



Bioreactor Landfills – Post Closure Care



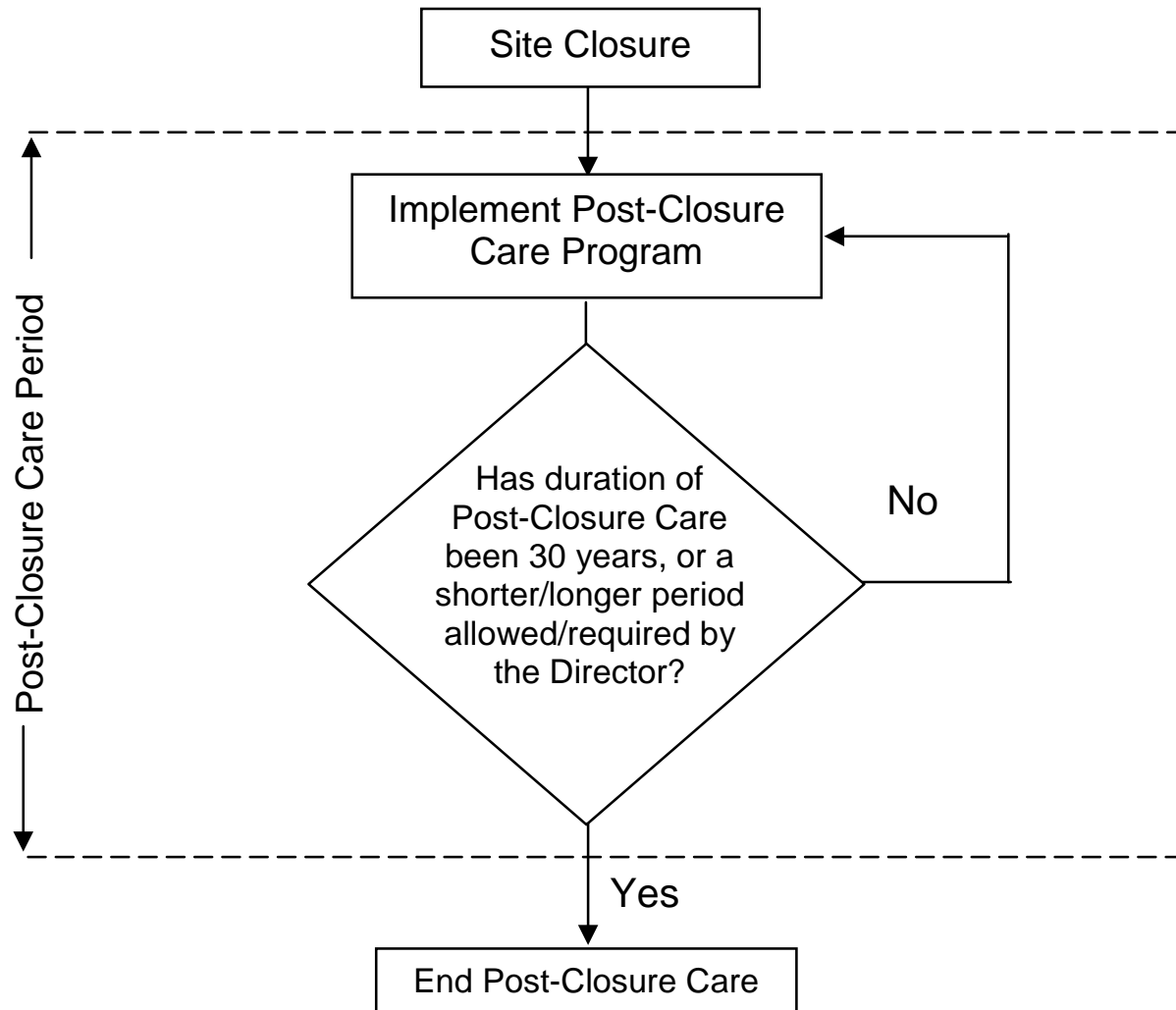


Topics Covered

- PCC Current Requirements
- Proposed Model for Exiting PCC
- Module Example

*Thanks to Geosyntech for use of slides in this presentation

Current USEPA and FDEP PCC Model





FDEP Closure Requirements

- Approved closure plan/permit
- Long-term care for 30 years from date of closure
- Department may extend 30-yr period
- Site may apply for permit modification to reduce PCC period (with 10-yr history of no groundwater quality violations)
- Financial assurance for closure includes long-term care costs



