# The Fundamentals

## RBCA
## For "Simple" Sites

Florida Department of
Environmental Protection
Bureau Waste Cleanup

# Risk Management Options

RMO Level III

NFA with controls

RMO Level II

NFA with controls

RMO Level I

NFA without controls

# RMO Levels

RMO I - No Controls

- Cleanup Target Levels (CTLs) are not exceeded

RMO II - NFA with ICs and if appropriate, ECs

- Groundwater can exceed RMO I CTLs within the property boundary

RMO III – NFA with ICs and if appropriate, ECs

- Groundwater can exceed RMO I CTLs within the IC boundary

# Institutional and Engineering Controls

## Institutional Control – IC

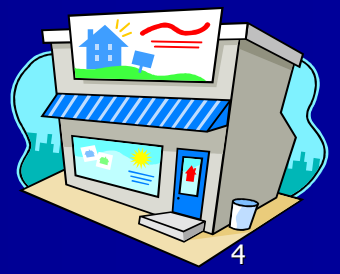
Restriction on use of or access to a site

- Deed restrictions
- Restrictive covenants
- Conservation easements

## Engineering Control – EC

Existing features or modifications to a site

- Physical or hydraulic control measures
- Capping
- Point-of-use treatments
- Slurry walls



# Presentation Overview

1. NFA Criteria
2. Examples
   - Natural Attenuation with Monitoring
     - ✓ NAM Criteria, NFA Criteria
   - Active Remediation – Soil
     - ✓ Leachability & Direct Exposure Criteria
   - Active Remediation – Soil &Groundwater
     - ✓ Post Active Remediation Monitoring
3. Site Rehabilitation and Completion

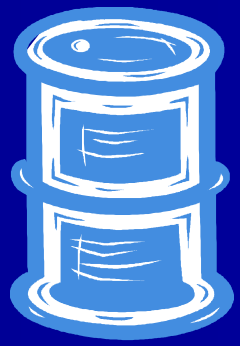
# NFA Criteria

NFA without controls applies if:

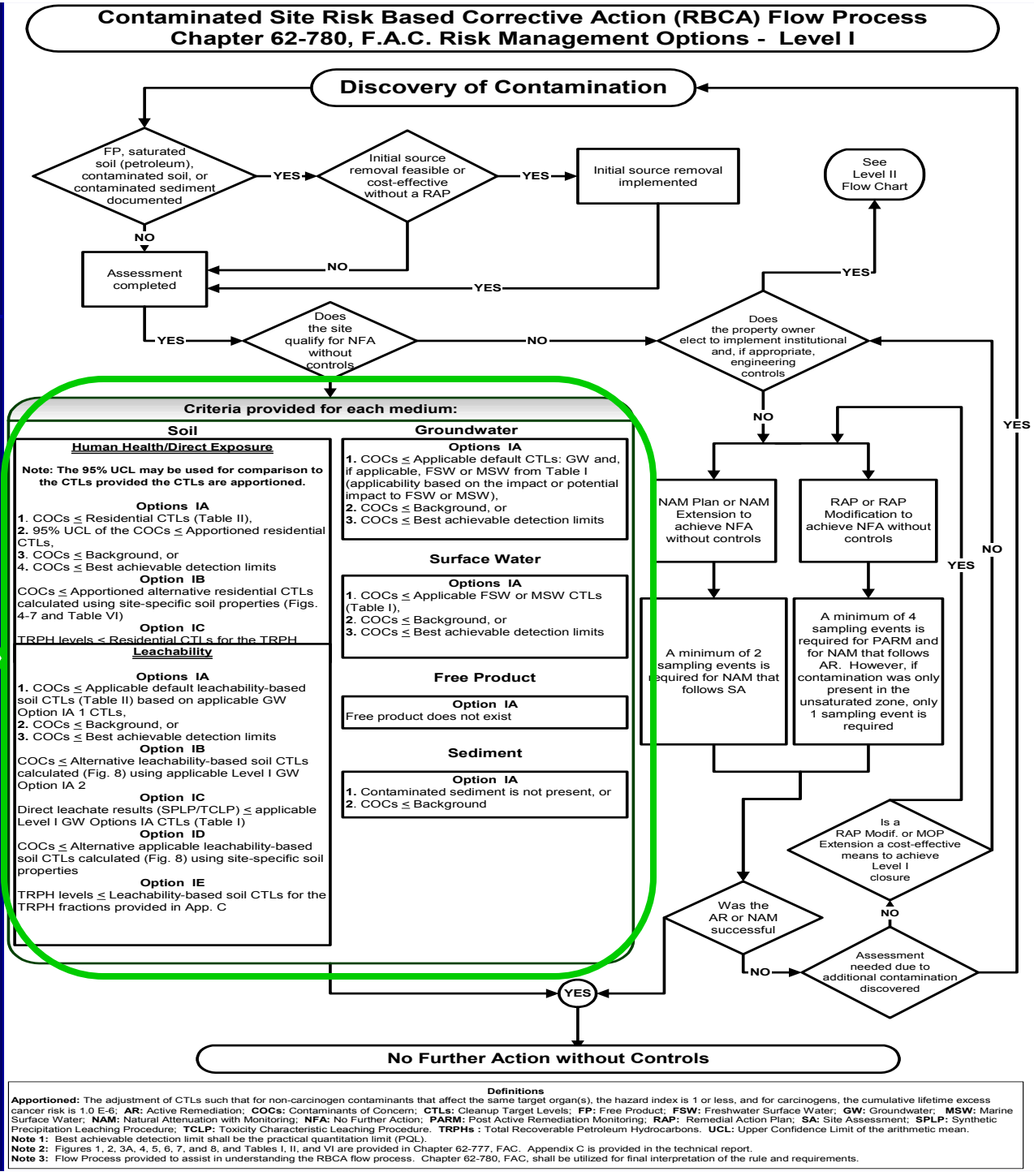
- No free product (FP)
- No fire or explosive hazard related to free product

And…

- No contaminated media present



NFA Criteria for each medium



# NFA Soil Criteria

## Two Criteria for Soil

- Direct Exposure
  - Residential SCTLs
    - ✓3 Options (1A – 1C)
- Leachability
  - Leachability SCTLs
  - Protect GW and SW from contaminants that may leach
    - ✓6 Options (1A – 1F)

