when key impacts may result in change (or when impact needs to be defined)
  - Triggers for closure
  - Groundwater impacts
- Developed into cost impacts
- Assessing holistically for a facility helps to consider entire facility operation
A Master Closure Strategy is necessary for:

- Effective communication
- Maintaining schedule
- Optimizing efficiency and safety
- Reducing cost
- Minimizing disruption to Facility operations
- Compliance with regulations
A Master Closure Strategy should include the following

01 Clear definition of Facility objectives, goals and constraints
   – Objectives may change depending on regulations, future decisions, fuel prices, and other factors

02 Discussion of environmental / regulatory compliance

03 Analysis of design alternatives (for improvement or closure)

04 Preliminary planning

05 Scheduling of design and subsequent construction for each Facility
   – Milestone schedules and identification of critical path activities
Definition of Facility Objectives, Goals and Constraints should include:

01 Life of Facility Fleet
02 Remaining life of Unit
03 Identifying Goals and Constraints may drive closure decisions

**Goals**
- Conversion to dry disposal
- Construction of new Unit
- Increase Beneficial Use options
- Impoundment closures

**Constraints**
- Time
- Available property
- Environmental impacts
- Regulatory Compliance
- Some units may need to remain open
- Construction coordination with existing operations
- Resources (soil and labor)
- Construction coordination with existing operations
Master Closure Strategy
Elements of Success

01 It is imperative to plan for Environmental / Regulatory Compliance
   • Need to consider permitting time and background work (i.e. subsurface investigations, work plan development…etc)

02 Typically there is a need to comply with multiple regulations and consider potential environmental constraints:
   • New CCR regulations
   • Existing State Regulations
   • 401/404 Permitting
   • SWPPP Permitting
   • NEPA Permitting
   • NPDES Permits
   • Impacts to neighboring properties—haul routes, dust mitigation
Master Closure Strategy
Elements of Success

03 **Need to revisit regulatory compliance throughout the life of the Master Closure Strategy**

04 **Analysis of Design Alternatives (for improvement or closure)**
   - Develop several design alternatives
   - Preliminary economic analysis of alternatives
   - Risk analysis of alternatives
   - Selection of chosen design alternative
   - Preliminary design of alternative
05 Preliminary Planning  
– A Management Tool

• Soil resources and availability are often key  
  (a borrow study may be required)

• Evaluate schedule and key planning milestones

• Develop a priorities list

• Identify potential red flags for early resolution

• Conduct workshop
Master Closure Strategy

Elements of Success

06 Scheduling of design and subsequent construction for each Facility

07 Scheduling all phases is critical for success

End of wet disposal

1 to 2 years (½ to 2+ years)

Design of Closure → Construction

Dry CCR Handling

2 ½ to 3 years

New Wastewater Treatment

3 to 4 years

New Solid Waste Disposal Facility & Haul Road

3 ½ to 5 ½ years

These tasks, while each having their own schedules, are VERY interdependent and should be executed together.
Master Closure Strategy

Flowchart

- **Bottom Ash Pond**
  - Design Closure
  - Future Material to New Landfill

- **Fly Ash Pond**
  - Dewatering Facility Construction Complete
  - Plant Flows
  - New Leachate Flows
  - Design Repurposing to accept stormwater from capped Fly Ash and Bottom Ash Ponds

- **Stilling Pond**
  - Design Closure
  - Future Material to New Landfill

- **Haul Road Construction**

- **Install Scrubbers**

- **New Landfill**
  - Closure
  - Repurpose as material staging area

- **Coal Yard**
  - Chemical Pond
  - Other Facilities

- **Wastewater Treatment Facility**

- **Plant Flows**

- **New CCP Leachate**

- **Dry Commingled Fly Ash and Gypsum**
Master Closure Strategy
Development

01 Assemble a Joint Project Team (JPT):
02 Complete a Key Drivers Assessment- review the “Elements of Success”
03 Conduct a Workshop
04 Document decisions and path forward
01 Assemble a Joint Project Team (JPT)

- Facility personnel
- Facility engineers
- Facility construction team
- Regulatory experts
- Consultants
- Legal team (as needed)
- Public relations personnel (as needed)

Communication is key to implementation and success
02 Complete a Key Drivers Assessment- review the “Elements of Success”

- Most effective with a few members of the JPT

- Assessment will increase effectiveness of Workshop
  - Review the “Elements of Success”
  - Discuss possible alternatives for closure of Units
    - In-place closure, clean closure, phased closure, innovative closure (repurposing)
    - Preliminary economic analysis
    - Risk analysis

