

US EPA ARCHIVE DOCUMENT



## RCRA Corrective Action Environmental Indicators

Notes:

There are many different Environmental Indicators (EIs) being used in different States and for different cleanup programs. This module addresses the two EIs being used in the RCRA Corrective Action program.

This document is part of the training materials for the RCRA Corrective Action Workshop on Results-Based Project Management. It contains summaries of EPA statutory authorities, regulations, and guidance materials. This document does not substitute for any of these authorities or materials. In addition, this document is not an EPA regulation and therefore cannot impose legally binding requirements on EPA, States, or the regulated community. EPA may change this document in the future, as appropriate.

## Objectives

Participants will:

### Part I

- Understand the background/history and role of Environmental Indicators (EIs) in the RCRA Corrective Action Program
- Become familiar with the new EI guidance\* via discussions, scenarios, and regional experiences



Notes:

\* “EI Guidance” is the forms/checklist of 2/5/99 in binder and CD. It contains:

- Cover memo
- Flowcharts
- Forms

A “User’s Guide” is being developed to assist users in completing these “forms.”

## Objectives continued...

Participants will:

Part II

- Use the new EI guidance on real-world case study



## What Are the RCRA Corrective Action (CA) Environmental Indicators (EI)?

- A means of evaluating and reporting on the acceptability of current site conditions (i.e., they are interim milestones and not final remedy or site closure goals).
- An opportunity for facilities and regulators to show meaningful progress that is achievable in the near future.
- A high priority within EPA and the #1 priority under the RCRA program
- Adopted by ECOS and equivalent to ASTSWMO cleanup measures



## How Many RCRA CA EI Are There?

There are two:

- Current Human Exposures Under Control
  - a.k.a. “Human Exposure EI”
- Migration of Contaminated Groundwater Under Control
  - a.k.a. “Groundwater EI”



## What Are the Possible Results (Determinations) for the EI?

- YES (YE)
  - conditions are “Under Control”
- NO
  - conditions are NOT “Under Control”
- IN
  - Insufficient information is available to determine if conditions are “Under Control”



## What are the RCRA CA EI used for?

- These EI are used to summarize and report on the site-wide environmental conditions at the RCRA CA Program's highest priority sites (i.e., the 1,714 facilities on the RCRA CA Cleanup (GPRA) Baseline).
- These EI are being used to track cleanup progress for the Government Performance and Results Act (GPRA), and the public (via web sites). [www.epa.gov/oswfiles/snapshot](http://www.epa.gov/oswfiles/snapshot)
- [www.epa.gov/oswfiles/rcraweb/web\\_reporting](http://www.epa.gov/oswfiles/rcraweb/web_reporting)





## How are sites evaluated to see if they meet RCRA CA EI?

- Known and suspected site(-wide) conditions are evaluated using a series of simple (as possible) questions and flow-chart logic to arrive at a reasonably defensible determination (YE, NO, or IN). These questions (EI forms) were issued as Interim Final Guidance for the RCRA CA EI on February 5, 1999 and are available on the Internet at the OSW web site:
- [www.epa.gov/epaoswer/osw/ei\\_guida.pdf](http://www.epa.gov/epaoswer/osw/ei_guida.pdf) &
- [www.correctiveactionwksp.org/EPA/indicator.htm](http://www.correctiveactionwksp.org/EPA/indicator.htm)



## Who Makes the EI Determinations (and fills out the EI forms)?

- The lead regulators for the site (Authorized State or EPA) make the EI determination.
- However, facilities or their consultants may assist States and/or EPA in the evaluation by providing information on the current environmental conditions
- (and may even assist by filling out the EI forms and making recommendations for the determination).



## How Does the Human Exposures EI Relate to Traditional Risk Assessments?

- The Human Exposure EI is an assessment of (actual current) human risks and, would typically take the form of a qualitative assessment of the completeness of exposure pathways,
- but as necessary, may include a traditional Quantitative Risk Assessment.



## How Does the Groundwater EI Differ From the Human Exposures EI?

- The Groundwater EI is strictly a resource protection measure and not a direct measure of human risk\*, and
- may include the assessment of impacts of groundwater discharges to surface waters and surface water eco-systems.
- \* risk is indirectly involved when the levels of concern (“stds”) are based on human risks.



## Will EI Require Additional Investigations (Beyond that Typically Required for CA)?

- No, since the EI are small components of typical site Corrective Action final remedies,
- the EI should not require any additional investigations to be conducted.
- Although, the timing of when investigations, or stabilization actions, occur
- may be altered in order to demonstrate that site conditions are “Under Control” as soon as possible.



## Is It Necessary to Complete an Entire Site Investigation to Show That Human Exposures Are Under Control?

- No, human exposures can be considered “Under Control” if adequately protective controls are in place
- to prevent unacceptable exposures
- (i.e., cut pathways between humans and contamination)
- for the reasonably-expected worst-case conditions (in the un-investigated areas).