NFA

# Soil – Direct Exposure Criteria

1A ~ Contaminated Soil Concentrations or

**Average Concentrations calculated using 95% UCL**

Do not exceed the less stringent of:

- Residential SCTLs 62-777, Table II
- Background
- Best Achievable Detection Limits (BADL)
  - ✓ If 95% UCL is used, must apportion CTLs

Or…

NFA

# Soil – Direct Exposure Criteria

1B ~ Below apportioned alternative residential SCTLs

- **Calculated using site-specific soil properties**
- **62-777 Figs 4-7 and Table VI**

1C ~ TRPH fractions below respective residential SCTLs

- **App C Technical Report**

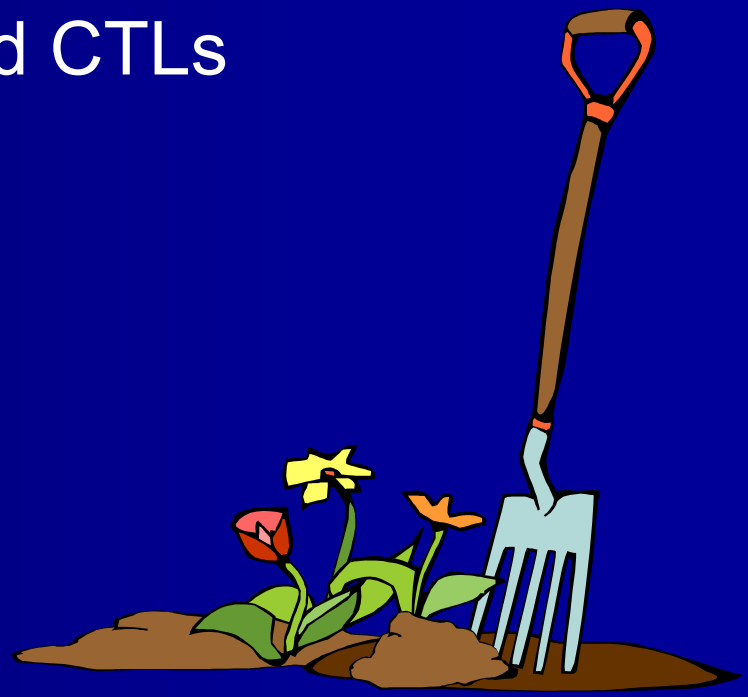
NFA

# Soil – Leachability Criteria

1A ~ **Soil contaminant concentrations below the less stringent of:**

- Leachability-based CTLs
  - 62-777, Table II
- Background
- BADL

Or…



NFA

# Soil – Leachability Criteria

1B ~ Alternative leachability-based SCTLs

- Derived from alternative GW CTLs
- Based on site-specific background concentrations

1C ~ Direct leachability testing SPLP/TCLP

- Leachate less than GW or applicable SW CTLs

1D ~ Alternative leachability-based SCTLs

- Using Site-specific soil properties

1B & 1D ~Equation & Default Assumptions 62-777, Fig- 8

NFA

# Soil – Leachability Criteria

1E ~ TRPH fractions below the respective leachability-based SCTLs

- App C Technical Report

1F ~ Soil exposed to the elements -minimum two years

- Contaminants will not leach into GW above CTLs
- Site-specific characteristics
- Minimum 1 year GW data

NFA

# Groundwater Criteria

1A ~ Groundwater concentrations below the less stringent of:

- CTLs 62-777, Table I
- Background
- BADL

✓And <u>If applicable,</u> SW CTLs

NFA

# Surface Water Criteria

1A ~ Surface water concentrations below the less stringent of:

- Surface Water CTLs 62-777, Table I
  - ✓ Freshwater
  - ✓ Marine
- Background
- BADL