Problem Statement

- 30-year PCC timeframe of Subtitle D and FDEP is not site-specific or performance based
- Little guidance is available on how to define length of PCC or to evaluate the performance of a PCC program
- Subtitle D regulations provide little direction on how to modify or complete post closure care
- Some other regulations that address long-term care (CERCLA, RCRA Subtitle C, etc.) are also unclear about implementation and exiting long-term care programs



Objective

Develop a Standardized, Performance-Based System to Define, Manage, & Ultimately Exit PCC. Intent is to:

- Improve Protection of the Environment, Relative to Current Ambiguous Approach
- Provide Guidance and Increased Certainty for Operators and Regulators
- Allow More Effective Management of Existing PCC Funds
- Build on, and be Consistent with, Current Regulations
- Promote Proactive Landfill Management

→ Make Approach Universally Applied (EPA Guidance, ASTM, ITRC Guidance, etc.)



Basis

1. Landfill source (i.e., leachate and landfill gas) characteristics can be quantified
2. Trends in concentrations and quantities at the source can be predicted
3. The release of constituents can be evaluated for potential impacts to human health and the environment.
4. We can monitor to confirm our predictions prior to going down a path of no return – be conservative.



Bioreactor Landfill Sites

- ✚ Accelerated biological activity will likely decrease PCC requirements
 - More rapid settlement
 - Shorted gas production period
 - Better leachate quality earlier
- ✚ A performance-based approach is ideally suited to proactive landfill management



PCC Model Description

The Model requires the Owner/Operator to:

1. Quantify source characteristics
2. Define trend of source characteristics over time
3. Evaluate future risk posed to human health and the environment by the source - and justify PCC changes on the outcome of this evaluation
4. Monitor to confirm evaluations or predictions

Evaluation Philosophy: Overview

1. Can you evaluate
change to PCC facility or
activity?

2. Evaluate change.

3. Make change.

4. Monitor impacts of
change.

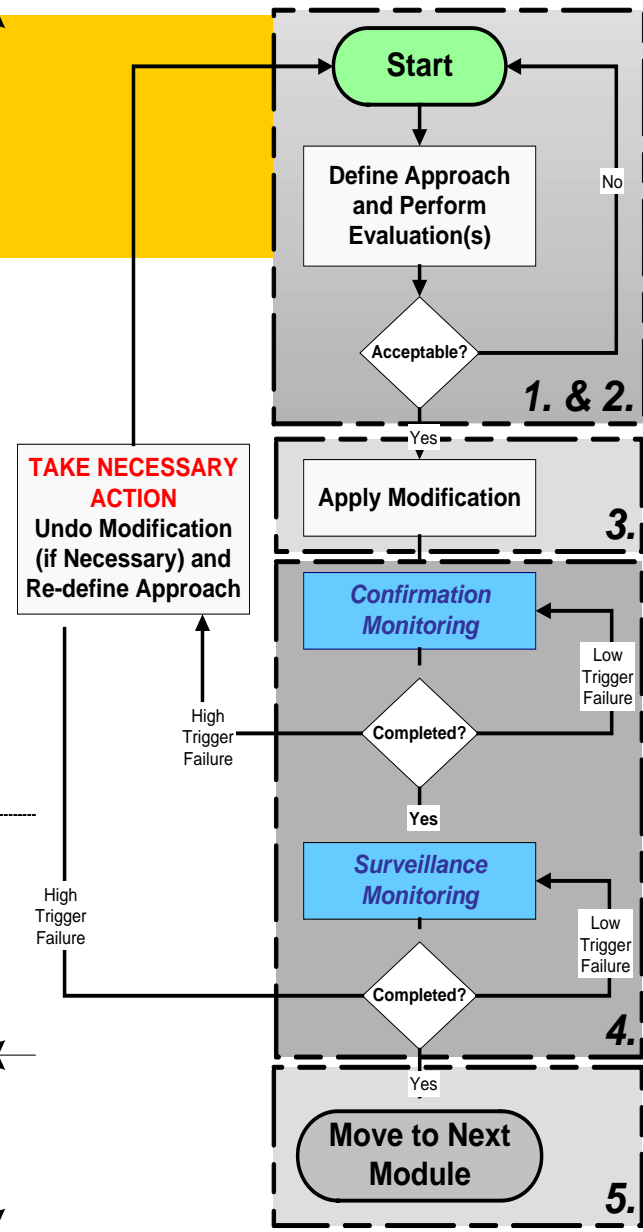
5. Module completed.

