Some Comments on Risk-Based End States & Contaminated Site Cleanup

Richland, Washington
March 10, 2004
Charles W. Powers, PI CRESP II

- DOE Policy 455.1 - Use of Risk-Based End States (7/15/03)
  - RBES are: “representations of site conditions and associated information that reflect the planned future use of the property and are appropriately protective of human health and the environment consistent with that use.”

Vision Document Guidance

- **Sites are to define risk-based end states that are sustainably protective of human health and the environment.**
- **The RBES depends on the site having defined of appropriate land uses and their associated exposure scenarios.**
- **RBES Vision documents are to define the RBES, and are not decision documents.**

RBES is Today a Lightning Rod

Sites **are** at very different places in the cleanup/completion process
and the state of the process Is viewed differently by different parties:

Close to closure; don't disturb;
agreements in place (Regulators and some Stakeholders)
Almost **No** sites closed; mostly interim agreements (TTBR, DOE)

Closure dates: 1997, 2000, 2006, 2015. 2025, 2035

And parties are energetically using the same words to describe different phenomena

Variances (from final RODs; interim ROD's; discussed approaches
PMP's, Site Baselines, what?)

Balancing what?
Balancing Criteria, Cost/Protection Balancing and Risk Balancing

Adequate Public: Interaction how much/at what point?

Peer Review of the U.S. Department of Energy's Use of Risk in its Prioritization Process

December 15, 1999

Peer Review Committee of the

Consortium for Risk Evaluation with Stakeholder Participation

317 George Street, Plaza 2
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*Ad Hoc Member of Committee
**Chairman of Committee

The principal findings resulting from the review can be summarized as follows:

1) In pursuit of the primary goal of DOE's environmental management program, which is the protection of human health and the environment, it is essential that risk be used as a criterion for priority setting and action.

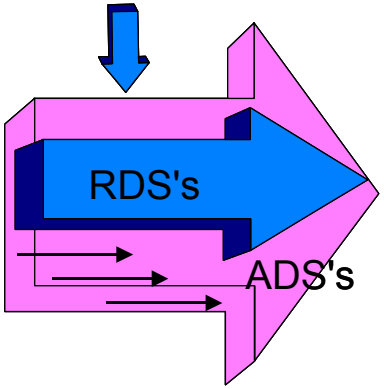
2) DOE's use of a risk-based approach for the purpose has been mandated by Congress and recommended repeatedly by external advisors, recognizing that DOE must also consider other important programmatic objectives, including compliance with pertinent laws and regulations, minimization of socioeconomic, cultural, and land-use impacts, and the cost-effectiveness of alternative remediation options.

3) In recent years, DOE has found none of the various approaches it has explored for prioritizing its environmental management activities to be entirely satisfactory for the purpose, but each approach has been abandoned before it could develop adequately, owing largely to lack of confidence in the approach by DOE and site personnel, and/or lack of support for it by other stakeholders;

My interpretation:
DOE has
Done too little with Risk – and when it has started to do so, it has been too timid and tentative

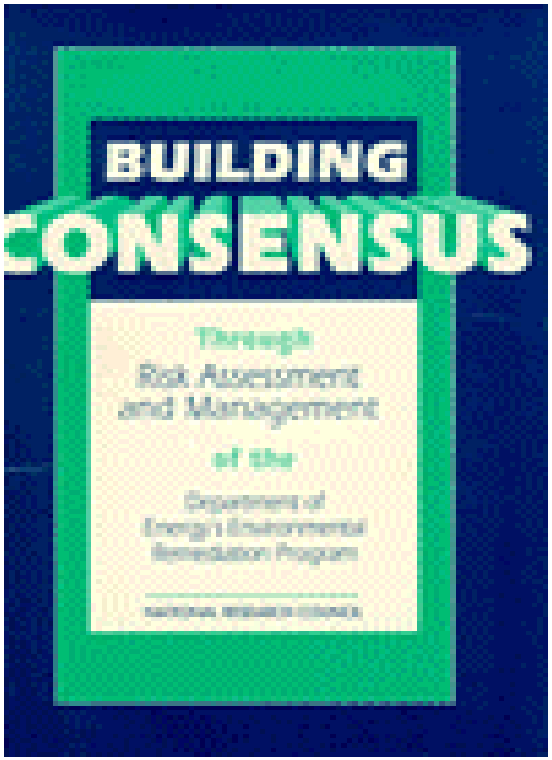
ERPS

Community
- values
- input
- outreach



PBS'

Risk Profiles



RISKS AND THE RISK DEBATE:

Searching for Common Ground

U.S. Department of Energy

Office of Environmental Management

1995

Consortium for Risk Evaluation with Stakeholder Participation (CRESP)
National Review Panel Report

Review of Risk Data Sheet Information

For Fiscal Year 1998

May 14, 1996

Selected elements

My interpretation: DOE's use of Risk has been too short-term,

Recommendations for improving the process include the following:

1) DOE should develop and implement appropriate strategies for responsible interim and long-term stewardship, based on sound principles of risk assessment and risk management.

4) Specific risk-related issues that deserve increased attention in the future include:

- The need for a more integrated approach to risk assessment than one that would suffice for compliance purposes alone at sites containing multiple sources of contamination;
- The need to include exposure evaluation as a key step in any risk assessment;
- The need to assess the potential impacts of remediating activities themselves on the health of involved workers;

• the need, particularly in complex assessments, for the Department and its contractors to provide clear summaries of the potential exposure pathways and hazardous agents in question, in order that the risk assessments may be more reviewable, credible, and useful in priority setting.

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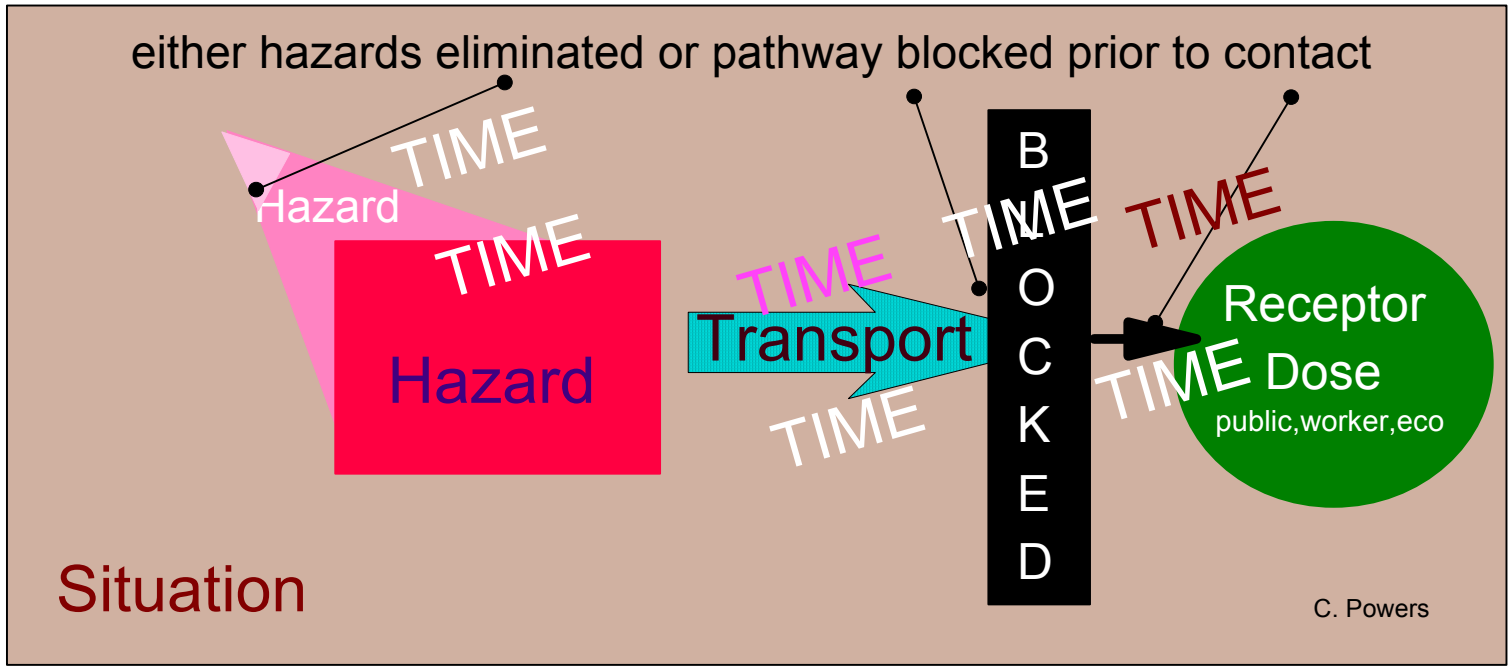
Time matters big time for DOE Sites:
Evaluation **must** address time