- Select chosen alternatives to present at Workshop

Key Drivers
- Regulatory
- Project
- Site Constraints
- Others
03 Conduct a Workshop

04 Document Decisions

Elements of Success
- Facility Objectives, Goals, & Constraints
- Environmental/Regulatory Impacts
- Design Alternative Analysis
- Preliminary planning
- Scheduling
- Identifying key milestone dates

- Develop Conceptual Schedule
- Select Chosen Alternative for Units
- Discussion of Alternatives for Success
- Revisit the "Elements of Success" with the entire JPT
- Most effective development strategy
Master Closure Strategy
Implementation

01 Develop selected alternative for each Facility
- Conduct borrow study if needed
- Design development
  - Type of Closure- phased, complete, partial, clean
  - Consider relationship to existing Units
- Environmental permits / regulatory document development
- Cost Estimating
- Detailed Schedule Development

02 Revisit as needed for Facility operational changes, regulatory updates etc.
- May require modifications to schedule and/or design

03 Meet regularly to track schedule and progress
Master Closure Strategy
Typical Timeline: Closure of Facility

Basic Steps for Final Closure Design / Permitting

- Conceptual Design
- Internal Funding Allocation
- Site Investigation
- Development of Construction Work Plan
  - Design Drawings
  - Specifications
  - Contract Documents
- Permitting
  - NPDES Modifications
  - Storm Water Construction
  - Permit (SWP3)
- CCR Compliance

Typical Construction Duration varies between 6 months and 2+ years
Total Project Length: 1 to >2 years
Advanced planning / Scheduling is especially critical if a new facility is needed.

Prior to the start of final unit closure, a new dry landfill will need to be:

- Sited
- Permitted
- Constructed
- Operational

CCR Compliance

Typical Timeline: New Facility

- **End of wet disposal**: 6 to 18 months
- **Hydrogeological / Geotechnical Investigation**: 6 months
- **Construction Work Plan Development**: 6 months
- **Permit Level Engineering**: 6 to 12 months
- **Permitting – Solid Waste, NPDES, Air, etc.**: 6 to 12 months
- **Construction Work - Initial Phase and Associated Infrastructure**: 18 to 24 months
- **Total Project Length**: 3 ½ to 5 ½ years

End of wet disposal
Master Closure Strategy
Development and Implementation

- Assemble JPT
- Frequent Regular Communication is Key to Successful Implementation!!!
- Discuss operational + regulatory changes

*Elements of Success
- Facility Objectives, Goals, & Constraints
- Environmental/Regulatory impacts
- Design Alternative Analysis
- Preliminary planning
- Scheduling
- Documentation

- Complete Key Drivers Assessment
  - Regulatory
  - Project
  - Site Constraints
  - Other

- Data Gathering
- Investigation (opt)
- Alternative Evaluation
- Red Flag Study

- Select Alternatives
- Develop Facility-wide Schedule
- Document Decision
- Assess Schedule
- Progress Meetings
- Modify Engineering

- Engineering + Permitting
- Substantial Completion
- Finalize Engineering + Permitting
- Create Bid Documents
- Construct

*Elements of Success
- Facility Objectives, Goals, & Constraints
- Environmental/Regulatory impacts
- Design Alternative Analysis
- Preliminary planning
- Scheduling
- Documentation

- Conduct Workshop
Master Closure Strategy
Significance

01 Environmental and Permitting Compliance
   • Adherence to permits and environmental standards
   • Avoidance of permit violations

02 Coordination of closures with O&M improvements
   • Reduction in maintenance issues (time & money)
   • Efficient Operations

03 Proper Planning results in effective compliance with design
   • Site performance consistent with design
   • Avoidance of stability and similar issues
   • Contact water/Leachate generation minimization / storm water segregation

04 Proper Planning results in cost reductions
05 Reduction in significant correctable maintenance
06 Improved and efficient operations = cost efficiency (and predictability)
Improvements / Lessons Learned

01 Lessons Learned
• Regular Communication

02 Success Factors and Value Added
• Be proactive / not reactive
• Allows for better long-term planning and operational projections
• More efficient utilization of designed and permitted facility
• Ability to plan for closure appropriately thus reducing areas to be maintained

03 Cost Efficiency
• Identify practices that minimize maintenance / costs
  – Higher $ today saves bigger $$ tomorrow
• Reduced financial risk
• Reduces high capital expenses in and overall cash flow
Thank you
Please contact us for more information

Mike Stepic
AECOM
330.289.0092
Michael.stepic@aecom.com

Shane Harris
TVA
423.260.9640
rsharri0@tva.gov