Incorporating Risk in DOE's Cleanup Decisions past, present and future

A Presentation to:
the Committee on Risk-Based Approaches
for Disposition of TRU and HL Radioactive Wastes,
NRC's Board on Radioactive Waste Management

in Augusta, Georgia January 28, 2004

by Charles W. Powers, Ph.D and PI CRESP II

A Presentation in Three Sections

I. DOE, NAS, CRESP and Risk – a brief retrospective

II. Risk and the increasingly complicated regulatory and institutional environment at DOE sites

III. Risk-Based Approaches and End States Definition: Why they must be linked to achieve sustainably protective DOE cleanup

CRESP II

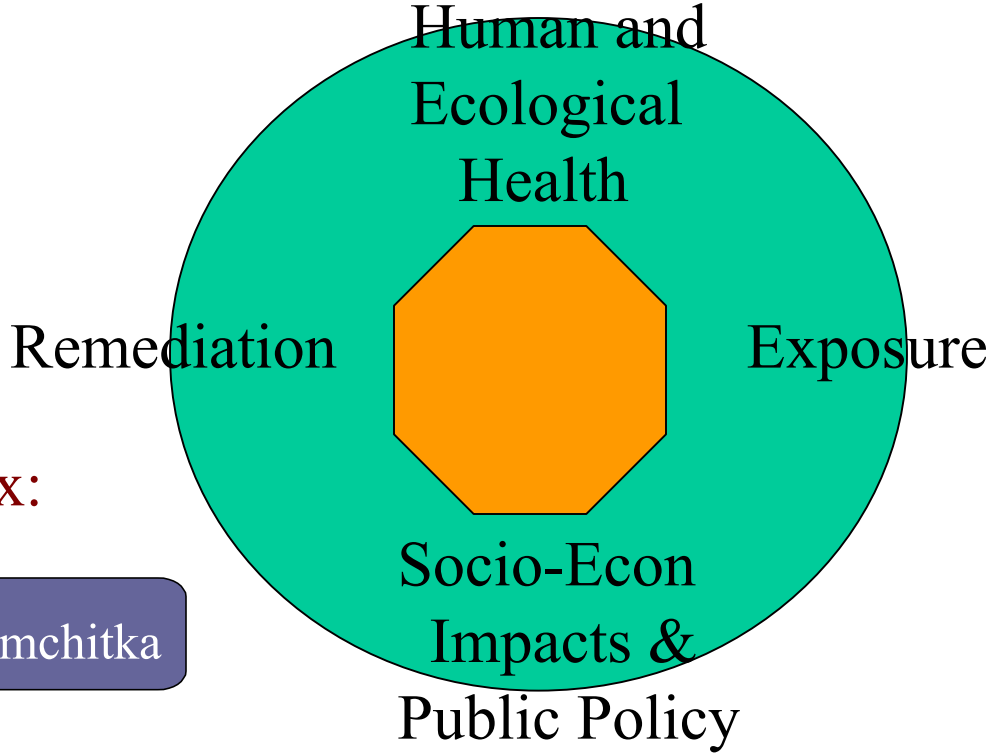
Consortium for Risk Evaluation with Stakeholder Participation

.....working to advance cost-effective cleanup and greater stakeholder understanding of the nation's hazardous and nuclear federal facility waste sites by improving the scientific and technical basis of environmental management decisions. (www.cresp.org)