TIME

Selected elements

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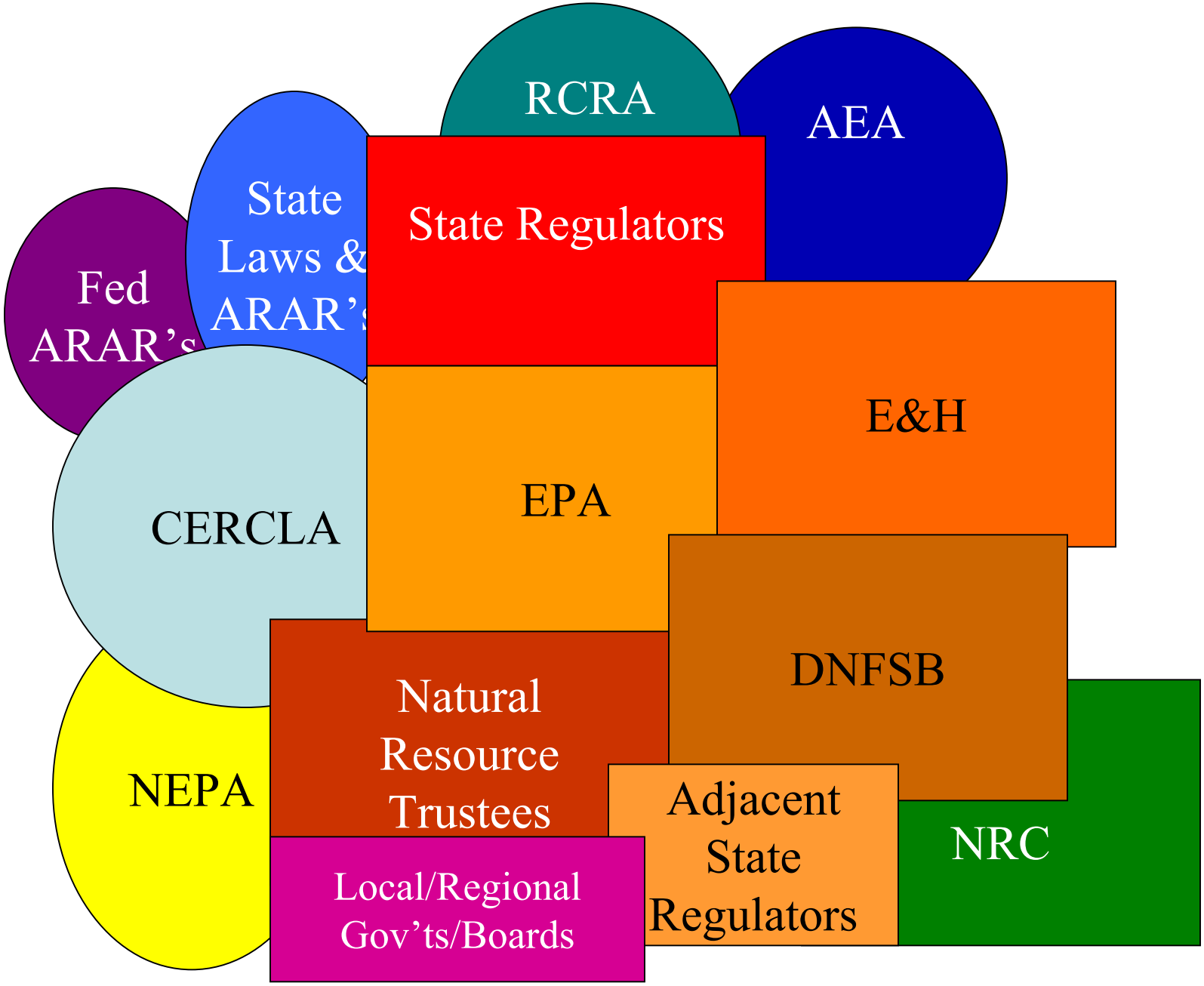

A Very Rich Regulatory Mix

Selected elements

My interpretation: DOE's use of Risk has been too short-term, too narrow, too focused on hazards not risks,

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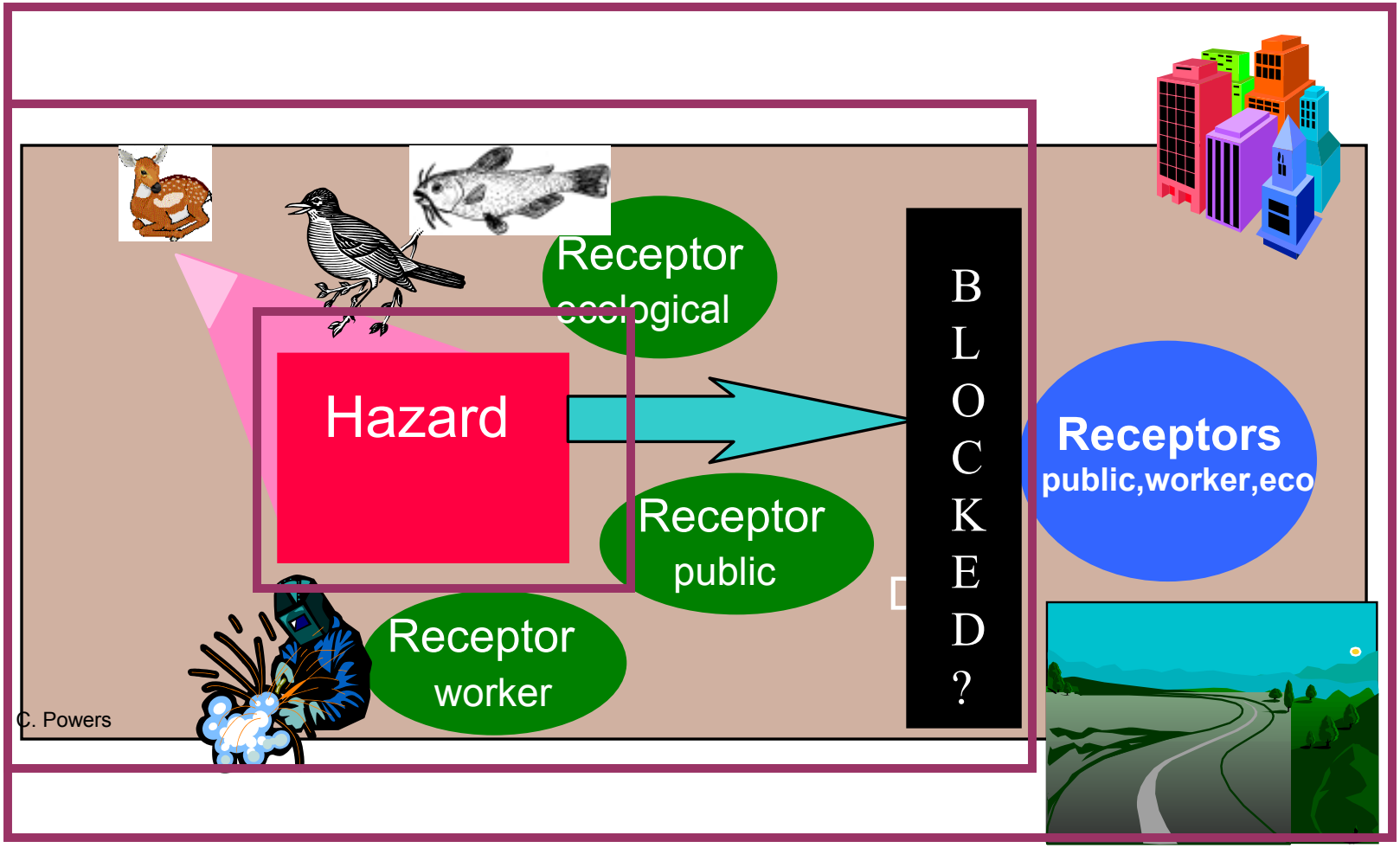
RBES Exposure Scenarios in the Context of Land Use