**Are EI Determinations a Point-in-time Determination,  
OR Do They Have to Be Maintained to Ensure They  
Remain True Through Time?**

- Yes, they are made in a point in time,
- and
- Yes, we are responsible (regulators & RP)
- for ensuring that the EI determinations accurately report site conditions through time.



## Background and History of RCRA CA EIs

- Conceptualized 1993 (Fagan/Price) (Pre-GPRA)
- As an escape from “the process”
- Focus 1 – most important species (humans)
- Focus 2 – highly valued resource (groundwater)
- Guidance in memoranda and RCRIS 1994 and 1995 (Parker)
- Limited evaluation and documentation criteria





## Background of RCRA CA EIs (Cont.)

- EIs measure the effectiveness of stabilization actions
- Stabilization/EIs is our first priority with limited resources
- Stabilize worst sites prior to final cleanups at fewer sites
- Focus on results (i.e., changes in the quality of the environment) and de-emphasize the corrective action process



Notes:

Some elements of the Program's stabilization objectives (e.g., source control) may not be included in EIs, however the EIs are effective statements for important elements of stabilization.

Stabilization/EIs for the "worst sites first" is the best way to maximize the protection of human health and the environment given our resource limitations.

## 1997: EIs are the Metrics for GPRA

Our GPRA sub-objective is:

- Controlling current human exposure at 95% of high priority (GPRA baseline) sites by 2005; [not 100%] and
- Controlling migration of contaminated ground water at 70% of “high priority” (GPRA baseline) sites by 2005



Notes:

Meeting these goals is the highest near-term priority for the National RCRA program.

EPA recognizes that these are significant “stretch” goals for the program.

The EIs do not change the EPA’s long-term goals for CA sites of groundwater restoration and source remediation.

Annual goals have been created to help ensure that we are on track to meet the 2005 goals.

Our progress to date is looking good (very near or surpassing our annual goals). (Of course we have been working at these sites for up to 15 years.)

Is there a wall out there (informational, budgetary, physical limitations) ?

Only the crystal ball knows.

The truth is we’ll see. (Nobody can fault us for doing our best.)

## EIs Became the Primary Near-Term Goals for RCRA Corrective Action

Environmental Indicators needed to:

- Reflect our overall program priorities
  - Protect humans & prevent spread of contamination
- Be implementable and meaningful
- Be as simple as possible, yet usable & defensible
- Allow for facility-specific conditions
- Communicate our results to Public (& Congress)



Notes:

The EIs began very simply (as simple as possible) and yet, to be able to meet other needs, they became somewhat more (but hopefully not too) complicated.

To be communicable (and useful) to people at all levels of technical understanding, the EIs needed to result in a very limited list of answers (Yes, No, and Insufficient information to know).

This required that we neatly (and defensibly) sort all kinds of site-specific conditions into these three boxes (as we all know RCRA sites are nearly infinitely variable).

While simpler appears better, it can be more difficult to implement and to be implementable, we had to sharpen the points that divide sites into one or the other of the boxes clearly.

## Updated EI Guidance February 5, 1999

- Compilation guidance (2-day EI Summit ,+++)
- Replaces previous guidance (1994 and 1995)
- “Interim-Final” (but unlikely to change)
- EI guidance consists of two forms with series of questions identifying national minimum:
  - Evaluation, and
  - Documentation
  - criteria for EI determinations.



### Notes:

The updated guidance is identified as “Interim-Final.” This label reflects that the guidance is unlikely to change unless a simpler or more efficient way of performing the task can be found.

The questions in the EI forms were designed to be as few and simple as possible with the goal of helping individual project managers to evaluate EIs at their facilities.

“This guidance has been developed with the cooperation and input of representatives from all ten EPA Regions and at least one State from each Region. The guidance is in the form of questions to be answered in making an EI determination. The questions and answer options express the minimum criteria for EI determinations and are not to be modified for Regional, State or site-specific conditions. The ‘Rationale’ portion of the forms can be filled in to explain unique situations to any length necessary. While the signed hard-copies of these forms should reside in the facility's administrative files, these forms should also be kept in electronic format that can be posted on an ‘EI database’ web site to be developed by the Office of Solid Waste in the near future. The ‘EI database’ will help communicate successes and provide examples for overcoming barriers to progress.” (from 2/5/99 cover memo from Elizabeth Cotsworth to RCRA Senior Policy Managers)

## Objectives of 1999 EI Guidance

- Help ensure:
  - Appropriate factors are considered when evaluating and making EI determinations
  - EI determinations are defensible to a reasonable person
  - Consistency (across States and Regions), and
- Helps individual case managers decide when determinations are complete and adequately documented.



Notes:

EIs are a means for documenting and summarizing professional judgments.