SW is or may be exposed to contaminated GW

- ✓ POC should be from the landward side immediately adjacent to the SW

NFA

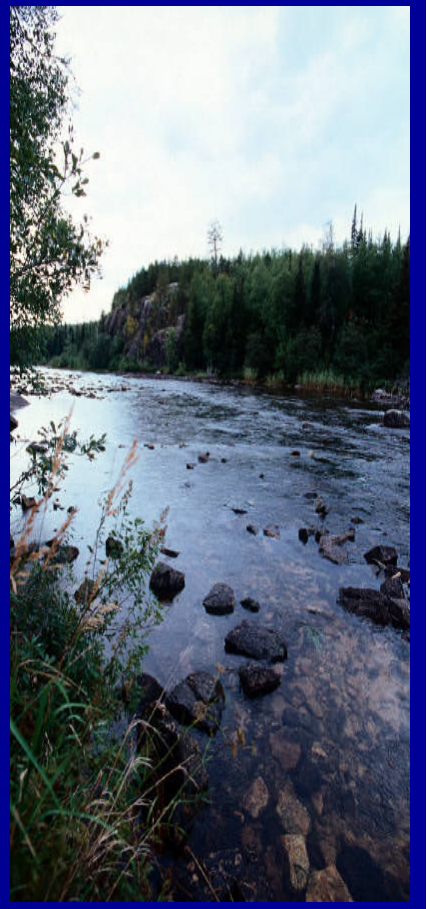
# Sediment Criteria

1A ~ Contamination not present, demonstrated by representative samples

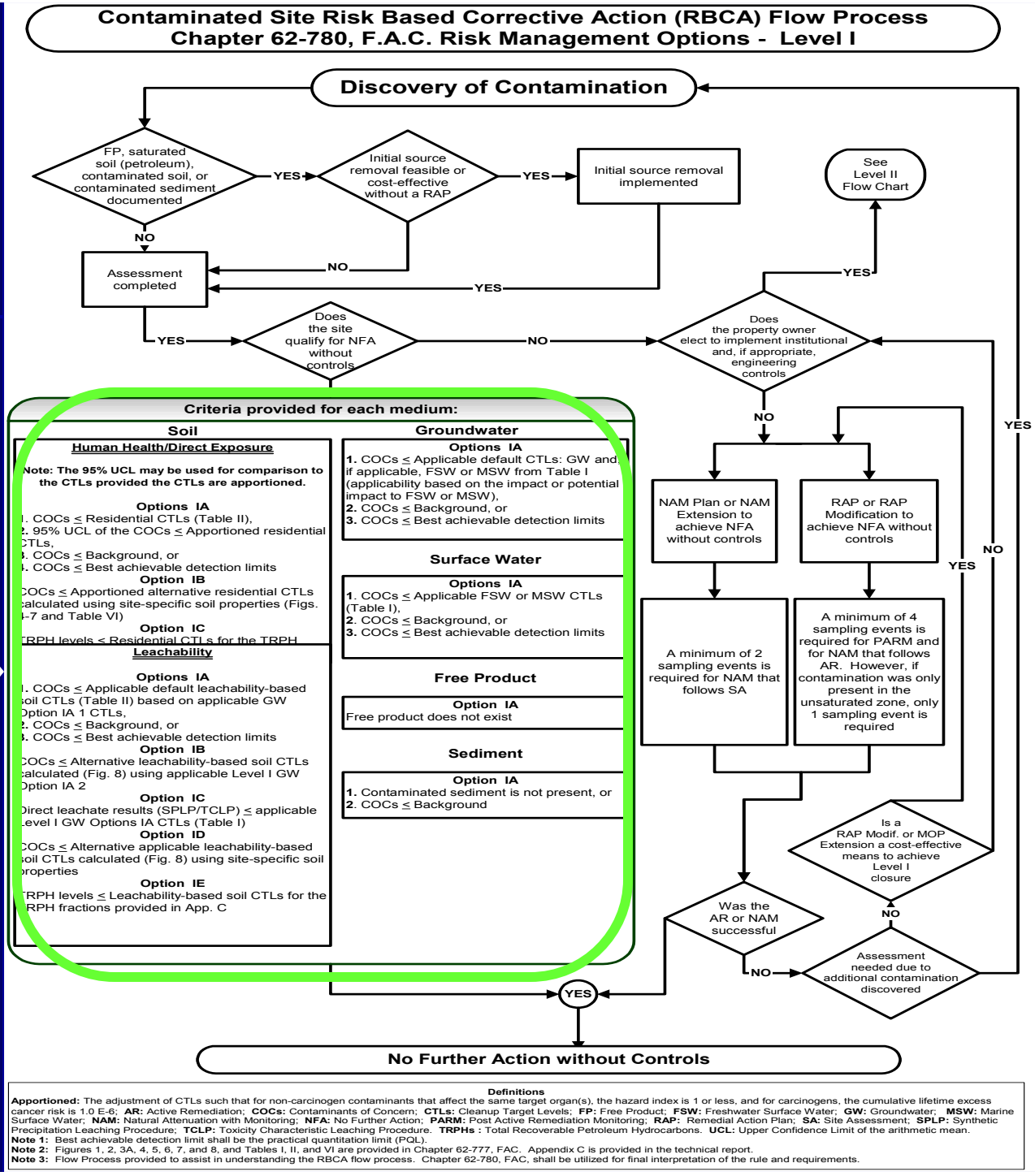
- Contaminants below background

**Or**

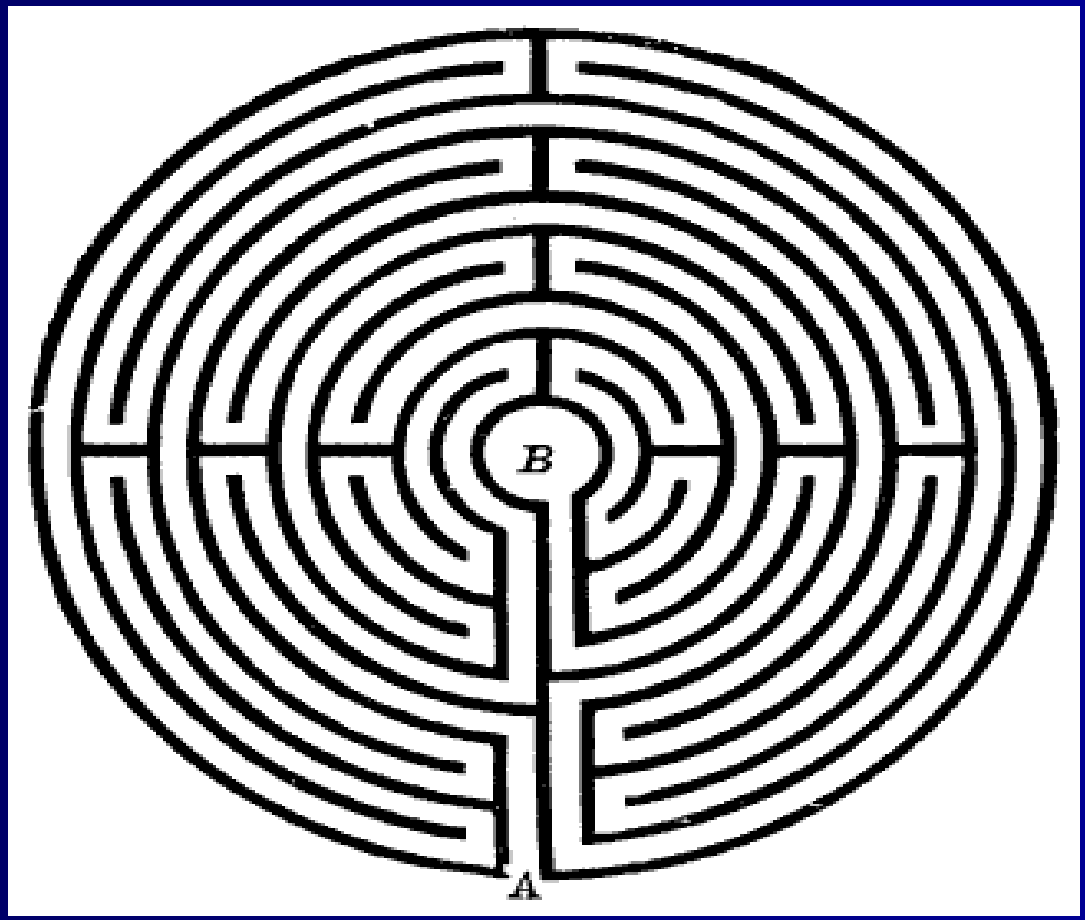
- Below the sediment quality assessment guidelines (SQAGs)