Developed by Charles W. Powers

Selected elements

My interpretation: DOE's use of Risk has been too short-term, too narrow, too focused on hazards not risks, failed to risk balance

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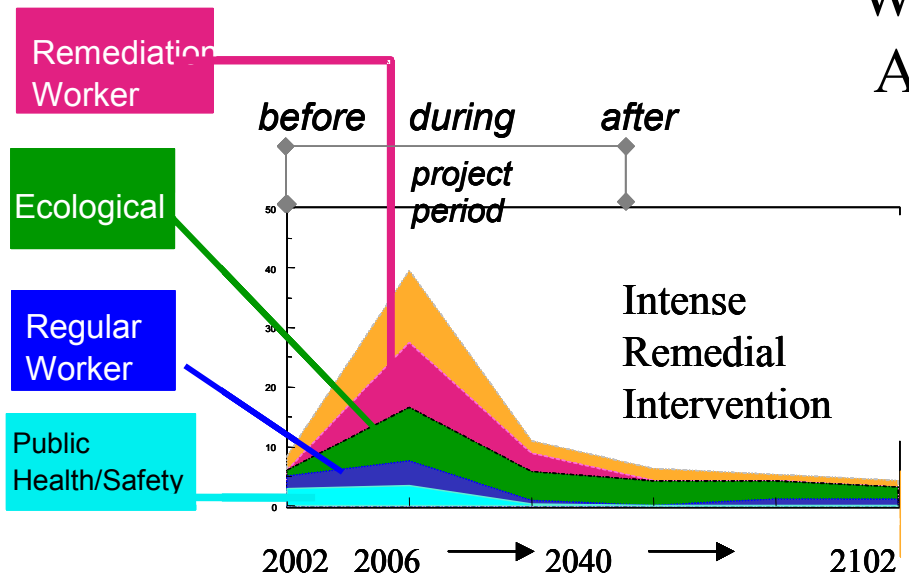
What Remedy Best Achieves A Risk-based End State?

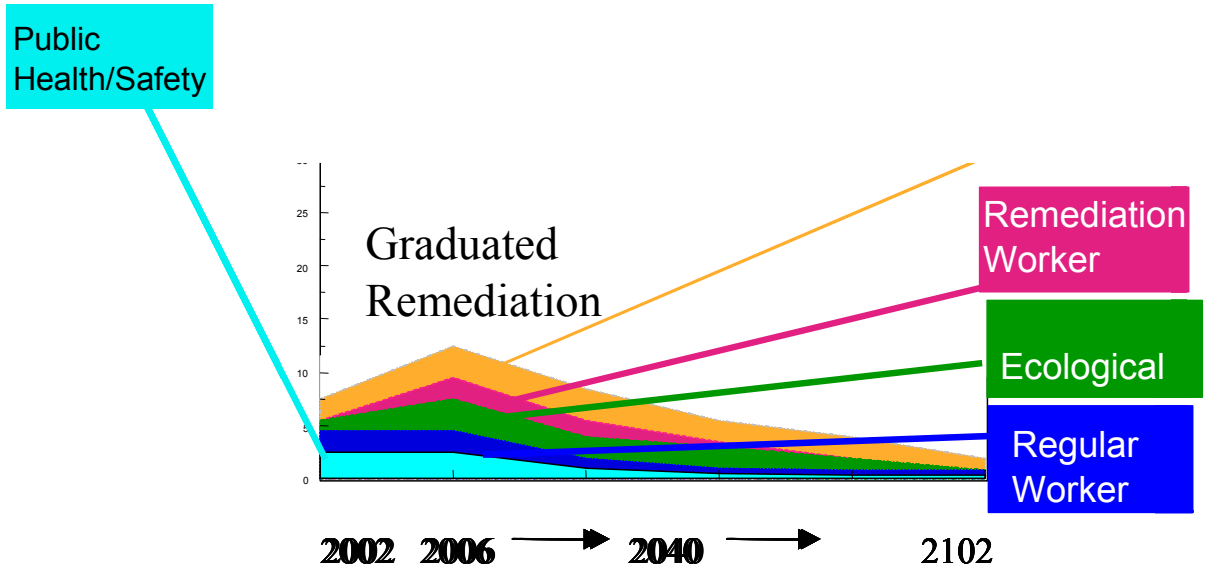


Vision Document Guidance directs sites to define risk-based end states that are sustainably protective of human health and the environment.

Protection of Health and Environment

Long-term effectiveness/permanence

Short-term effectiveness
– adverse impacts on health/environment during implementation of remedy



Developed by Charles W. Powers

Selected elements

My interpretation: DOE's use of Risk has been too short-term, too narrow, too focused on hazards not risks, failed to risk balance and is not transparent enough

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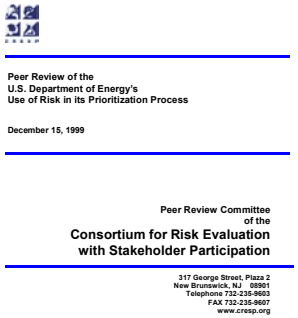


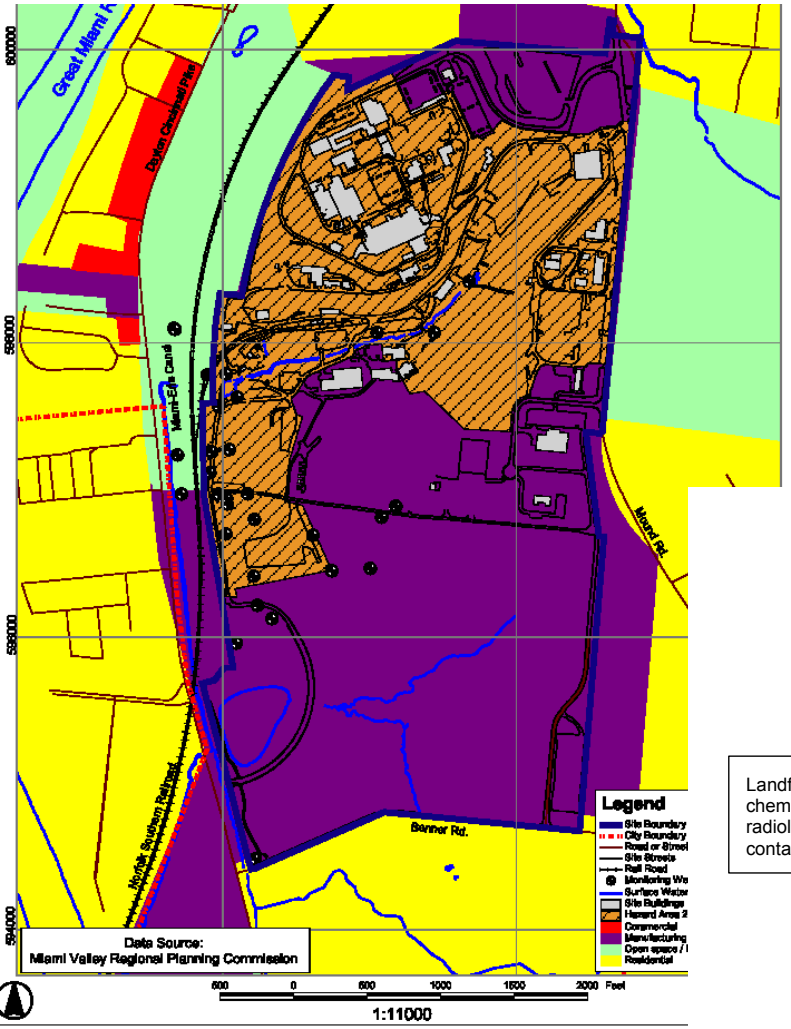
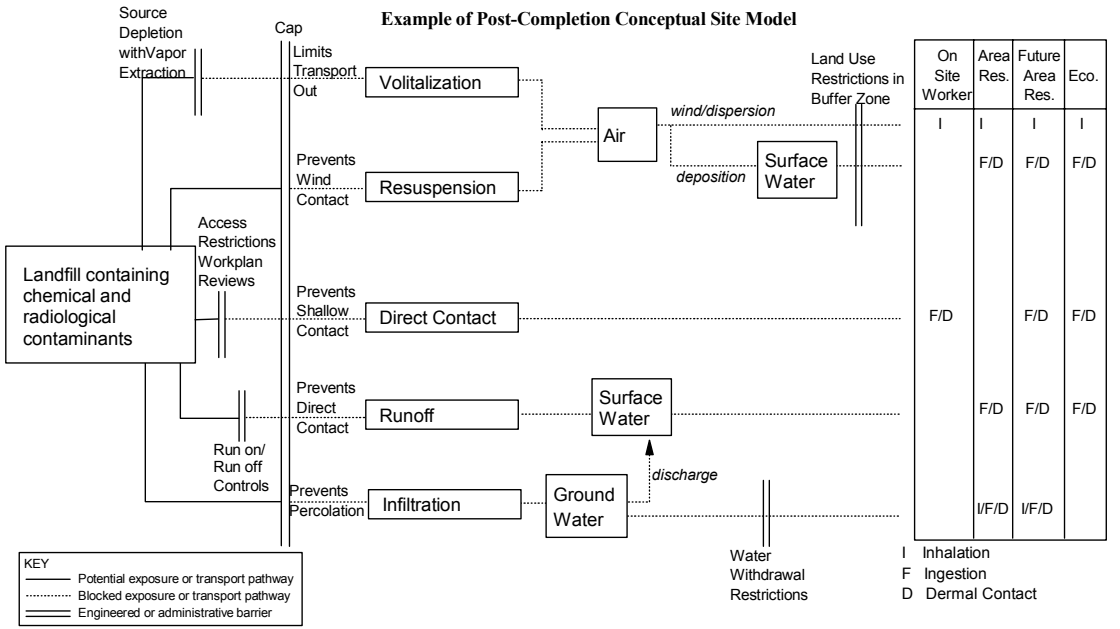