The guidance helps ensure consistency and equivalency of determinations by identifying a consistent list of factors that should be considered in making a site-specific professional judgment.

Recommended minimum documentation criteria help case managers decide when determinations are complete and adequately documented in order to survive internal and external audits, public scrutiny, and facility's questions.

EI determinations are likely to undergo public scrutiny because the general intent is to make this information available to the public. In addition, short cuts in determinations once made and documented are always subject to being picked up and highlighted.

## EI Guidance has Three Levels

- 1) Cover memorandum (w/ notice of e-forms)
- 2) Flowchart (unofficial summary)
  - Guidance Forms
    - a) Basic questions (top of each page)
    - b) Criteria confirming (and documenting) responses (associated w/ YE, NO, IN)
  - Will become more clear next segment of module where we discuss the guidance in detail and use the guidance for the Case Study



Notes:

Questions are answered with “YE,” “NO,” or “IN” (Insufficient information) with space for narrative description of the rationale and references for the given answers.

## Background: General EI Definition

- Needs to be verifiable (by public or auditors)
- Designed to be achievable (within GPRA schedule)
- Designed to be meaningful to the public
  - site-wide determinations
  - inclusive of all environmental contaminants of concern to potentially exposed populations \*



Notes:

This following definition is provided on page 1 of each evaluation form.

Environmental Indicators are measures being used by the RCRA Corrective Action Program to go beyond programmatic activity measures (e.g., reports received/approved, etc.) to track changes in the quality of the environment. The two EIs developed to date indicate the quality of the environment in relation to current human exposures to contamination and the migration of contaminated ground water. An EI for non-human (ecological) receptors is intended to be developed in the future.

EIs are site-wide determinations. This means that while a particular unit or area-of-concern may not represent an unacceptable threat to humans or to groundwater, the facility would not achieve the EIs until all aspects of the facility subject to RCRA Corrective Action were considered in the determination.

Site-wide criterion applies even if another program (e.g., voluntary, unauthorized State, UST, or CERCLA) is working on part of the facility.

Notes (Cont'd.):

This determination is being made for the identified facility only and by a cleanup program with limits in its ability to address some environmental hazards or risks (which may also be present or remain at and/or adjacent to this facility but which are not attributable to this facility). For example, background or regional contamination/hazards/risks which are not attributable to this facility may be present or remain after a positive “under control” determination or cleanup is completed. In such cases, this condition will be clearly indicated in the documentation of the EI determination and a local health official contact should be identified for further information.

Furthermore, while this determination would typically have included a comprehensive consideration of environmental hazards and risks at and/or adjacent to this facility, the EI determination can only be based on factors that are both attributable to this facility and subject to the applicable cleanup laws, regulations, and guidance. For example, although where they are a problem they are typically incorporated into site-wide Corrective Action activities, there may in some cases be specific chemicals (i.e., radioactive constituents and certain pesticides) that due to legal precedent may not have been included in Corrective Action at particular facilities and their EI determinations. In such cases, this condition will be clearly indicated in the documentation of the EI determination and a local health official contact will be identified for further information.



## Definition of Human Exposures EI

### Key components:

- New title with “Current” and “Under Control”
- “Current” conditions (i.e., known/expected at the time of the determination)
- A positive (“YE”= under control) determination means ongoing exposures are acceptable
- Should reflect all contaminants of concern present above risk-based levels of concern
- Site-wide



### Notes:

Current Human Exposure Under Control EI is represented by RCRIS code CA725 (RCRIS stands for the RCRA Information System database).

This following definition is provided on page 1 of each evaluation form:

### Definition of “Current Human Exposures Under Control” EI

A positive “Current Human Exposure Under Control” EI determination (“YE” RCRIS Status code) indicates that there are no “unacceptable” human exposures to “contamination” (i.e., contaminants in concentrations in excess of appropriate risk-based levels) that can be reasonably expected under current land- and groundwater-use conditions (for all “contamination” subject to RCRA Corrective Action at or from the identified facility (i.e., site-wide)).

The previous (1994) title (“Human Exposures Controlled”) did not clearly identify that the determination applied to current conditions only, and also implied to many readers that physical remedial actions were taken, when remedial actions (other than investigation and evaluation) may not have been necessary in all cases to ensure that human exposures were under control.

## Migration of Contaminated Groundwater Under Control EI

### Key components:

- This EI is strictly resource protection-based re: physical migration (not risk-based)\*
- It reflects EPA's long-standing policies of groundwater protection
- Determinations are based on existing plume boundary (not property boundary or projected exposure point)
- Site-wide



### Notes:

\* Risk frequently enters into the Contaminated Groundwater EI (RCRIS Code CA750) indirectly through the selection of the appropriate standard ("level") for identifying the extent of contamination (e.g., a drinking water standard). However, the EI is primarily related to the protection (prevention of further contamination) of the resource.