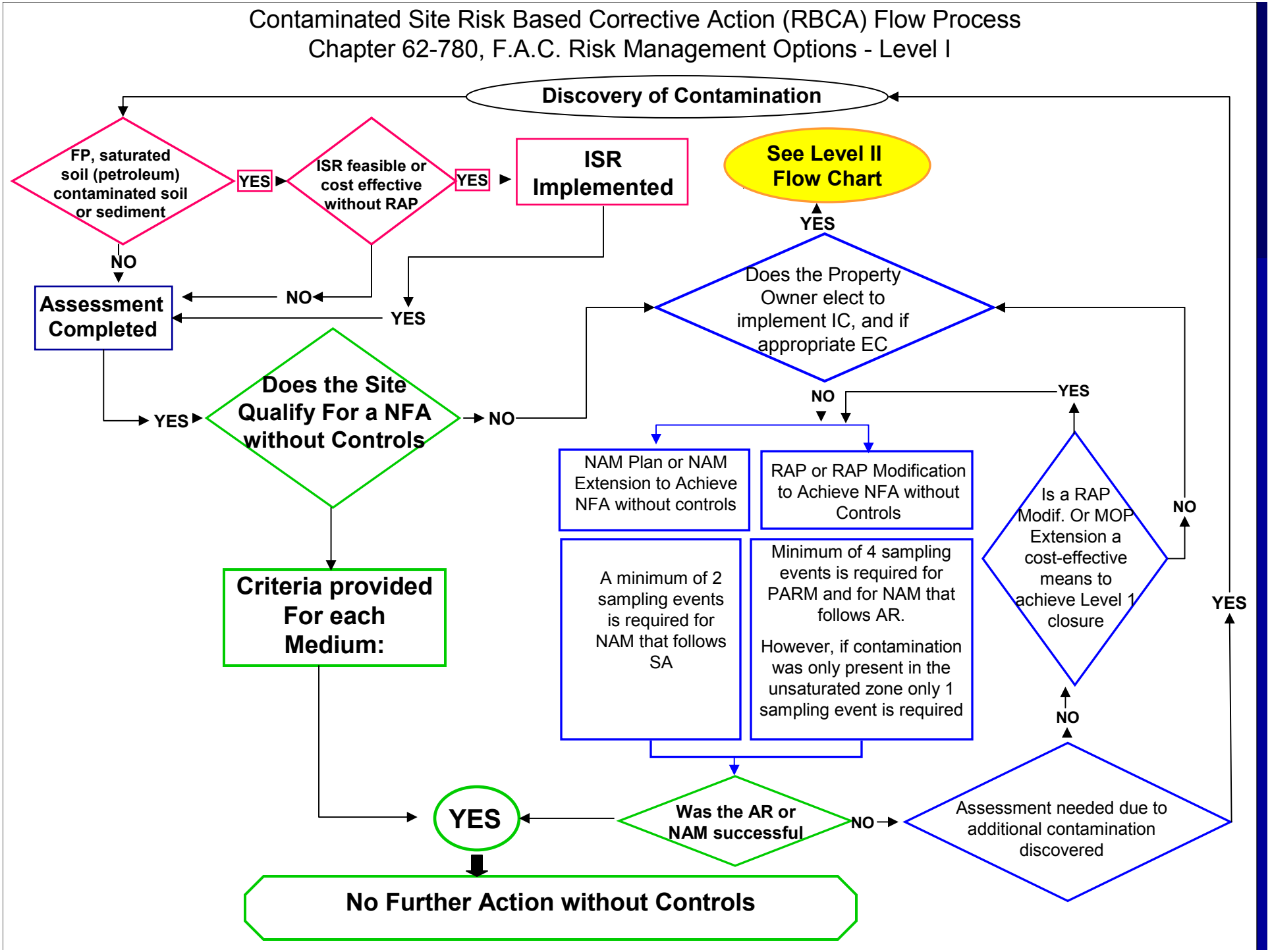
# NFA Criteria



# What, No NFA?



# Contaminated Site Risk Based Corrective Action (RBCA) Flow Process
## Chapter 62-780, F.A.C. Risk Management Options - Level I



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     **NAM Criteria, NFA Criteria**
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- Site Rehabilitation and Completion

# Natural Attenuation with Monitoring

What is NAM?

Natural Attenuation with Monitoring

- Verifiable approach to site rehabilitation
- Natural processes contain spread of contamination and
- Reduce contaminants in groundwater and soil

✓Site must meet NAM Criteria

*Example 1*

# NAM Criteria

- No free product

Or…

- Free product removal not feasible
- No fire or explosive hazard related to free product

*Example 1*

# NAM Criteria

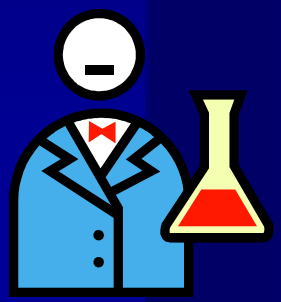
- Contaminated soil not present

**Except**

- Not a continuing source to groundwater

  Demonstrated by:

  - ✓ **USEPA Test Method 1312 (SPLP) or**
  - ✓ **USEPA Test Method 1311 (TCLP)**



*Example 1*

# NAM Criteria

## Groundwater

- Not migrating -

  Beyond temporary point of compliance (TPOC), or vertically

- Contaminant and transformation product(s) are conducive to NA

- Data shows an overall decrease

And…

*Example 1*

# NAM Criteria

The following is met:

- NFA criteria in five years or less
- CTLs or background are not exceeded at the TPOC
- Concentrations do not exceed Natural Attenuation Default Criteria (NADC)
  - ✓62-777, Table V

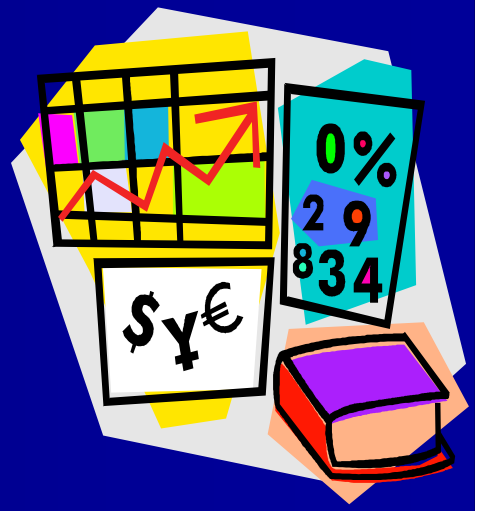
Or…

*Example 1*

# NAM Criteria

## Demonstrate

- Technical evaluation
  - ✓ Site–specific conditions and parameters
  - ✓ 62-777, Table IV
- Scientific evaluation
  - ✓ Historical data or modeling results
- Life-cycle cost analysis of remedial alternatives