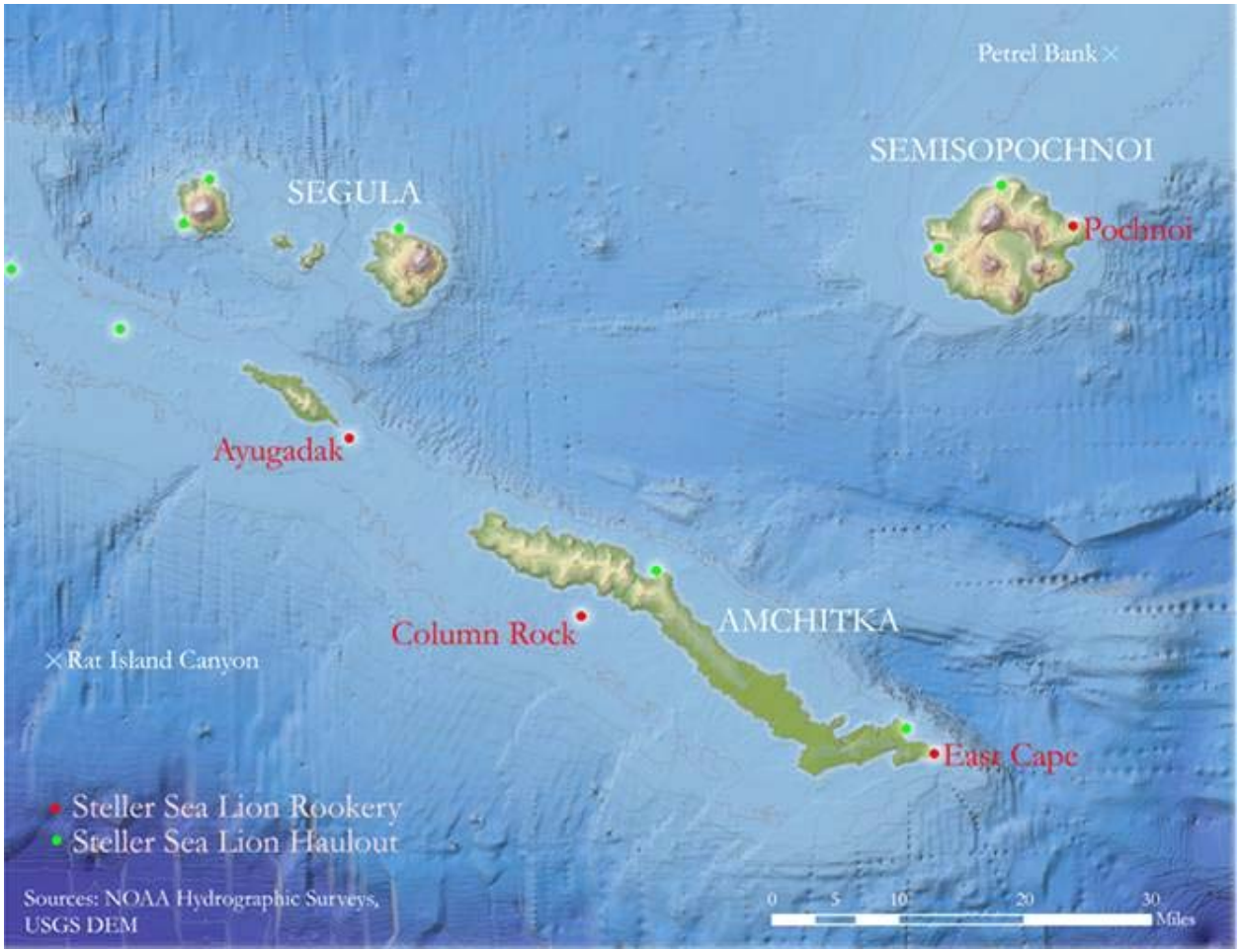
I
R
M

University of Pittsburgh
University of Georgia
University of Alaska
New York University

A True Consortium of Universities and Others Organized for Interdisciplinary Work