## Background: Relationship of RCRA CA EI to Final Remedies

- Final Remedies remain the long-term Corrective Action objective
- Human Exposure EI (CA725) pertains ONLY to current land and water uses
- Groundwater EI (CA750) pertains ONLY to physical migration of contaminated groundwater (and acceptability of current impacts to surface water)



Notes: (from Page 1 of each of the Human and Groundwater EI guidances)

While Final Remedies remain the long-term objective of the RCRA Corrective Action program, the EIs are near-term objectives, which are currently being used as Program measures for the Government Performance and Results Act of 1993 (GPRA).

The "Current Human Exposures Under Control" EI is for reasonably expected human exposures under current land- and groundwater-use conditions ONLY, and does not consider potential future land- or groundwater-use conditions or ecological receptors. The RCRA Corrective Action program's overall mission to protect human health and the environment requires that Final Remedies address these issues (i.e., potential future human exposure scenarios, future land and groundwater uses, and ecological receptors).

The "Migration of Contaminated Groundwater Under Control" EI pertains ONLY to the physical migration (i.e., further spread) of contaminated ground water and contaminants within groundwater (e.g., non-aqueous phase liquids or NAPLs). Achieving this EI does not substitute for achieving other stabilization or Final Remedy requirements and expectations associated with sources of contamination and the need to restore, wherever practicable, contaminated groundwater to be suitable for its designated current and future uses.

## EIs = Min. Documentation and Max. Effectiveness

- Document only as much as necessary to verify
  - Minimal restatement and maximum referencing
- EIs can be used to FOCUS and PRIORITIZE traditional Corrective Action activities
- EIs present an OPPORTUNITY to focus on key “problems” and “results” which are achievable in near term (exposures & plume expansion)
- Recent findings: EIs = improved health protection, and recognition of aquifer resources



Notes:

References (as specific as possible, e.g., pages, section, chapter, volume) to in-depth reports or submittals are adequate documentation, although brief summary descriptions are very helpful.

## How do Corrective Action EIs Relate to ASTSWMO and ECOS Measures?

- ASTSWMO's Remediation Task Force Report on EI is consistent with our EIs (although they are termed "Remediation Outcomes")
- ECOS has identified the RCRA CA EIs as Core Performance Measures (since 1998)
- EPA grant for ECOS EI recently resulted in 3 EI
  - 1) = Human Exposures = EPA's
  - 2) = Groundwater = EPA's
  - 3) = Area cleaned up (still to be defined)



ASTSWMO = Assoc. of States and Territorial Solid Waste Management Officials (operational-level management and staff)

ECOS = Environmental Commissioners of States (political appointee-level heads of State environmental programs)

## EIs Are Not a Cookbook

- Assessing risks due to contamination is both complex and has potentially volatile results
- Cookbook approaches fail (2 many variables)
- EIs are a means of documenting professional judgment
- Assessing risks commonly raises more questions than it answers (not a failure)
- Important to know what decisions can be made by project manager and when to consult with trained risk expert



## Why doesn't an EI Evaluation Warrant Additional Investigation?

- Current conditions are only a small component of final (now and forever) remedies
- Data necessary for EI determinations are a subset of data necessary for RFI-CMI (since data for future use scenarios and standards are not typically necessary)
- Final remedies should not be allowing ongoing unacceptable human exposures or plume migration that is "out of control"



## Who Makes EI Determinations?

- Overseeing regulators (lead State or Region) i.e., those most familiar with the facility
- EI determinations are a regulatory function, and regulators should review information (submitted by responsible parties)
- On both contamination and exposures
- to determine if it is verifiable and adequate for making the EI determination



Notes:

Those working at the facilities should be allowed to provide input to the EI evaluation process because they are at the site most frequently.

Likewise, those responsible for the contamination should be the ones responsible for making statements about what exposures can reasonably be expected.

Regulators' role should be to review submittals and accept them as reasonable or not.

It should be owner/operator's responsibility to notify regulators of changes that may affect the EI determination (this is an ongoing responsibility). Mechanism being developed.



## Who Selects EI Evaluations Standards (“levels”)?

- Lead Agency/Dept.
- It is the professional responsibility of the Lead Agency/Dept. to select appropriate “levels” for the EI determinations
- Appropriate “levels” depend on a number of factors (such as the use of the media, and acceptable risk levels (within the risk range))
- Levels selected should balance flexibility and consistency



## Who Fills Out the EI Forms?

- Overseeing regulators (and/or owner/operators or their consultants)
- Teamwork can help to get to “Under Control”
- The ultimate responsibility for the content of the forms and the determination is the regulators



## Who Signs EI Determinations?

- Overseeing regulators (lead State or Region) individuals making the EI determination
- People do things (not agencies)
- To maintain credibility it is important to identify the individuals making the professional judgments
- Responsible party signatures on submitted DRAFTS can improve their usefulness to regulators



## What Level of Confidence is Appropriate for EI Determinations?

- “Reasonable certainty” that can be documented and is verifiable (i.e., defensible to reasonable person)
- Does NOT mean 100 percent certainty
- Can be revisited and revised as new information becomes available,
- For example, as conditions change



Notes:

EIs provide a framework for documenting professional judgment. EIs also encourage consistency by establishing broad boundaries and listing the factors to be considered by all, while still allowing flexibility for professional judgment dealing with site-specific conditions.