Figure 4.2a1 Hazard Area 2 - Current State

Today there is apparent Unanimity on one RBES issue:
It is a major advance to have common maps and CSM's through which to understand sites and from which to be able to compare current and risk-based end-state scenarios



Components of End State	Description
Waste Characteristics	One landfill remains on site. Contaminants include: NO, CHCL, DCE, Toluene, H_3, C_{14}, and DCA. The estimated volume of material disposed in the landfill is 420,000 y_3 based on historical records and knowledge of past practices.
Unit Characteristics	Landfill is approximately 50 - 60 feet above the upper huydrostratigraphic unit (HSU) and approximately 80 ft. above the lower HSU of the groundwater aquifer. The contaminants detected in the upper HSU include: $CHCl_3$, DCA, Cr, NO_3, DCE, Toluene, H_3, and C_{14}. Contaminants detected in lower HSU include: Cr, NO, CHCl3, DCE, Toluene, H_3, C_{14}, and DCA.
Barriers in Place	One single-layer cap with a design life of 30 years covers the landfill. Vapor extraction system installed and operated until concentrations drop below threshold. Land use restriction covenants in place such that: (1) There can be no digging in the landfill area; and (2) There shall be no agriculture or residential use of groundwater; pumping groundwater from wells is prohibited.
Other Key Assumptions to Maintain Protectiveness	Land use will remain industrial. Monitored natural attenuation will demonstrate that contaminants in the groundwater are below MCLs in 20 years. Remaining contaminants in landfill are will not continue to leach to the groundwater. An alternate water supply is provided to local residents.

Introduction to the Session
Obstacles and Resolutions on Site Land Use
by Charles W. Powers, PI CRESP II
TIE Conference
Albequerque, New Mexico

November 12. 2001

CRESP has long believed geographical clarity Is needed - for example:

Developed by CRESP Researcher, Christie Drew

Decision Mapping System
116-C-1 Waste-site Information

- Name: 116-C-1 Process Effluent Trench
- Location: 100-BC Area (GIS coordinates)
- Type: Process Effluent Trench learn more
- Status: Complete (see CVP 98-0006)
- Excavation Diagram
- Dimensions:
  - Site Depth Designation: Intermediate
  - Rectangular: 167 m x 32 m x 5.2 m (548 ft x 105 ft x 17 ft)
  - Volume: 31,957 CM (41,799 LCY)
- Contaminants of concern:
  - Radionuclides: ^{137}CS, ^{152}EU, $^{239/240}$PU, ^{241}AM, ^{60}CO, ^{154}EU, ^{155}Eu, ^{238}Pu, ^{90}Sr, ^{238}U,
  - Inorganics: Cr(total), Cr^{+6} (Hex), Hg, Pg, Sb
- Cost
- Risk estimates
- Back to the 100-B/C Area Map

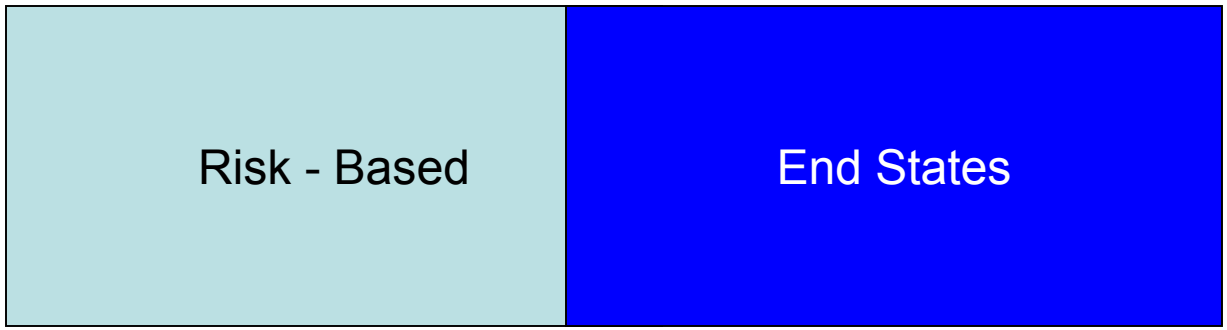
- Decision Information
  - 100 Area Soil cleanup ROD
  - TPA Milestones
- Related (Analogous) sites list
- Make a comment
- Sources

Sources: DOE, 1999. Cleanup Verification Package (CVP-98-0006) and
DOE 1998, Remedial Design Report/Remedial Action Work Plan for the 100 Area. (DOE RL-96-17)

CRESP has long pushed for geographical clarity

But Risk-Based End States
Flows too easily; it is a complicated concept –

We have to understand the relationship
Between the adjective and the noun



Probability & consequence sustainably protective

Risk-Based?: it is not so easy even within CERCLA

EPA's Genl & CERCLA Risk Assessment Guidleines

Exposure Assessments and Land Use

Points of Compliance
eg., for MCL's

MEI's in RME Scenarios

Risk Range (cancer/noncancer)