*Example 1*

# Implementation

- NAM Plan
  - Separate, SAR, Risk Assessment Report
- Includes
  - Minimum of 2 wells
    - ✓ Downgradient edge of plume
    - ✓ Within the highest GW contamination
  - Water-levels within 24-hours of sampling
  - Data evaluated annually
- NAM Report
  - Within 60 days of sample collection

*Example 1*

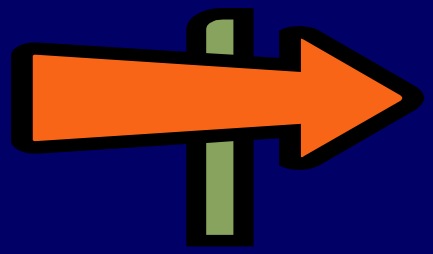
# Sampling

- NAM following Assessment
  - ✓ Minimum 2 events required
- NAM following Active Remediation
  - ✓ Minimum 4 events required

Soil contamination present at beginning of monitoring program?

- ✓ Collect confirmatory soil samples

*Example 1*

# NAM  SRCR

## When can you propose NFA?

- ✓ When NFA Criteria are met for 2 consecutive sampling events

- Submit
  - 2 copies of Site Rehabilitation Completion Report (SRCR) with an NFA Proposal
  - Within 60 days of the final sampling event
  - Same information as the NAM Report
  - Documentation to support the opinion that cleanup objectives have been achieved

*Example 1*

# NAM Concepts

- A strategy for site rehabilitation
  - ✓Not bio-procrastination
- Site may meet the NAM criteria
  - ✓BUT is it appropriate?
- NFA is the goal
  - ✓Data evaluation, active site management is required

# Presentation Overview

- NFA Criteria
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# Active Remediation

NFA at a site with soil contamination

Site Data

TCE impacted Soils

- Above the leachability SCTL

TRPH impacted Soils

- Above the residential SCTL

✓Groundwater below default CTLs

*Example 2*

# Remediation Required?

Maybe

Direct Exposure Criteria

1C ~ TRPH Site Specific Fractions < Residential SCTLs for the TRPH Fractions

- ✓ TRPH Fractionation

Leachability Criteria

1C ~ Leachate < GW or applicable SW CTLs

- ✓ SPLP/TCLP

*Example 2*

# Leachability Testing

## Purpose

- Demonstrate contaminants will not leach into the GW above GCTLs

## Sampling

- Each source area exceeding SCTLs
- Sampling based on
  - Horizontal and vertical extent
  - Site stratigraphy

*Example 2*

# SPLP Example

| Soil | SS-01 | SS-02 | SS-03 | SS-04 |
|---|---|---|---|---|
| 0 - 0.5’ | .033 | .086 | .250 | .090 |
| 0.5’ - 2’ | BDL | .050 | .134 | .040 |

Units mg/kg

| Leachate | SS-01 | SS-02 | SS-03 | SS-04 |
|---|---|---|---|---|
| 0 - 0.5’ | BDL | BDL | **5** | BDL |
| 0.5’ - 2’ | NA | BDL | 1 | NS |

Units ug/L

TCE leachability SCTL .030 mg/kg
TCE GW CTL 3.0ug/l

*Example 2*

# SCTLs for TRPHs

Current Method for TRPH

- Florida Petroleum Residual Organic (FL-PRO)

Method is limited

- Limited for mixed $C_8$-$C_{40}$
- Does not measure $C_5$-$C_7$
- Does not distinguish between aliphatic & aromatics

*Example 2*

# SCTLs for TRPHs

Two Tiered approach

Tier I - Default TRPH SCTL

- Residential 460 mg/kg
- Leachability 340 mg/kg

Tier II - Fractionation

- Compare individual fractions to their respective CTLs

  ✓Appendix C Technical Report

# SCTLs for TRPH Fractionation

Table C-5

Calculated SCTLs for TRPH Fractions

| TRPH Fraction | SCTL (mg/kg) | | | Target Organs/ Systems or Effects |
|---|---|---|---|---|
| | Residential | Industrial | Leachability [a] | |
| $C_5$-$C_7$ Aromatic | 340 | 1800 | 34 | Liver, neurological |
| >$C_7$-$C_8$ Aromatic | 490 | 3700 | 59 | |
| >$C_8$-$C_{10}$ Aromatic | 460 | 2700 | 340 | Body weight |
| >$C_{10}$-$C_{12}$ Aromatic | 900 | 5900 | 520 | |
| >$C_{12}$-$C_{16}$ Aromatic | 1500 | 12000 | 1000 | |
| >$C_{10}$ $C_{21}$ Aromatic | 1300 | 11000 | 3200 | Kidney |
| >$C_{21}$-$C_{35}$ Aromatic | 2300 | 40000 | 25000 | |
| $C_5$-$C_6$ Aliphatic | 6200 | 33000 | 470 | Neurological |
| >$C_6$-$C_8$ Aliphatic | 8700 | 46000 | 1300 | |
| >$C_8$-$C_{10}$ Aliphatic | 850 | 4800 | 7000 | Liver, blood |
| >$C_{10}$-$C_{12}$ Aliphatic | 1700 | 10000 | 51000 | |
| >$C_{12}$ $C_{16}$ Aliphatic | 2900 | 21000 | * | |
| >$C_{16}$-$C_{35}$ Aliphatic | 42000 | 280000 | * | Liver |

[a] Based on the acceptable concentration of 5000 µg/L for groundwater and surface waters.

* Not a health concern for this exposure scenario.