Evaluation Philosophy: Details

POST-CLOSURE CARE MAINTENANCE AND/OR MONITORING

POST-CLOSURE CARE SURVEILLANCE MONITORING

POST-CLOSURE CARE WITHIN MODULE COMPLETED WITH RESPECT TO REGULATORY FRAMEWORK. OPERATOR MUST CONTINUE TO MEET END-USE OBLIGATIONS.



1. Can change be evaluated?

2. Evaluate change

3. Make change

4. Monitor impacts of change

5. Complete



New Monitoring Under Program

1. Confirmation Monitoring: Monitoring during PCC to confirm that a change produced the predicted outcome
2. Surveillance Monitoring: Monitoring after PCC for an extended period to further validate the decision to end PCC for a module



Model Requirements for Ending PCC

- Duration of PCC is based on performance criteria (HH&E)
- Performance criteria are site specific
- Performance criteria for ending PCC are very well defined



Approach

– Leachate Management System

- Quality meets GWPSs
- Monitoring has been performed long enough to have detected a release
- Build-up of leachate head addressed (e.g., bathtub effects)

– Landfill Gas System

- Satisfied all applicable NSPS Requirements
- Gas migration (at future quantities and concentrations) does not represent a threat to HHE



Approach – Cont'd

– Groundwater Monitoring

- Currently in Detection Monitoring
- Monitoring has been performed long enough to have detected a release

– Final Cover

- Cap predicated on other modules' requirements
- Containment of waste addressed
- Provide care as needed

Example: Leachate Module – Step 1, Prerequisites

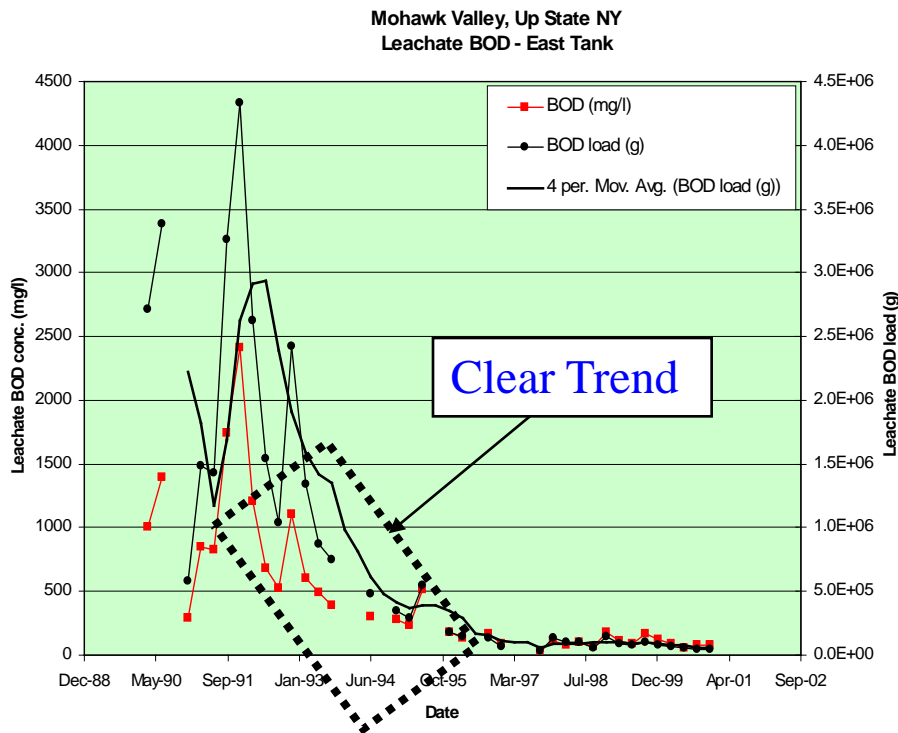
1. Can you evaluate change to PCC facility or activity?

☛ Define End-Use Setting (done)

☛ Obtain Required Data (done)