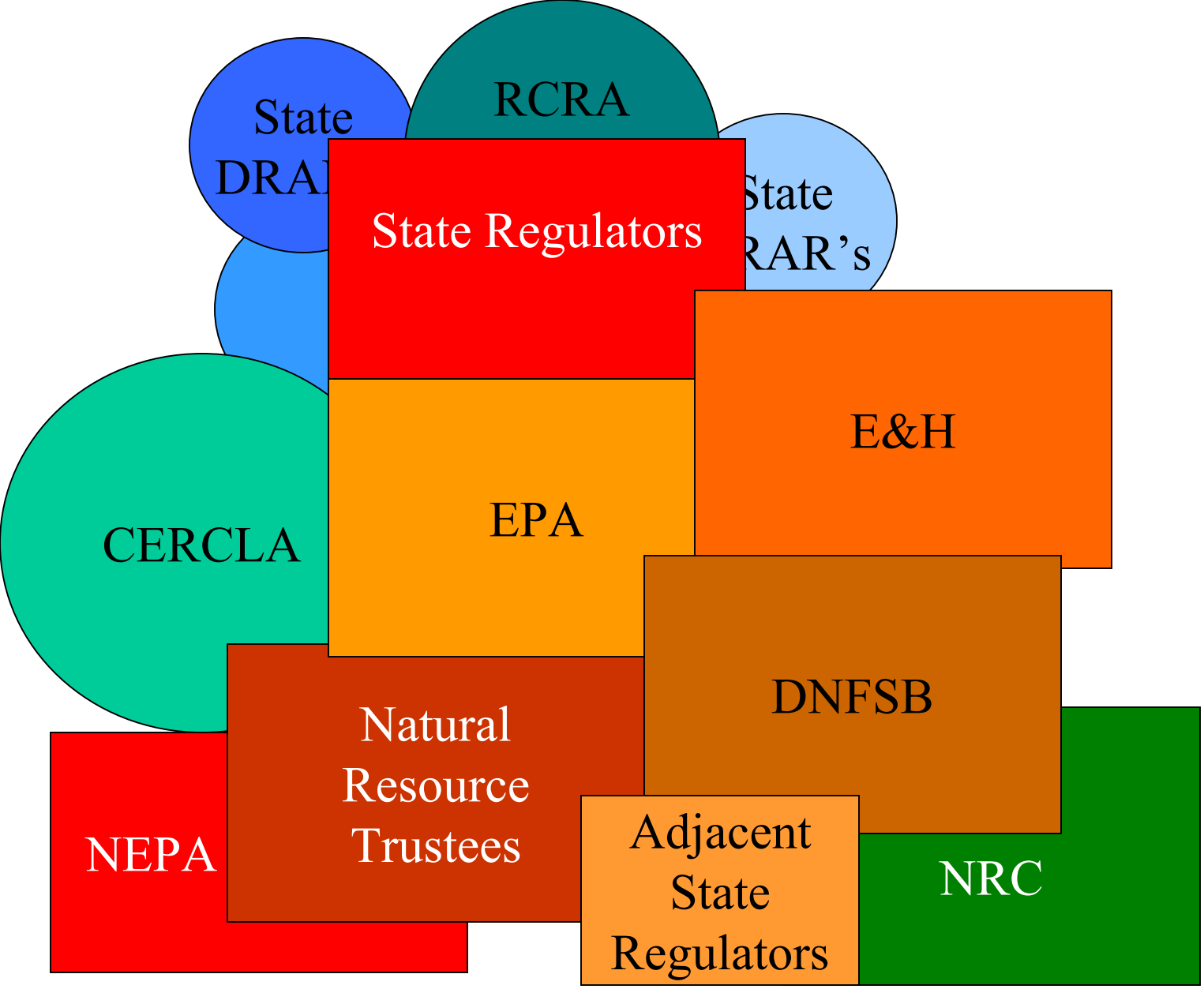
At sites across the complex:



The Amchitka Story

In the field is important:

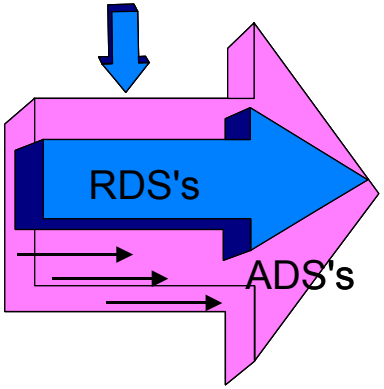
CRESP Researcher, David Kosson, Ph.D. and DOE-SRS official, Jerry Nelsen, Ph.D.