# TRPH Fractionation Approach

*Example 2*

1. Resample each source area that exceeds default CTLs for TRPH

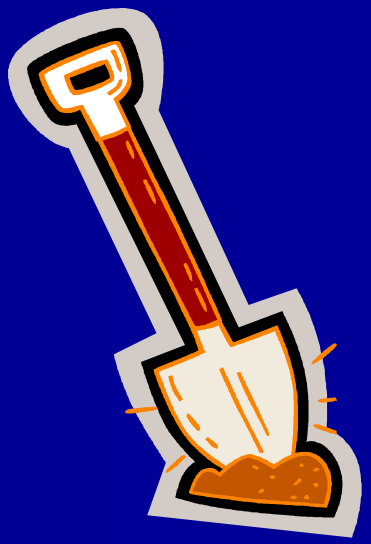
2. Split soil samples
   - FL-PRO
   - TPHCWG or MADEP (Fractionation)

- Methods for Fractionation Accepted by DEP
  - ✓ TPHCWG - Total Petroleum Hydrocarbon Criteria Working Group method
  - ✓ MADEP - Massachusetts Department of Environmental Protection method

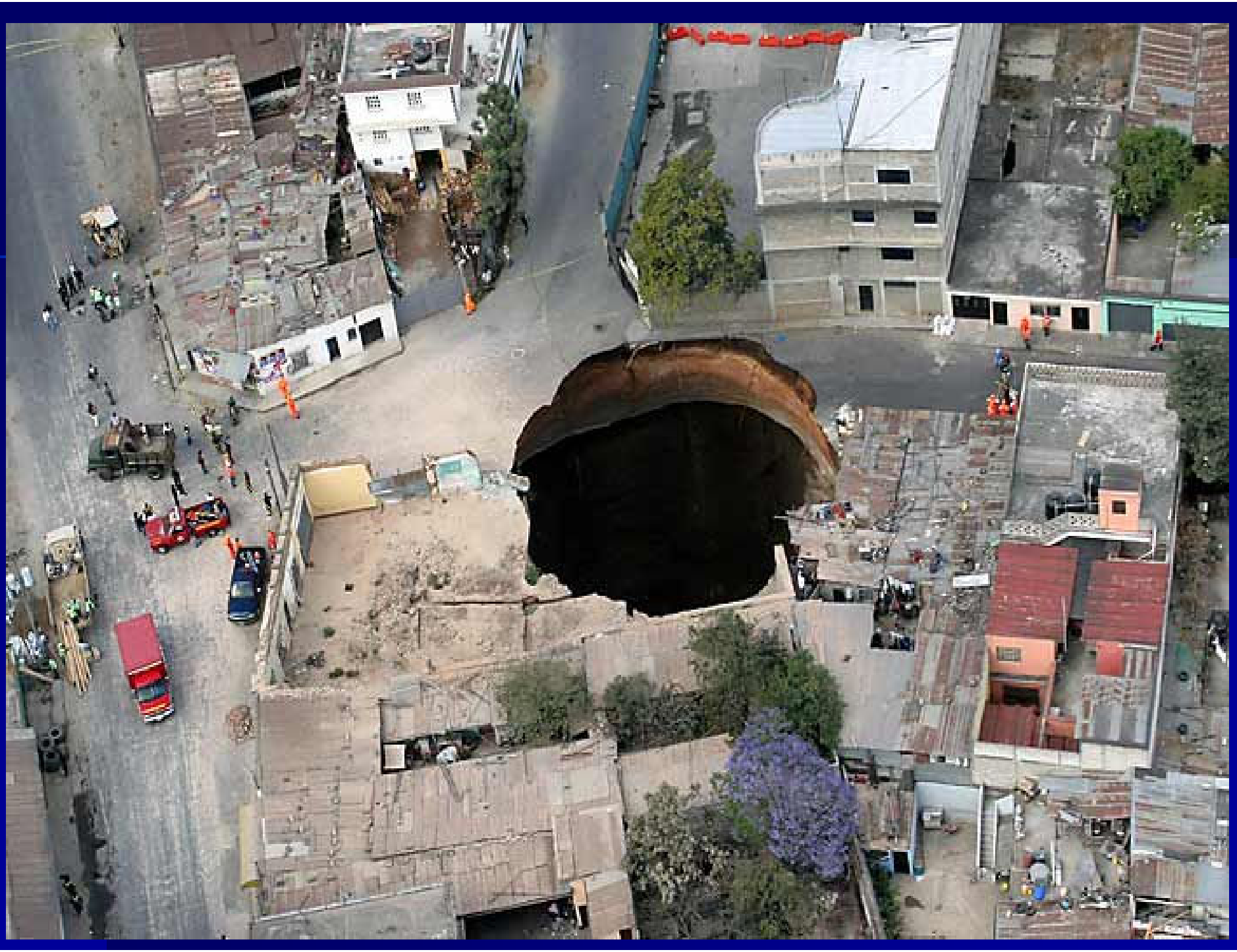
# Remediation Required?

- Direct Leachability testing
  - ✓ Leachate above the GCTL
- Fractionation
  - ✓ TRPH fractions above the individual fraction specific CTLs

Yes



- Active Remediation?
  - ✓ Soil Excavation Source Removal



*Example 2*

# Post Active Remediation Monitoring (PARM)

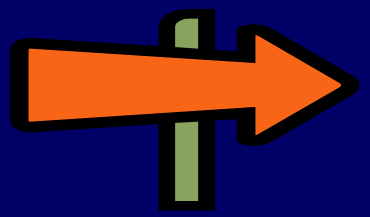
Following soil remediation, are additional groundwater samples required to meet NFA Criteria?

Yes

PARM

If contamination was only present in the unsaturated zone the NFA criteria must be met for one sampling event

*Example 2*

# PARM  SRCR

## When can you propose NFA?

- ✓ When the final sampling event indicates NFA criteria have been met

## Submit

- ➢ 2 copies of SRCR with an NFA Proposal
- ➢ Within 60 days of the final sampling event
- ➢ Same information, as the PARM Report
- ➢ Documentation to support the opinion that cleanup objectives have been achieved

# Active Remediation

## Main Concepts

- Two Types of Soil CTLs
  - Direct Exposure
  - Leachability
- Focus Remedial Strategy
  - TRPH Fractionation
  - Direct Leachability Testing

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# Active Remediation

NFA at a site with soil and groundwater remediation

Objective of Active Remediation

- NFA Criteria
- NAM Criteria

Remedial Strategy

- SVE and Bioaugmentation
- Pilot Study?