Deterministic/Probabilistic RA's

Relationship of Baseline to Post-Remedy Assessments

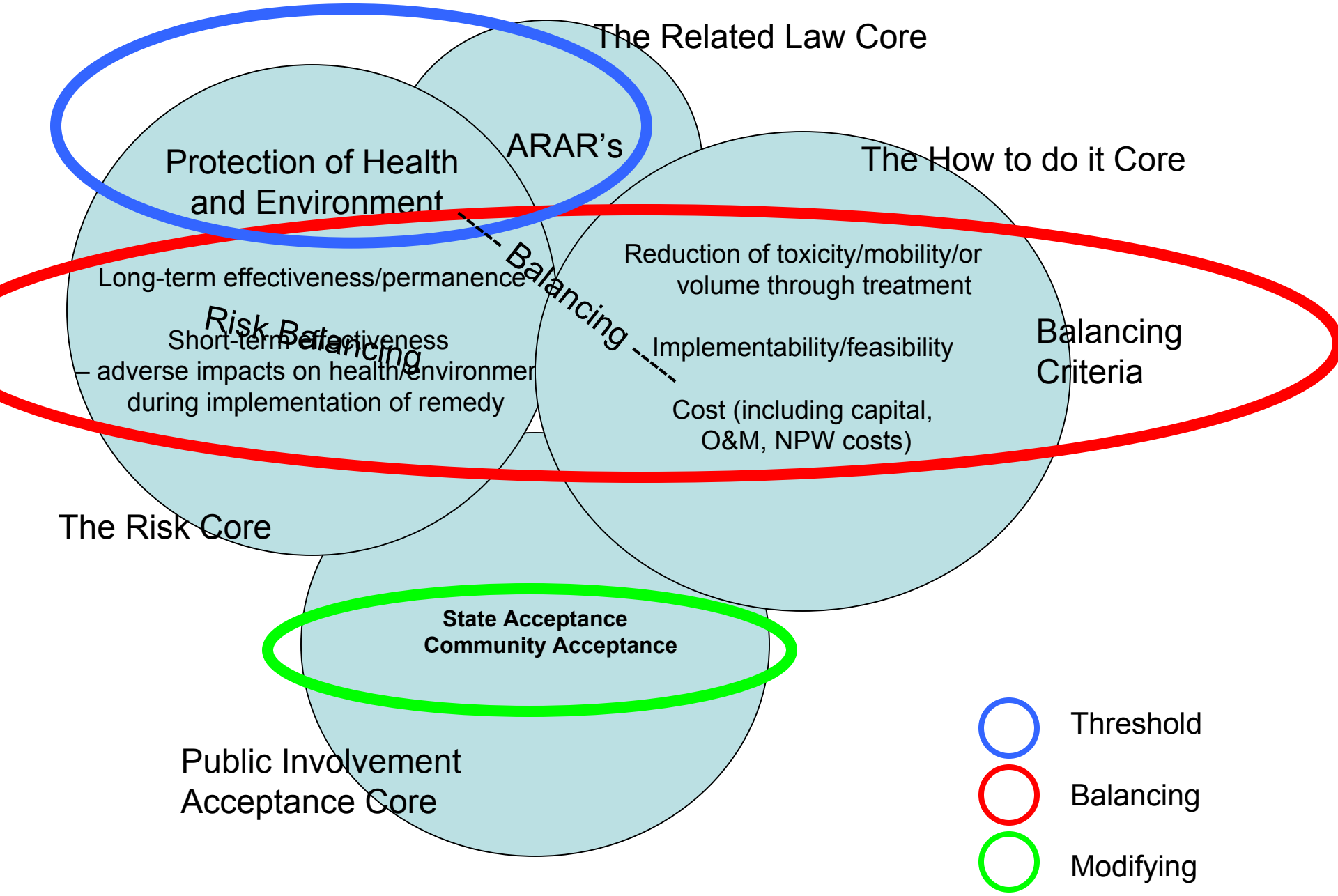
Nine CERCLA Criteria for Remedy Selection

Threshold Criteria
- Protection of Health and Environment
- ARAR's (unless waived*)

Balancing Criteria
- Long-term effectiveness/permanence
- Reduction of toxicity/mobility/or volume through treatment
- Short-term effectiveness – adverse impacts on health/environment during implementation of remedy
- Implementability/feasibility
- Cost (including capital, O&M, NPW costs)

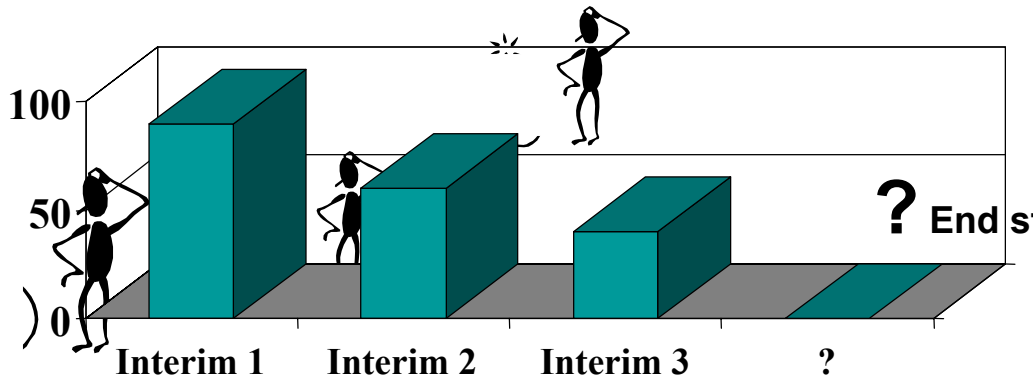
Modifying Crtiteria
- State Acceptance
- Community Acceptance

* Specific procedures


The Related Law Core
ARAR's
Protection of Health and Environment
The How to do it Core
Balancing
Reduction of toxicity/mobility/or volume through treatment
Long-term effectiveness/permanence
Risk Balancing
Short-term effectiveness – adverse impacts on health/environmer during implementation of remedy
Implementability/feasibility
Balancing Criteria
Cost (including capital, O&M, NPW costs)
The Risk Core
State Acceptance
Community Acceptance
Public Involvement Acceptance Core
Threshold
Balancing
Modifying

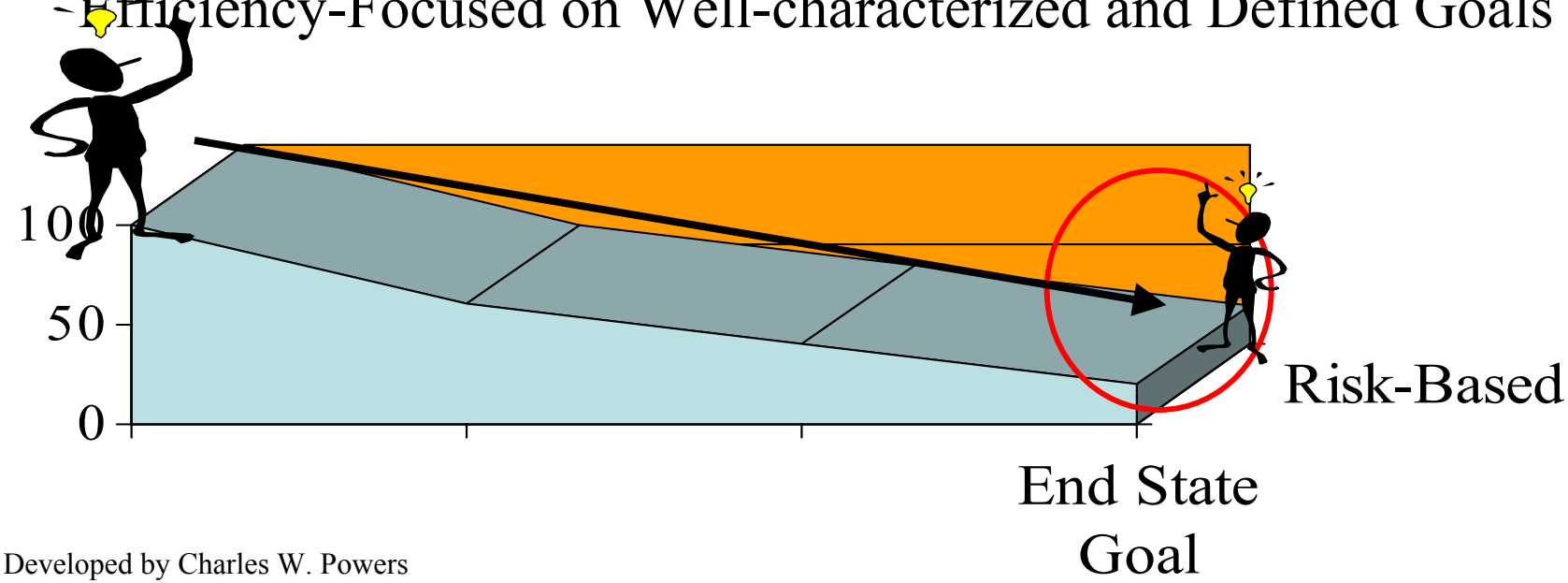
Two Approaches to Risk Reduction

Separate Step-by-Step Reduction w/ no Final Goals Specified



Lost in the process?