A Rich Regulatory Mix

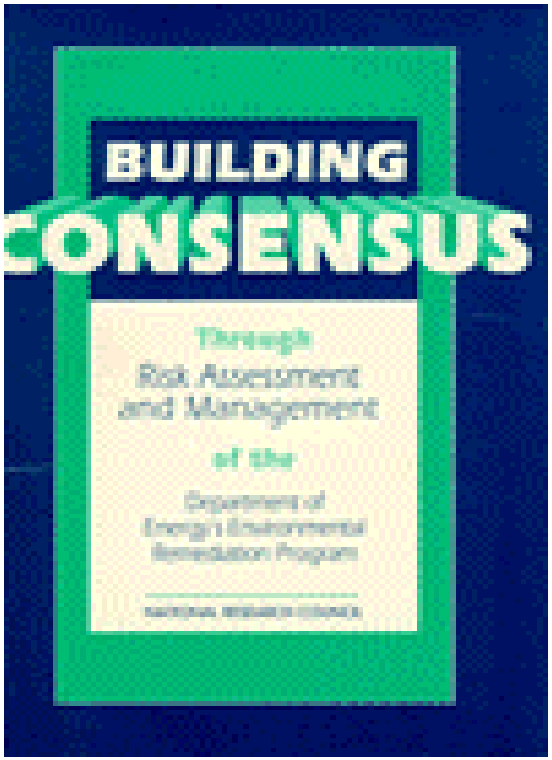
ERPS

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

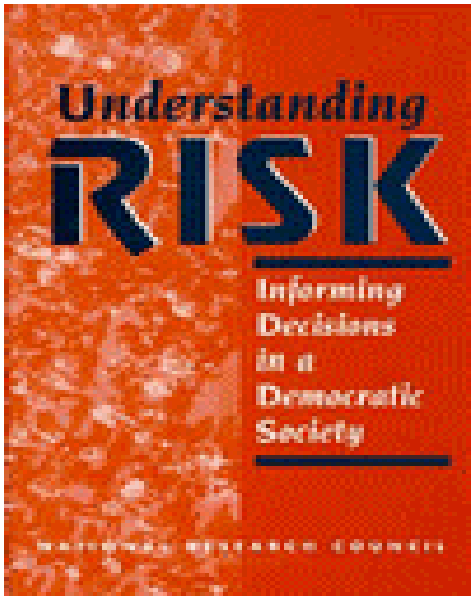
Consortium for Risk Evaluation with Stakeholder Participation (CRESP)
National Review Panel Report