## Duration/Applicability of EI Determinations

- Codes entered in RCRIS “YE,” “NO,” or “IN” sufficient Information, remain in database ONLY as long as they are TRUE
- Codes should be changed when regulators become aware of contrary information
- New information should be included in EI determination (e.g. new SWMU, property, etc.)



## Maintenance of Accuracy in EI Determination

- It is highly recommended that the EI determinations be based on written submittals by the responsible parties (particularly for exposure conditions and controls in place)
- Owner/operators should be made aware of their responsibility to notify regulatory agencies when they become aware of changes in conditions that could cause a change in EI status (possible model form letter)



## EI Guidance Cover Page

- Signed hardcopies of forms should reside in administrative files
- Electronic version EI forms needed for “EI database” web site to be developed by OSW in the “near future” (noted in cover page, draft OIG recommendation, draft OSW Directive)
- pdf interim web site very soon (volunteers now)
- Searchable web site/interactive forms with possible integration with SCEM builder



### Notes:

Advantages of sharing evaluation forms are increased sharing of good ideas to overcome barriers and get more sites “under control.”

Advantages of making EI results records available (in Program Accomplishment Reports (PARs) reports and/or on location maps) is to help encourage the regulated community and regulators to team up and do the right thing, and look good together.

## Availability of EI Determinations

- Completed EI forms will be available to other regulators via web site (yet to be created)
- States and Regions will decide on the public availability

Electronic format for EI forms (blank) is available on the web at

[www.epa.gov/epaoswer/osw/ei\\_guida.pdf](http://www.epa.gov/epaoswer/osw/ei_guida.pdf)

- Web site with completed EI forms and examples (in pdf format) available at [www.correctiveactionwksp.org/indictor.htm](http://www.correctiveactionwksp.org/indictor.htm)





## Closing EI Remarks

- Don't let the desire to show "YE" results lead to indefensible EI determinations
- Given our resources, we can only be faulted if we say it is a "YE" when that is not reasonable or defensible
- The more difficult the determination, the greater the need for acknowledgment by all stakeholders that a reasonable determination was made (or else we'll pay for it later)



Notes:

We need to "do whatever it takes" to get to the right answer.

Public participation was not specifically identified as an expectation in the guidance except where natural attenuation remedies will allow some further migration of the plume and we are still calling it "Under Control" (i.e., in particularly sensitive situations).

However, for several reasons (e.g., often significant Interim Actions will be involved in achieving EIs) public participation activities concurrent with EI determinations is highly recommended especially in cases where stakeholders could be impacted or alarmed by determinations made without their involvement.

## El Issues Conference Calls

- 1st Thursday of Month (typically 3:00 e.s.t.)
- State, Regional and HQ participants
- Opportunity to raise site-specific issues/problems
- Share information on developing issues
- Discuss and further develop guidance
- Contact to get name on call list:
  - Schuver.Henry@EPA.gov
  - (703) 308-8656



## Current Human Exposures Under Control EI

Key components:

- Intended to be realistic, risk-based evaluation
- Based on actual, “current” land use, not hypothetical or future land uses
- Looks at complete exposure pathways resulting in human exposure to levels of contaminants giving rise to unacceptable risk
- No ecological risk evaluated (eco-risk EI possible in future)