Efficiency-Focused on Well-characterized and Defined Goals

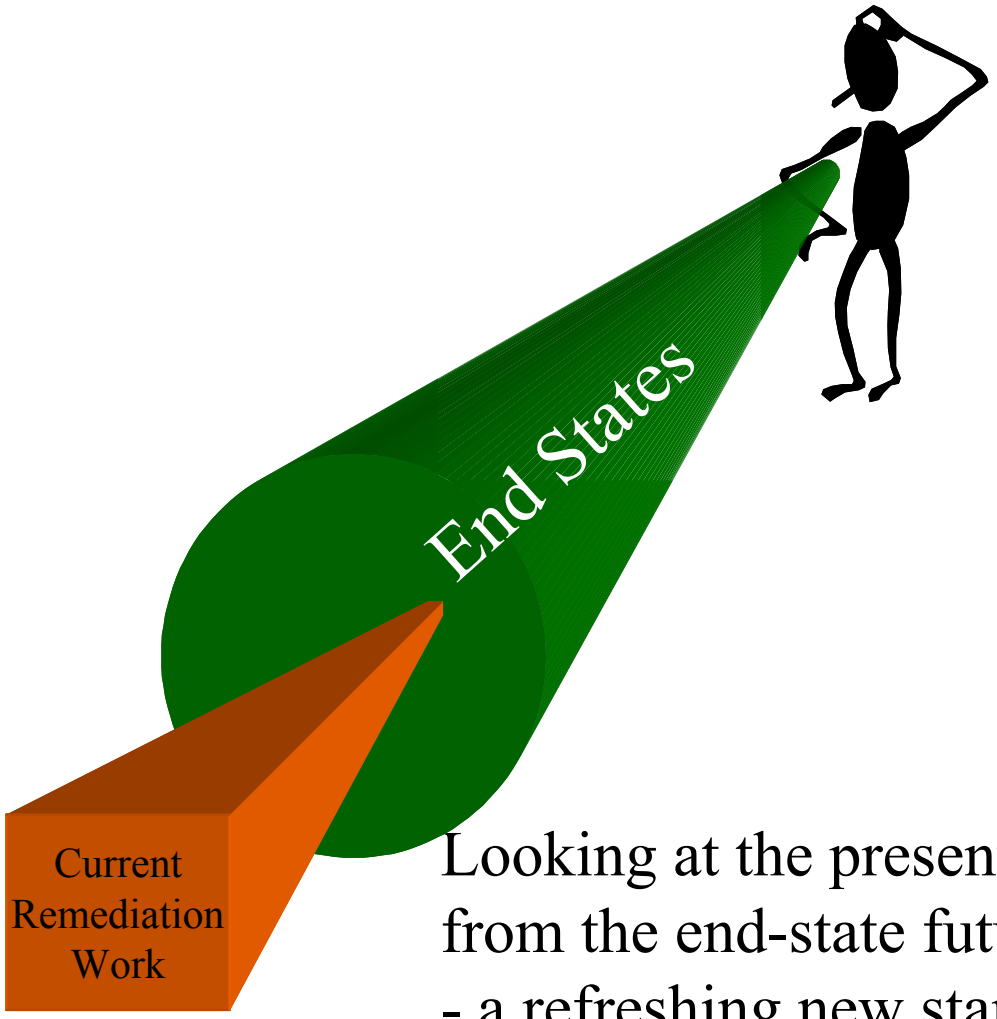


Developed by Charles W. Powers

We need to start over!

But where?

Risk–based End States
A Copernican Revolution?
It depends on what we mean



Looking at the present
from the end-state future
- a refreshing new start
but completely unrealistic
as a stand alone approach?

CRESP to the BRWM – August 2001

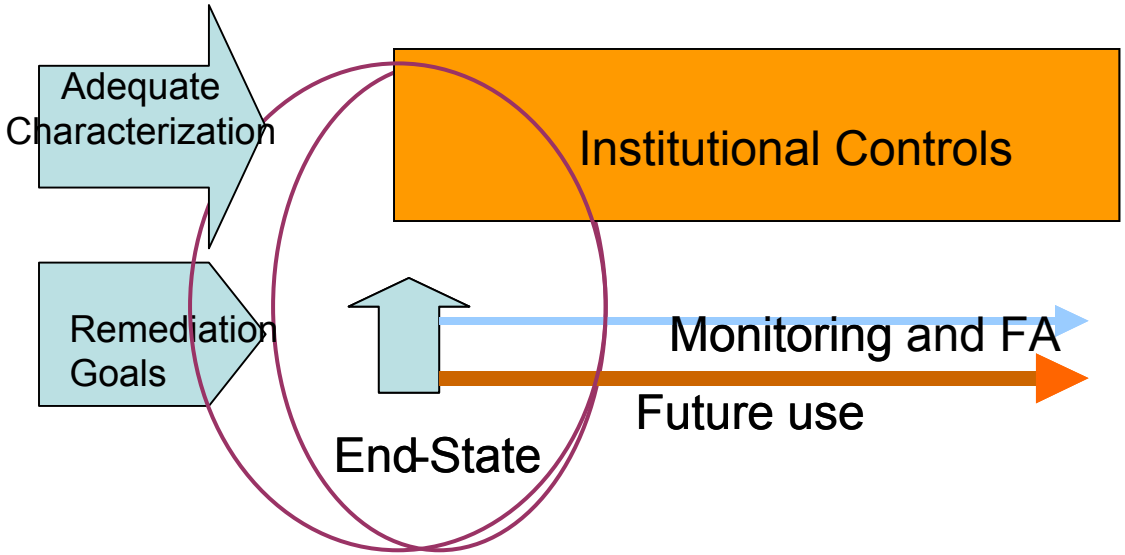
Developed by Charles W. Powers

That is not a rhetorical question

What would we have to have to define and support risk-based end-states?