Review of Risk Data Sheet Information

For Fiscal Year 1998

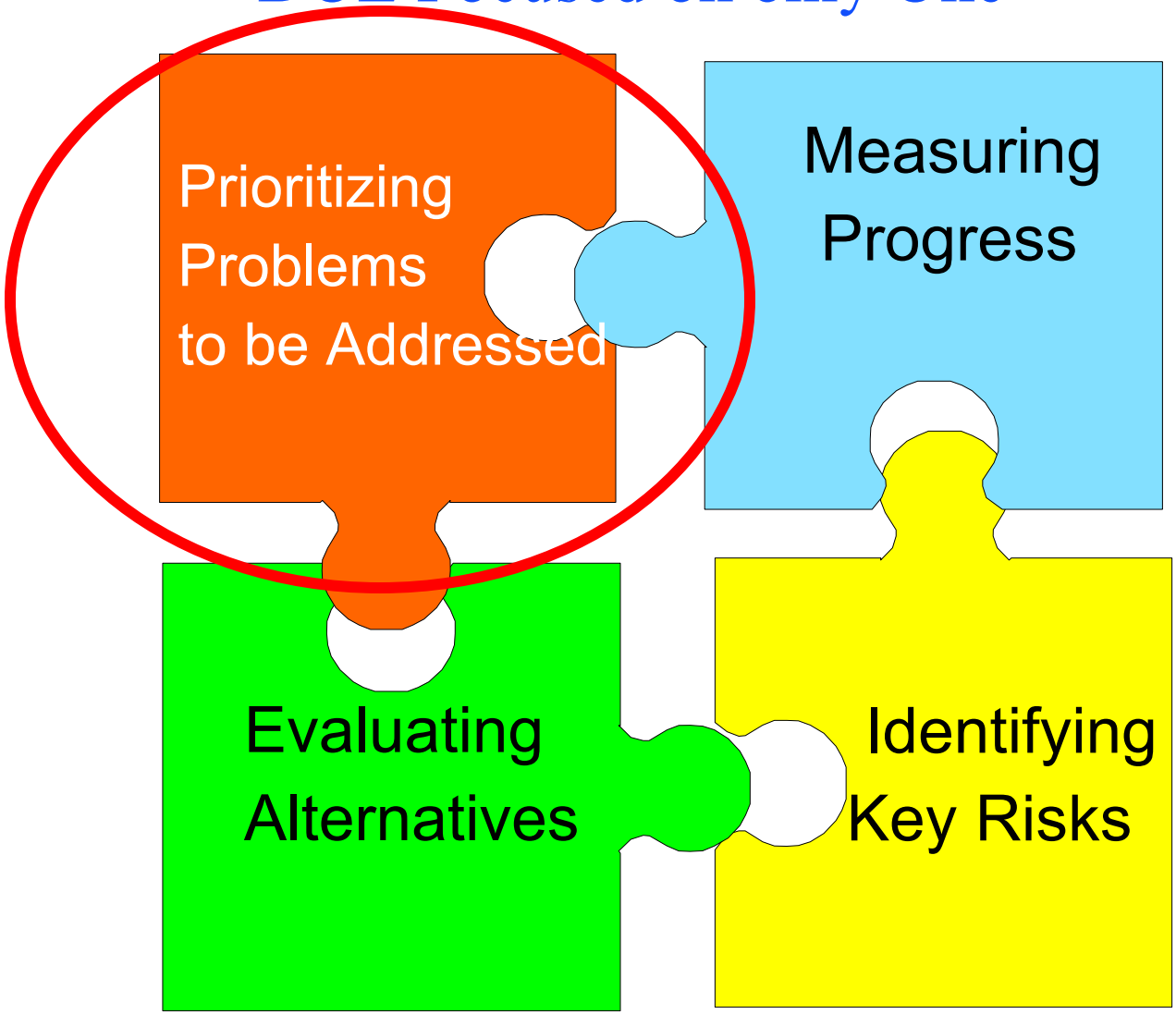
May 14, 1996

Risk was the major focus of environmental policy in the mid ’90’s



From Framework for Environmental Health Risk Management The Presidential/Congressional Commission on Risk Assessment and Risk Management, Final Report Volume I, 1997.

Risk Management Involves Four Different Tasks
DOE Focused on only One



CRESP

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
New Brunswick, NJ 08901
Telephone 732-235-9603
FAX 732-235-9607
www.cresp.org

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;

The Risk Prioritization Process as it Shapes the SRS Integrated Priority List (IPL):

An Initial Review of the SRS Model
June 23, 2000

Charles W. Powers, Ph.D.
CRESP Executive Director

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Selected elements

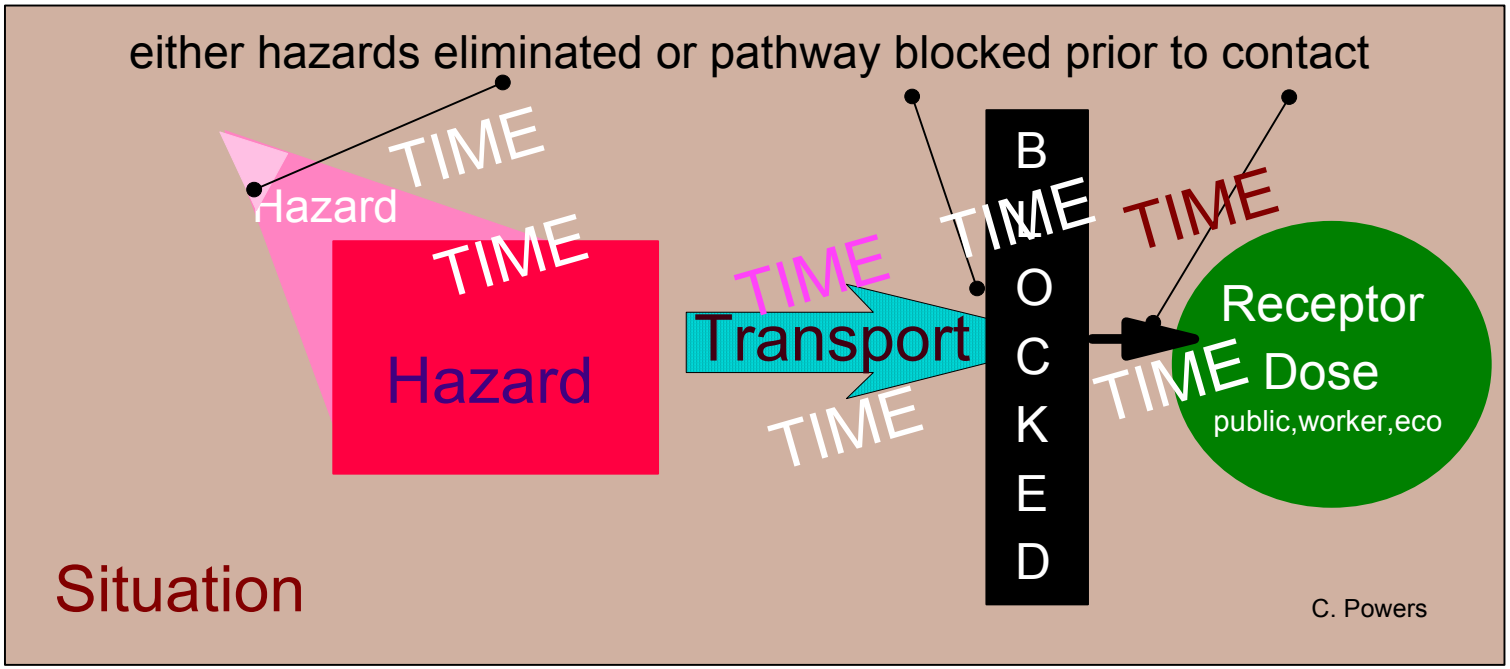
Recommendations for improving the process include the following:

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:

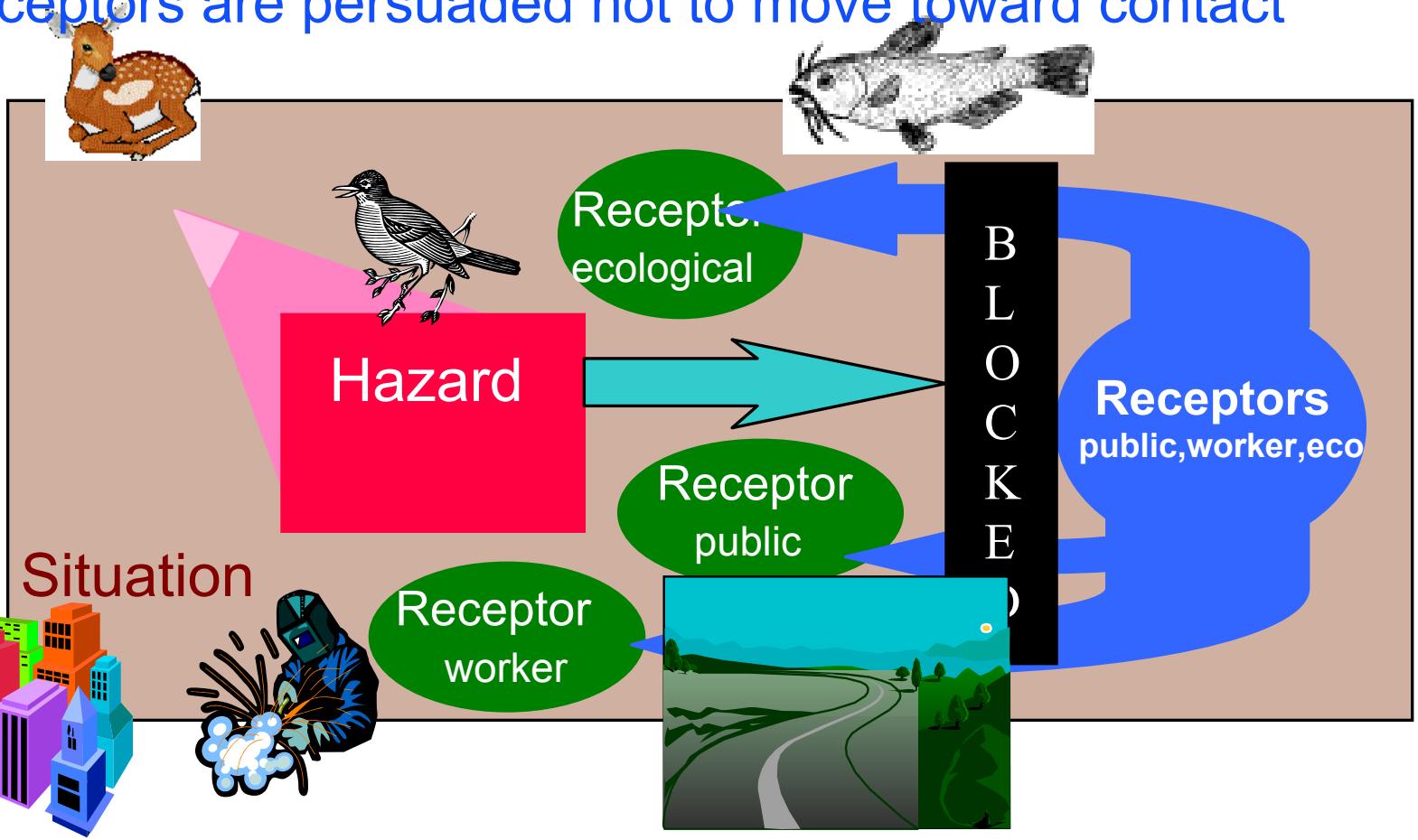
- The need for a more integrated approach to risk assessment than one that would suffice for compliance purposes alone at sites containing multiple sources of contamination;
- The need to include exposure evaluation as a key step in any risk assessment;
- The need to assess the potential impacts of remediating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