*Example 3*

# Active Remediation

## Pilot Study

- Submit Pilot Study Work Plan
  - Department permits or authorizations
    - ✓ UIC, NPDES, or Air Emissions
  - Protect human health and environment

*Example 3*

# Remedial Action Plan

## RAP

- Addresses all contaminated media
- If contamination extends beyond the source property boundary
  - ✓ TPOC may be extended to lateral extent of plume as determined at the time of CAD or approved SAR
  - ✓ PRSR shall provide notice

RAP shall include…

*Example 3*

# Remedial Action Plan

- ✓ QA requirements
- ✓ SAR conclusions, data since SAR
- ✓ Rationale
  - ✓ Results of pilot, bench test
  - ✓ Evaluation of RA and why RA considered were rejected
- ✓ Evaluation of breakdown products
- ✓ Operational details
- ✓ Monitoring schedule
- ✓ Proposed treatment or disposition
- ✓ Discussion of when AR will be discontinued
- ✓ Innovative technologies
- ✓ RAP Summary Form

***"If you don't know where you are going, you will wind up somewhere else"***

*- Lawrence Peter*

*Example 3*

# Remedial Action Plan

Remedial Action Plan

- Within 90 days of SAR approval or Recommended Remedial Action (RAR)

- If the latest GW analytical data were obtained greater than 270 days prior to RAP?
  - ✓ Collect confirmatory round of samples

*Example 3*

# Time Frames

Operation of Active Remediation System

- Within 120 days of RAP approval

As Built Drawings

- Within 120 days of initiating operation

Remedial Action Status Report

- Within 60 days of initiating operation

*Example 3*

# Active Remediation

If effluent concentrations or air concentrations exceed those approved in the RAP or plume migration occurs?

Corrective actions taken and

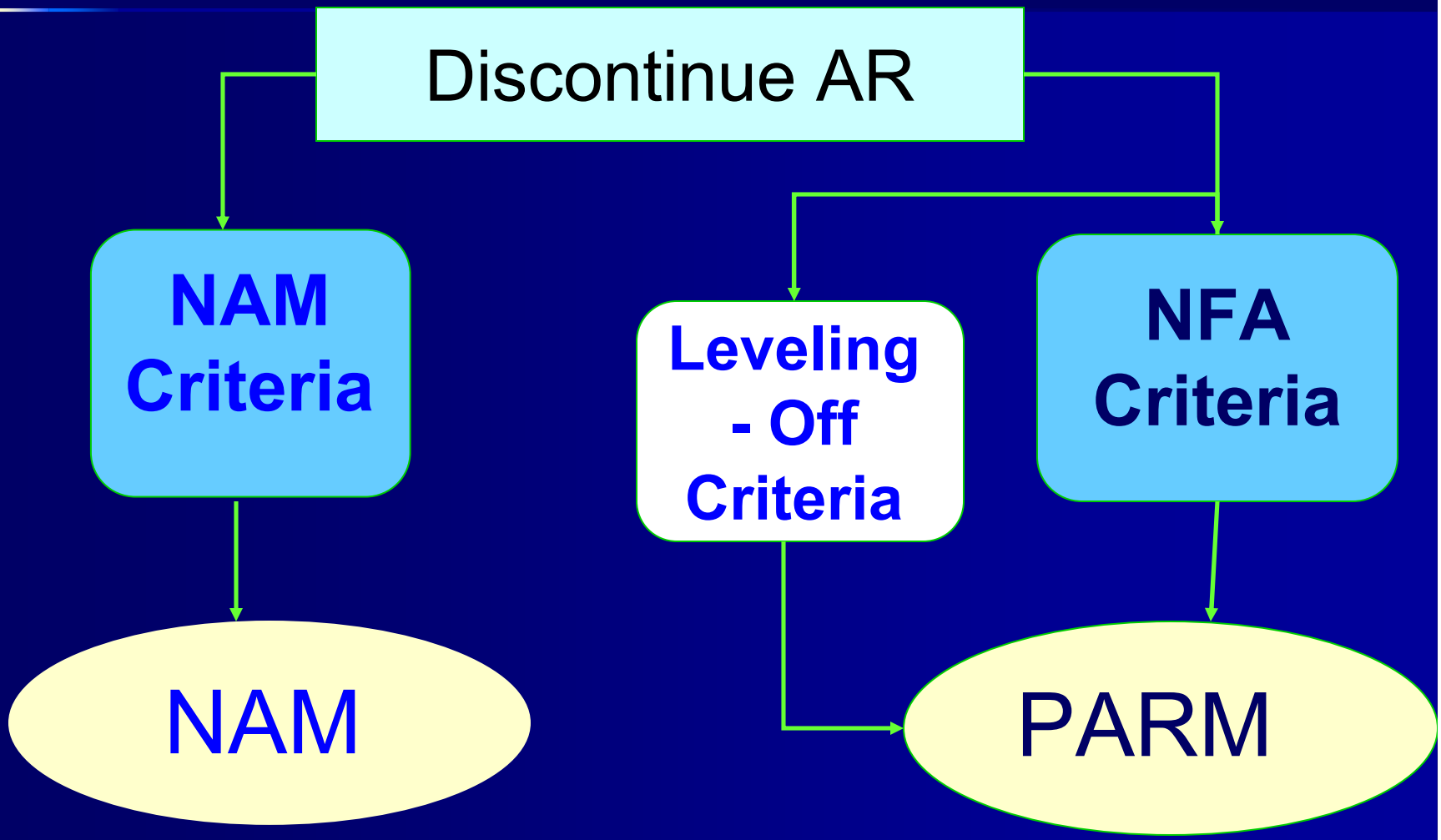
- Department notified within seven days

Imminent threat

- Department notified within 24 hours

*Example 3*

# PARM Criteria



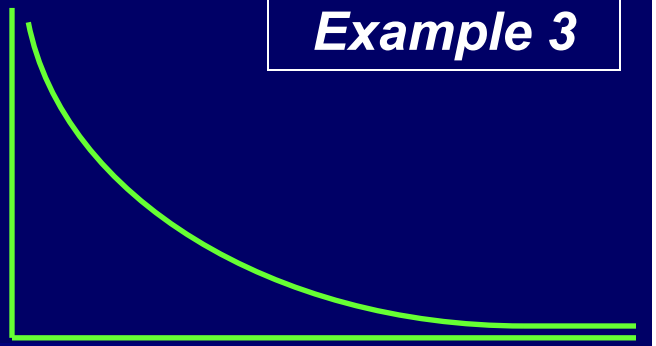
*Example 3*

# Leveling-Off Criteria

- GW remediation only
- NAM or NFA Criteria is not met
- Discontinuing GW remediation appropriate
  - Applicable CTLs are met
  - Minimum of 1 year of GW treatment
  - Concentrations have leveled off