☛ Satisfy Module-Specific Requirements

- Steady or Decreasing Trend in Leachate Quality



Leachate Module: *Step 2, Evaluate*

2. Evaluate change.

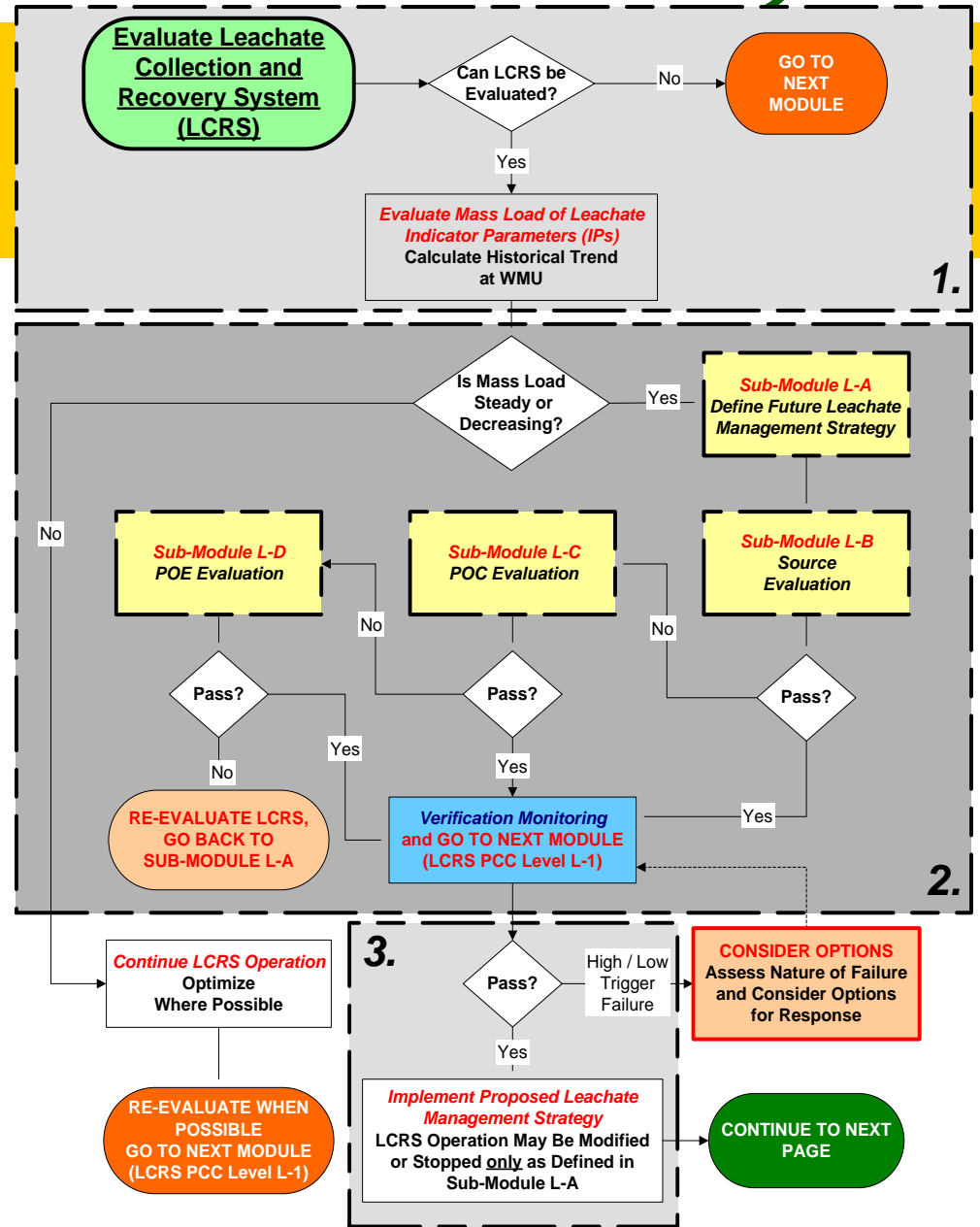
- ✦ Define change
- ✦ Step-up evaluation of change
 - Step 1: Compare source to standards
 - Step 2: Evaluate dilution/attenuation at the point of compliance (POC)
 - Step 3: Assess risk at the point of exposure (POE)
- ✦ Evaluate whether criteria are met (indication that risk is acceptable)
- ✦ Identify opportunities to optimize LCRS operation
- ✦ Modify PCC plan as appropriate