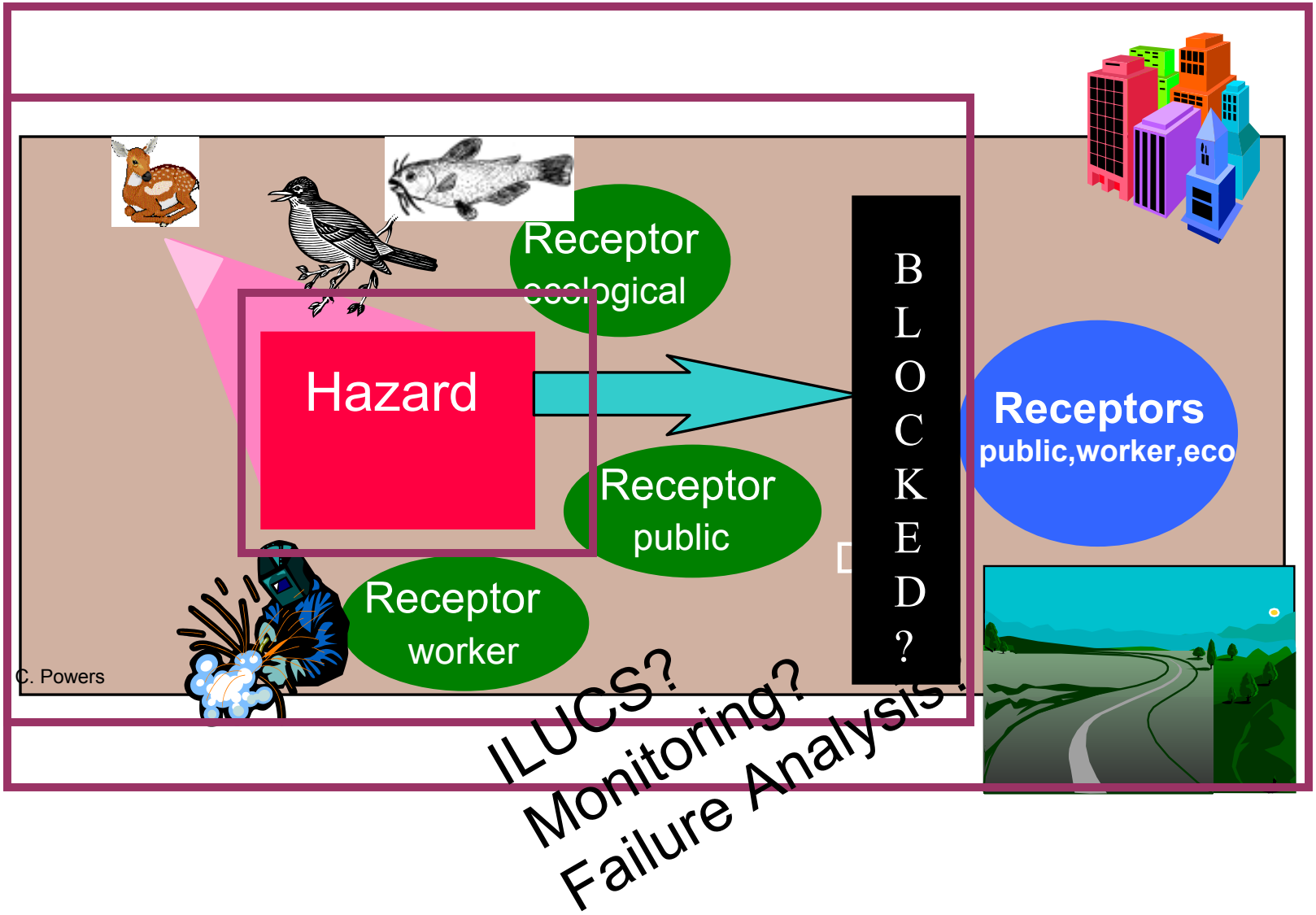
We would Possess:

An ability to have adequately characterized the contamination, to have forecast goals for remediation effectiveness, linked those goals to a monitored future use, and then forecast the controls needed to anticipate failure, to secure the blocked pathway and to monitor performance and assure long-term oversight as required



We think these are the basic elements – and they are not yet achieved

RBES Exposure Scenarios in the Context of Land Use



Developed by Charles W. Powers

RBES is Today a Lightning Rod

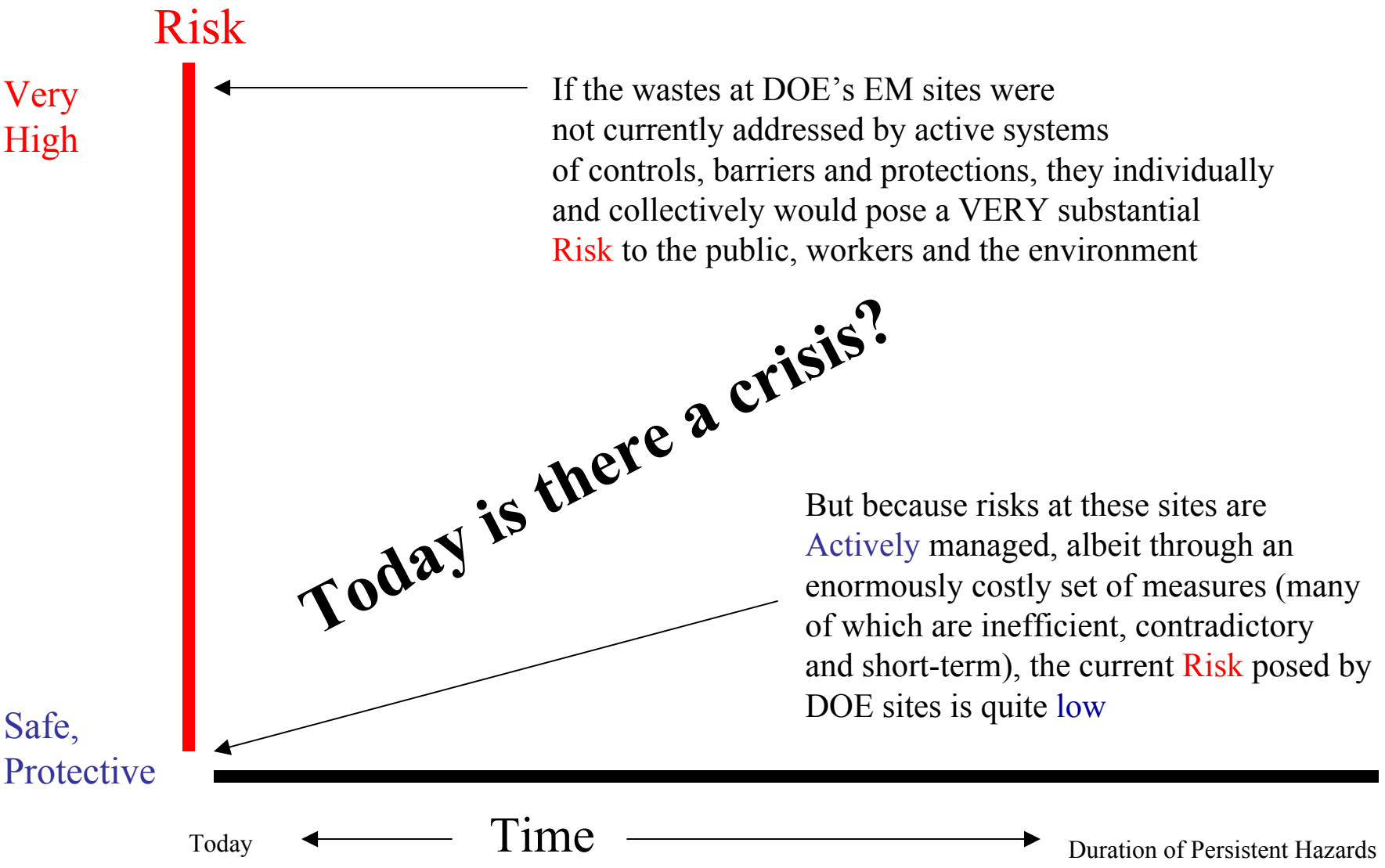
But again – why now?

Sites **are** at very different places in the cleanup/completion process and the state of the process Is viewed differently by different parties:

Close to closure; don't disturb;
agreements in place (Regulators and some Stakeholders)
Almost **No** sites closed; mostly interim agreements (TTBR, DOE)