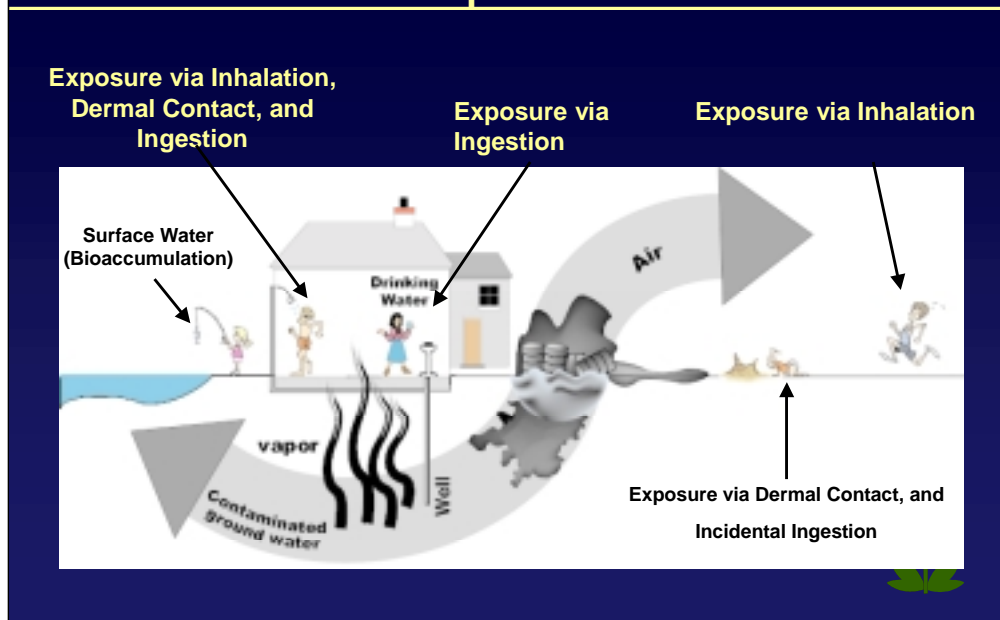
## Current Human Exposures Under Control EI (Cont.)

Key components (continued):

- All media need to be considered (soil, sediment, water, air).
- A number of potential exposure pathways need to be considered if realistic (e.g., actual groundwater use to be considered).
- A number of potential exposure scenarios need to be considered if realistic (consistent with current actual land use).



## Some Principal Pathways to be Considered for “Current Human Exposures Under Control”



Summary Exposure Pathway Evaluation Table (CA725 Question 3, Page 3)

Potential[ly Applicable] Human Receptors (Under Current Conditions)

“Contaminated” Media	Residents	Workers	Day-Care	Construction	Trespassers	Recreation	Food3
Groundwater	—	—	—	—			—
Air (indoors)	—	—	—				
Soil (surface, e.g., <2 ft)	—	—	—	—	—	—	—
Surface Water	—	—			—	—	—
Sediment	—	—			—	—	—
Soil (subsurface e.g., >2 ft)				—			—
Air (outdoors)	—	—	—	—	—		

## Human Exposures EI Evaluation and Documentation Guidance

Tiered five-step screening process:

- has all relevant data been evaluated?
- any media contaminated above appropriate risk-based levels (“contamination”)?
- are there complete pathways between humans and “contamination”?
- are exposures expected to be significant?
- have exposures been demonstrated (e.g., quantitatively) to be acceptable?



Notes:

This slide presents an easy-to-read introduction to the EI guidance questions.

These questions will be discussed in more depth in the next section of this presentation.

The full text of these questions is in the 2/5/99 guidance provided in the Handbook

These questions are summarized and their functional relationships are illustrated in the EI flowcharts.

## Exposure Controls for Human Exposures EI

The objective is to reduce 1) concentrations, or 2) exposures (e.g., cut the pathways):

- It is not necessary to investigate all areas if there are exposure controls in place that adequately limit, control, or prevent exposures to the concentrations likely or possibly present
- Optional pathway evaluation worksheet and example controls (early draft available)



### 1. Examples of Physical Controls

- Caps
- Fences/Walls
- Security Guards
- Vegetative Cover
- Natural Inaccessibility
- Remoteness/Unattractiveness
- Vapor Barriers/Ventilation Systems
- Permitted releases – NPDES, CAA, etc.

### 2. Examples of Institutional Controls – Do not need to be legally binding documents (sitting in courthouse), could be written commitments (e.g. on facility letterhead). “EFFECTIVE controls”

- Posted Signs
- Land-use Restrictions (e.g., zoning, deed, Responsible Party statements)
- Level of PPE (Personal Protection Equipment)
- Safety Training/Newsletters
- Activity Permits/Notifications (e.g., construction permits/notifications)
- Well Restrictions
- Media-use Restrictions
- Responsible Party statements of activity/use restrictions
- Testing/Monitoring (and restrictions if necessary)
- Consumption Restrictions
- Restrictions on Frequency of Exposures

## Current Human Exposures Under Control EI

### Risk:

- Is the probability of an undesirable effect
- For environmental risk, it is the product of contaminant concentrations and exposures (i.e., = Conc. x Exposure) [& Toxicity]
- Can be reduced by controlling either concentrations or exposures
- Acceptability is a societal value judgment
  - Voluntary – Involuntary
  - Benefits – No benefits
  - Well-known – Not familiar
  - Warnings – No warnings



Notes:

Risks\* can be reduced by:

Reducing contaminant concentrations (cleanup, remediation, restoration, etc.)

or

Reducing exposures (effective controls on exposure intensity, frequency, or magnitude)

Obviously, reducing contaminant concentrations (and removing all hazards) is preferable (for many reasons); however, given the GPRRA timeframe, exposure controls are likely to be more frequently used to meet “Under Control” goals.