Leachate Module: *Step 4, Monitoring*

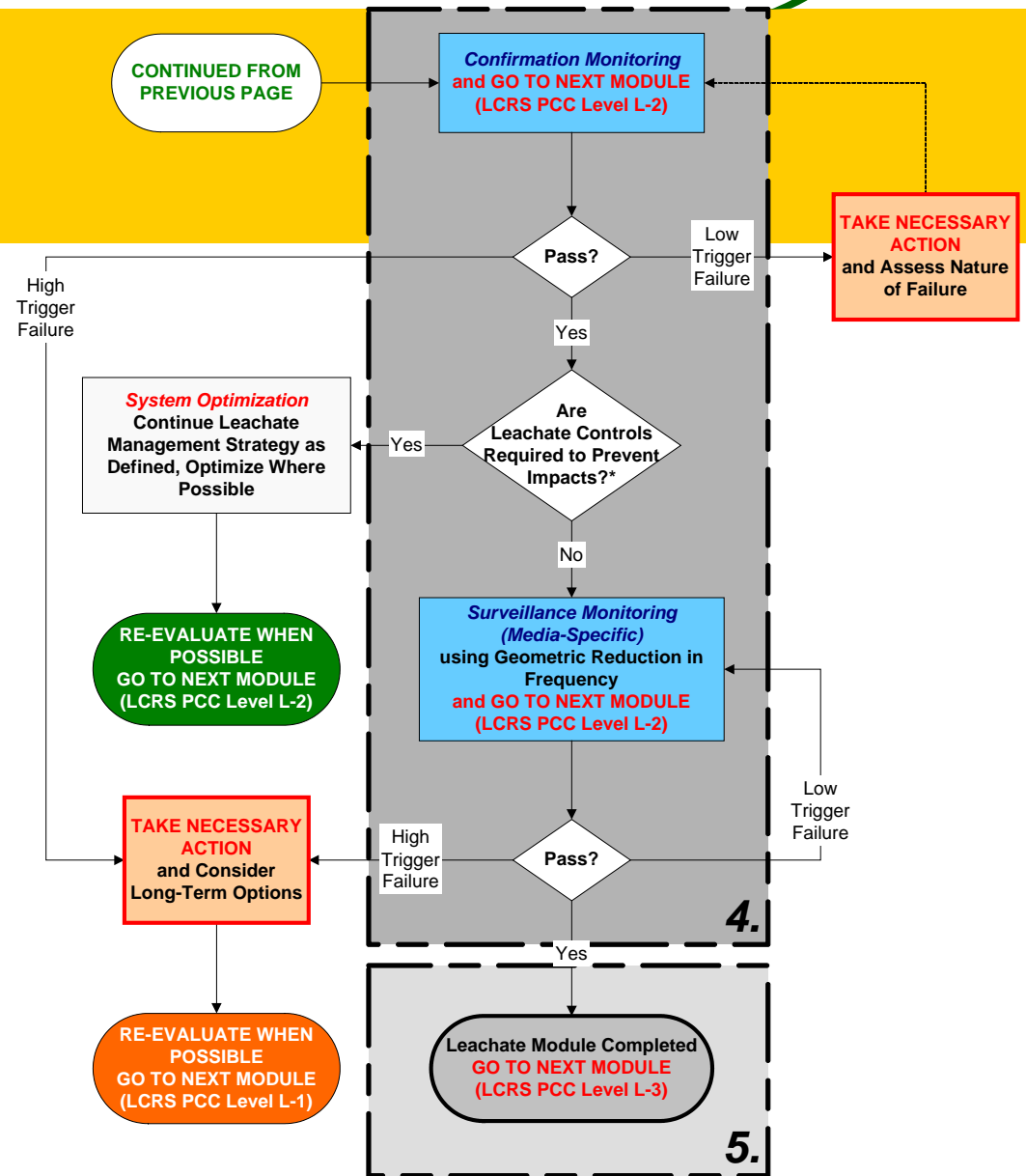
4. Monitor impacts of change.

- ✦ Types of Monitoring:
 - Verification (for trend analysis)
 - Confirmation (to confirm prediction)
 - Surveillance (geometric reduction)
- ✦ Parameters to be Monitored for
 - Indicators where possible
 - Specific constituents where warranted
- ✦ Outcomes of Monitoring
 - Failure: Undo Change
 - Alarm: Reconsider Monitoring Program
 - Pass: Absence of "alarm" or "failure"

Module (Leachate Module example)



Module (Leachate Module example, cont.)





Advantages of Approach

- ↓ Addresses concerns with long-term PCC requirements
- ↓ Identifies and demonstrates how a site has reduced and eliminated threats to HH&E using technically defensible approaches.
- ↓ Doesn't depend on quantifying "stabilization", which can be problematic
- ↓ Includes additional monitoring (i.e., verification, surveillance, and confirmation) as "insurance" for decisions that were based on analysis



Advantages – Cont'd

- Has re-openers (with specific instructions for required actions) to redress problematic outcomes after PCC systems have been retired
- Has performance criteria that are more closely tied to protection of human health and the environment than current approaches
- Is consistent with requirements of the current FDEP Regulations