2000, 2006, 2015. 2025, 2035

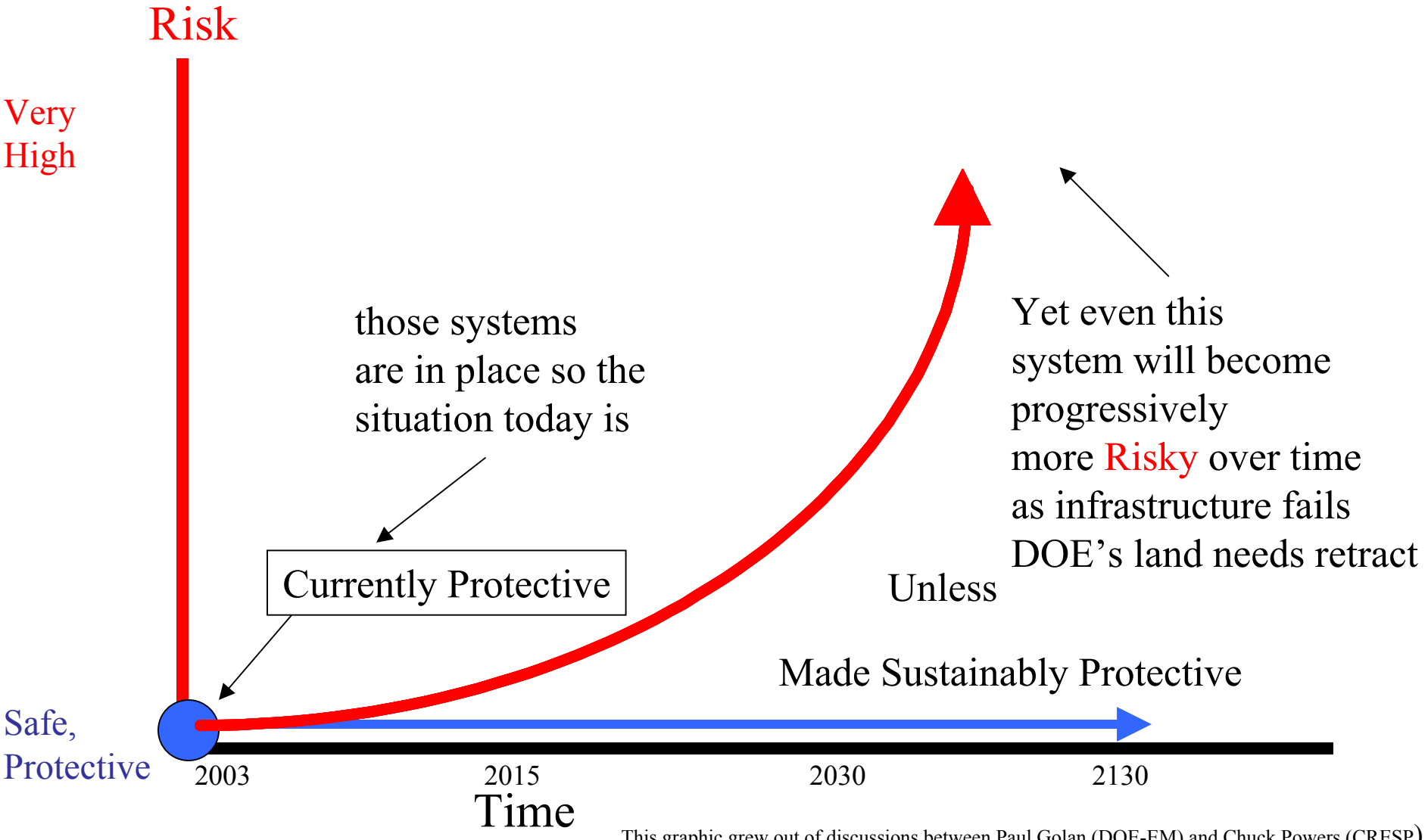
RBES: Are Sustainable Solutions for DOE Cleanup essential?



This graphic grew out of discussions between Paul Golan (DOE-EM) and Chuck Powers (CRESP)

RBES: Are Sustainable Solutions for DOE Cleanup essential?

1) the current system is not sustainable w/o remedial planning designed for **long-term protection** as DOE reduces its footprint



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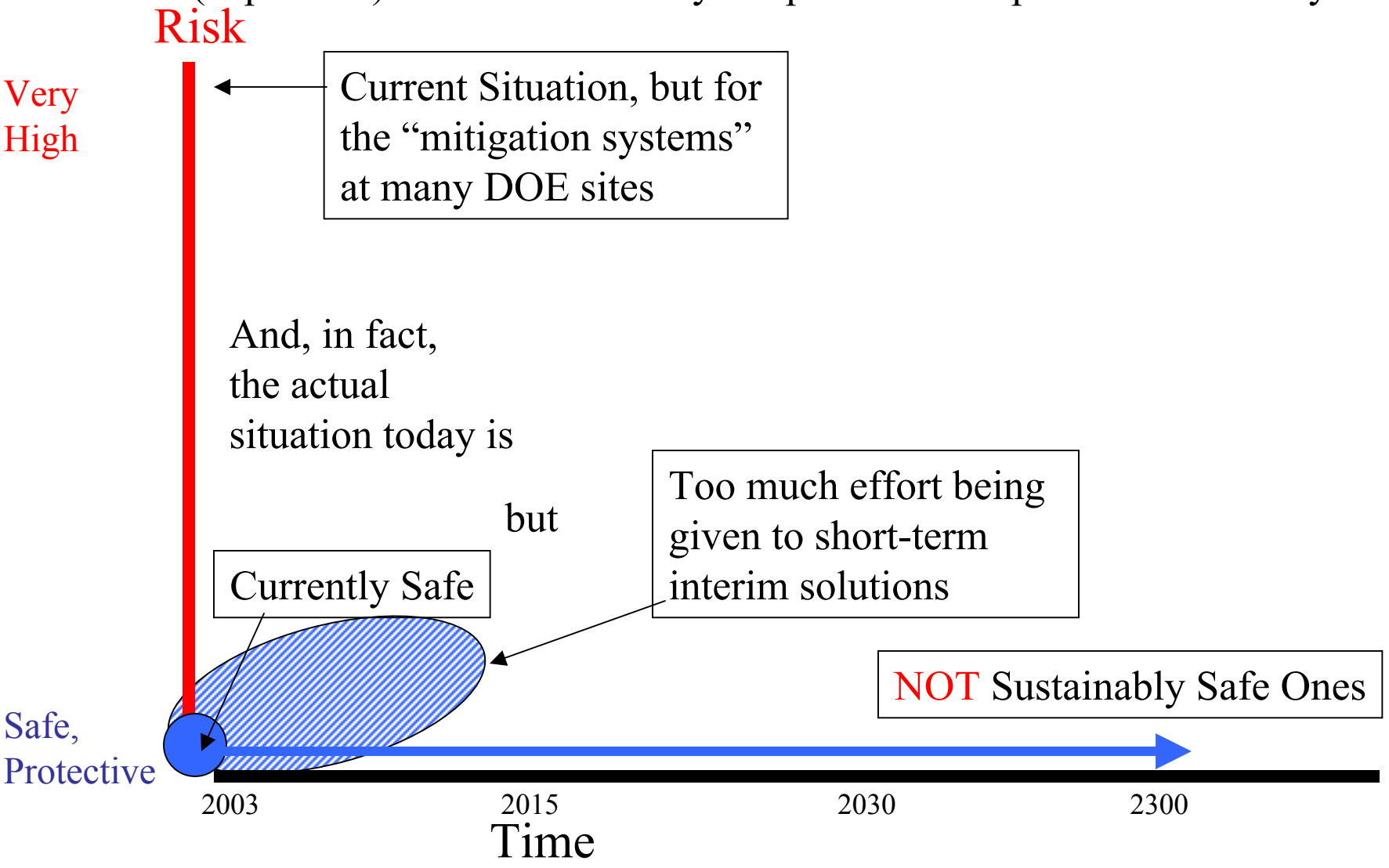
RBES: Are Sustainable Solutions for DOE Cleanup essential?

And : 2) major national investment in this cleanup will ***atrophy***; yet current (expensive) interim measures yield partial cleanup not sustainability



Developed by Charles W. Powers

Charles W. Powers

Charles W. Powers, Ph.D. is the Principal Investigator of the Consortium for Risk Evaluation with Stakeholder Participation, a university consortium led by faculty from six major research universities that has, for nine years, focused on ways to use risk concepts to accelerate protective cleanup of the Department of Energy's legacy waste sites. He is also Professor of Environmental and Occupational Medicine at Robert Wood Johnson Medical School-University of Medicine and Dentistry of New Jersey and President of the Institute for Responsible Management (IRM), a non-profit corporation located in Piscataway, New Jersey. IRM is the recipient of the CRESP grant from DOE. (See www.cresp.org.)

Powers is a graduate of Yale University, Oxford University, Union Theological Seminary and Haverford College. He has served on the faculties of Yale, Harvard, Tufts and Princeton universities in addition to his current academic assignment at UMDNJ. He was the founding chief executive of The Health Effects Institute, Clean Sites Inc., HEI-Asbestos Research, and the Custodial Trustee for the Industriplex Superfund Site in Massachusetts. He was for 6 years the PI on IRM's co-operative agreement with EPA to support and track the development of Brownfields through the Agency's Brownfields Pilot Program, a program he conceived in 1994. Earlier he was the Counselor to Senator Bill Bradley and Vice President for Public Policy at Cummins Engine Company where he was the chief environmental officer of the Company. He currently chairs the NY Academy of Science Consortium on the NY/NJ Harbor.