Acceptable risk levels are typically identified in State or EPA guidance (e.g., lifetime cancer risks within  $10^{-4}$  to  $10^{-6}$  range and Hazard Indices of  $<1$ ).

\*(Incremental risks due to environmental hazards)



## Current Human Exposures Under Control EI

Summary and key communication points:

- Three possible answers (“YE,” “NO,” & “IN”)
- “YE”(s)\* exposures are “Under Control”
- A “NO” answer means that Current Human Exposures are Not Under Control
  - we are aware that unacceptable human exposures are currently occurring
  - these conditions should be addressed as soon as possible
- “IN” sufficient data to make a determination 

Notes:

There shouldn't be many “NO” status codes (if we are protecting human health)

“NO” status codes shouldn't exist for long (if we are addressing problems as soon as we are aware of them)

“YE”s status codes (exposures are “Under Control”) need to be carefully communicated for sites where “un-natural” (or natural) background hazards exist (i.e., from sources other than these facilities, and/or not reachable by RCRA)

It is important for us (regulators) to be careful in the communication of what "under control" means. "Under control" refers to a specific facility's releases and may not mean that there are not other unacceptable exposures (which are not the responsibility of the identified facility).

Additional guidance/methodologies for clearly and accurately communicating this issue will likely need to be developed in the future. (All we need is someone to do it.)

## Migration of Contaminated Groundwater Under Control EI

- There are two primary elements:
  - 1) The stability of geospatial (horizontal and vertical) dimensions of “contaminated” groundwater
  - 2) Impacts of discharges of “contaminated” groundwater into surface water, if any
- Ongoing monitoring is required to document both stabilization of migration and impacts to surface water (by contamination)\*



Notes:

\* Ongoing monitoring is typically only required where “contamination” has been identified (i.e., concentrations above “levels of concern”).

## Definition of Groundwater EI

### Key components:

- A positive determination means the physical migration of contaminated groundwater has been stabilized (and impacts to surface water are currently acceptable)
- Monitoring will be conducted to confirm
- Should reflect all contaminants of concern present above appropriate levels of concern
- Site-wide



### Notes:

The Migration of Contaminated Groundwater Under Control is identified by RCRIS status code CA750

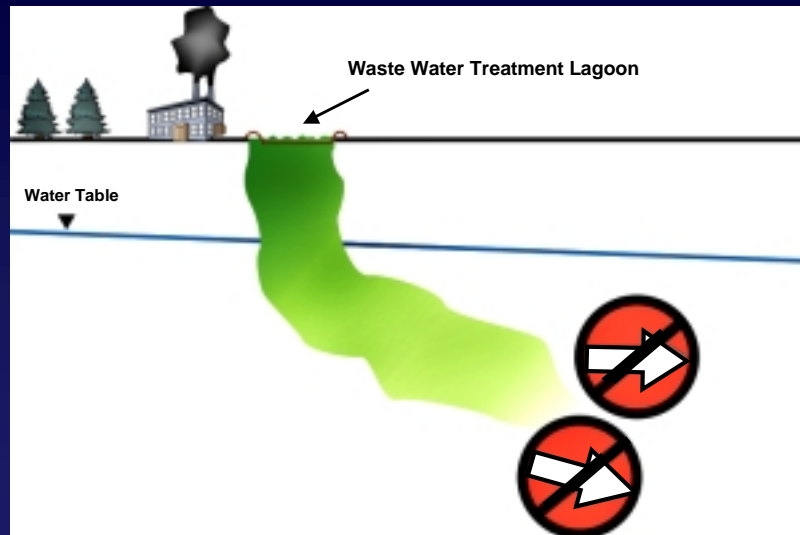
### Definition of "Migration of Contaminated Groundwater Under Control" EI

A positive "Migration of Contaminated Groundwater Under Control" EI determination ("YE" status code) indicates that the migration of "contaminated" groundwater has stabilized, and that monitoring will be conducted to confirm that contaminated groundwater remains within the original "area of contaminated groundwater" (for all groundwater "contamination" subject to RCRA corrective action at or from the identified facility, i.e., site-wide).

Site-wide criterion applies even if another program (e.g., State, voluntary, UST, or CERCLA) is working on part of the facility.

The previous (1994) title (Groundwater Releases Controlled") did not clearly identify that the determination applied only to the physical movement of the outside boundary of contamination and even though the full text explained this, the title implied to some readers that it also included elements of source control. This title also implied to many readers that physical remedial measures were taken, when remedial actions (other than investigation, evaluation, and perhaps continued monitoring) may not have been necessary in all cases to ensure that the migration of contaminated groundwater was under control.