# Leveling-Off

*Example 3*



Demonstrating the leveling-off criteria

- Minimum 180 days monthly sampling
- Graph concentrations versus time
- Lower limb is linear, slope of the curve approaches zero
- Technical feasibility of other treatments cost, time frames, and effects

*Example 3*

# Monitoring Requirements

- Active Remediation followed by NAM or PARM
  - ✓ Minimum 4 events required
- Soil Contamination
  - ✓ Confirmatory Samples
  - ✓ Applicable soil CTLs are met
- When can you propose NFA?
  - ✓ When NFA Criteria are met for 2 consecutive sampling events?
- Submit
  - ✓ 2 copies SRCR with an NFA Proposal

*Example 3*

# Active Remediation

## Main Concepts

- Process is not new
- Flexibility in treatment strategies
  - ✓ Pilot test, innovative technologies, source removal, NAM
  - ✓ Combination or phased approach
- PARM only when site meets
  - ✓ NFA or
  - ✓ Leveling-off criteria

# Overview of Session

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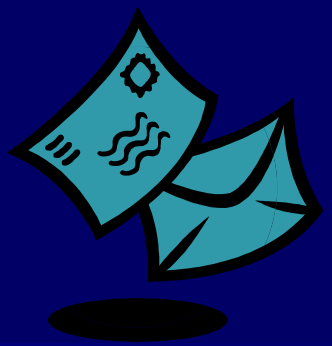
SRCO

# Site Rehabilitation Completion Order

If SRCR is approved the Department Shall

- ✓Provide the PRSR with a SRCO that approves the SRCR

# SRCO

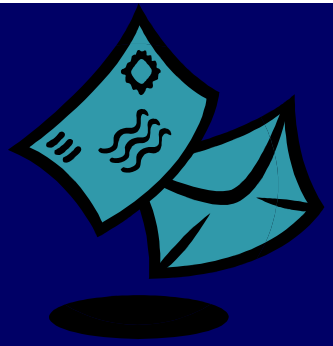


## SRCO shall contain the following

- ✓ DEP or USEPA tracking number
- ✓ Street address of the property
- ✓ Date(s) of the discharge(s) if known
- ✓ Reference to map or legal description
- ✓ Most recent tables generated

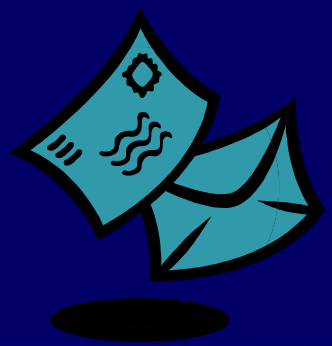
And…

# SRCO

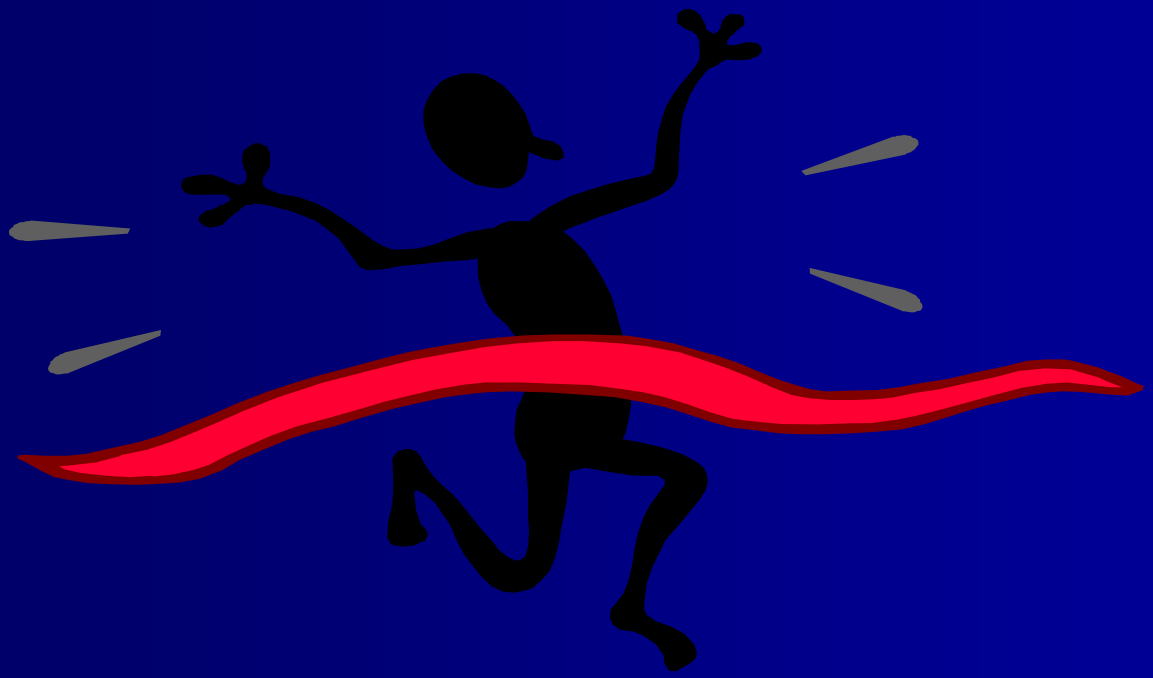


- ✓ If applicable, reference all EC and IC that were implemented (RMO II and III)
- ✓ If applicable, SRCO is conditioned upon controls being effective, properly maintained, and remaining in place (RMO II and III)
- ✓ SRCO subject to statutory re-openers and a listing of those re-openers
  - ✓ Section 376.30701(4), F.S.

# SRC0



*The SRCO shall constitute final agency action regarding cleanup activities at the site.*



# Questions

Web sites-

http://www.dep.state.fl.us/waste/quick_topics/rules/default.htm

http://www.dep.state.fl.us/waste/categories/wc/pages/LinksToGuidanceDocuments.htm