Time matters big time: Evaluation **must** address time

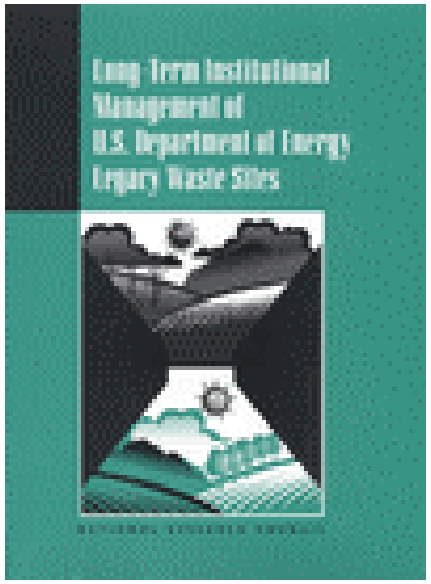


TIME

Receptor Location Management: receptors differ and move unless hazards are moved away or receptors are persuaded not to move toward contact

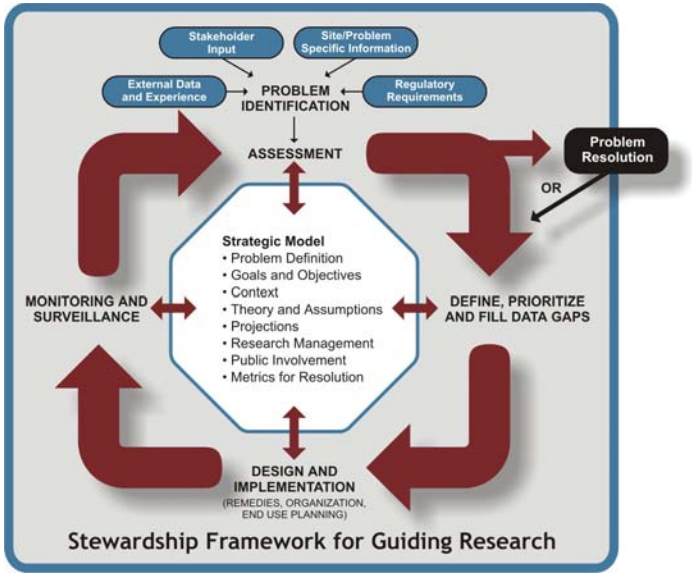


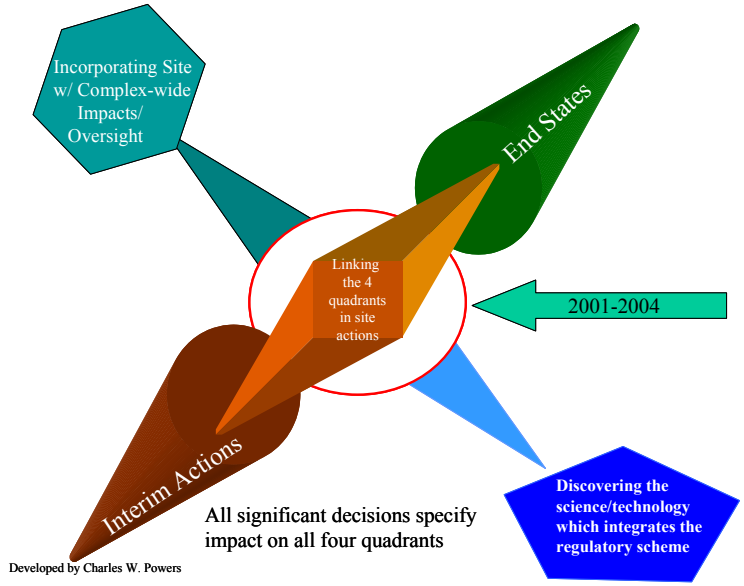
Now, let's put those receptors in motion