## “Migration of Contaminated Groundwater Under Control” Environmental Indicator - Dissolved Plume Example



Notes:

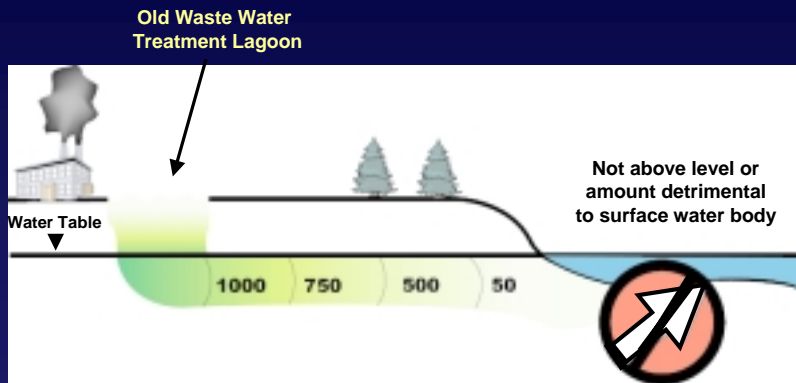
This illustration shows only a simple dissolved phase plume.

However, be aware that contaminants in a separate phase (“pure product”), for example,

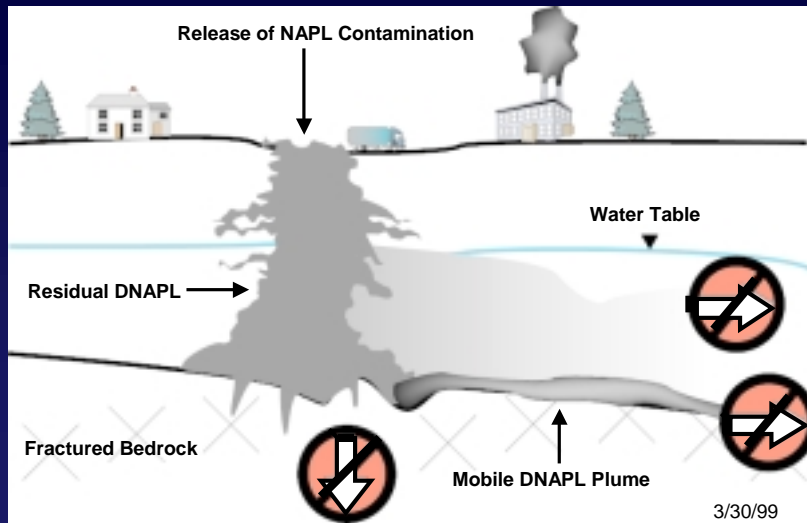
- floating (LNAPL-Light Non-Aqueous Phase Liquids) like gasoline, or
- sinking (DNAPL - Dense Non-Aqueous Phase Liquids) like TCE, or perhaps
- neutral buoyancy (NNAPL - Neutral Non-Aqueous Phase Liquids) due to pure mixtures of light and dense chemicals

[may move in different directions, at different speeds, and due to different mechanisms (e.g., up-(water-table) gradient or down strata dip regardless of water pressure head and flow direction).]

# “Migration of Contaminated Groundwater Under Control” Environmental Indicator - Dissolved Groundwater Plume Discharging to Surface Water Example



# “Migration of Contaminated Groundwater Under Control” Environmental Indicator - Dissolved and NAPL Plume Example



## Groundwater EI Evaluation and Documentation Guidance

Tiered seven-step screening process:

- Has all relevant data been evaluated?
- Is groundwater “contaminated” above aquifer-appropriate, risk-based levels?
- Does monitoring data demonstrate horizontal and vertical migration has stabilized?
- Does contaminated groundwater discharge to surface water?



Notes:

This slide presents an easy-to-read introduction to the EI guidance questions.

These questions will be discussed in more depth in the next section of this presentation.

The full text of these questions is in the 2/5/99 guidance.

These questions are summarized and their functional relationships are illustrated in the EI flowchart.

## Groundwater EI Evaluation and Documentation Guidance (Cont.)

Tiered seven-step screening process (cont.):

- Is the discharge of contaminated groundwater into surface water likely to be insignificant (<10x gw std and no other issues criteria)?
- Are impacts to surface water, sediments, and ecosystems “currently” acceptable?
- Is there adequate monitoring to document no migration and no unacceptable impact to surface water?





## Migration of Contaminated Groundwater Under Control EI

Summary and key points:

- Three possible answers (“YE,” “NO,” & “IN”)
- Limited migration permissible if part of “formal” natural attenuation remedy (i.e., involving public participation)
- Background conditions considered in EI
- Predictive modeling may be a component, but monitoring is required to demonstrate a “YE” (with “contamination”)



Notes:

Our 2005 goal for the Groundwater EI is only 70% due to the recognition of physical limitations that can prevent the physical control of plume migration.

The EI guidance was constructed to allow limited migration under “formal” natural attenuation remedies (i.e., where stabilization is expected in the near future and public has acknowledged this assessment/decision).