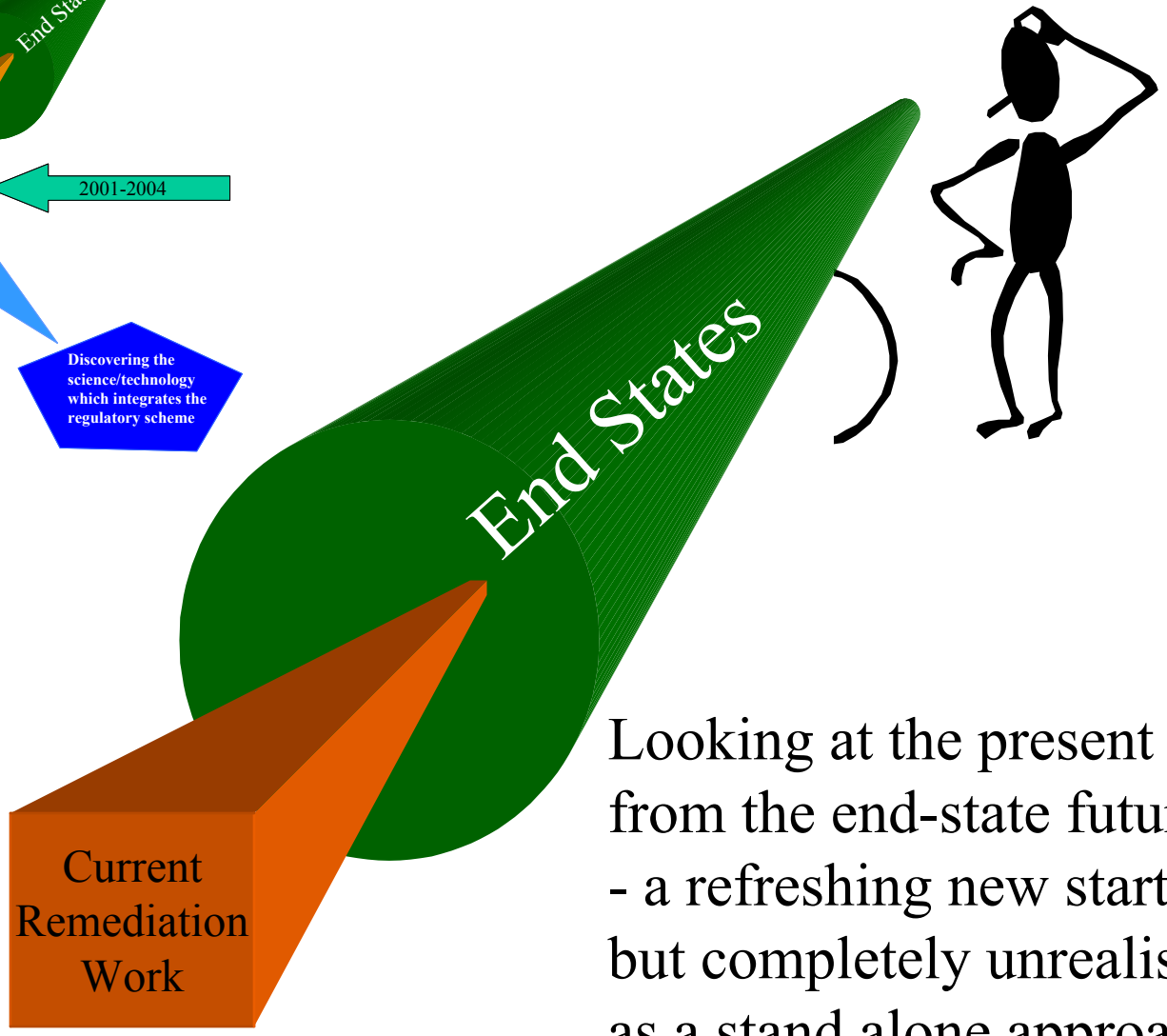


Trying to Get Hold of Sustainability

DOE Report to Congress on
On Long-Term Stewardship







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

A REVIEW OF THE ENVIRONMENTAL MANAGEMENT PROGRAM

UNITED STATES DEPARTMENT OF ENERGY

PRESENTED TO THE

ASSISTANT SECRETARY FOR ENVIRONMENTAL MANAGEMENT

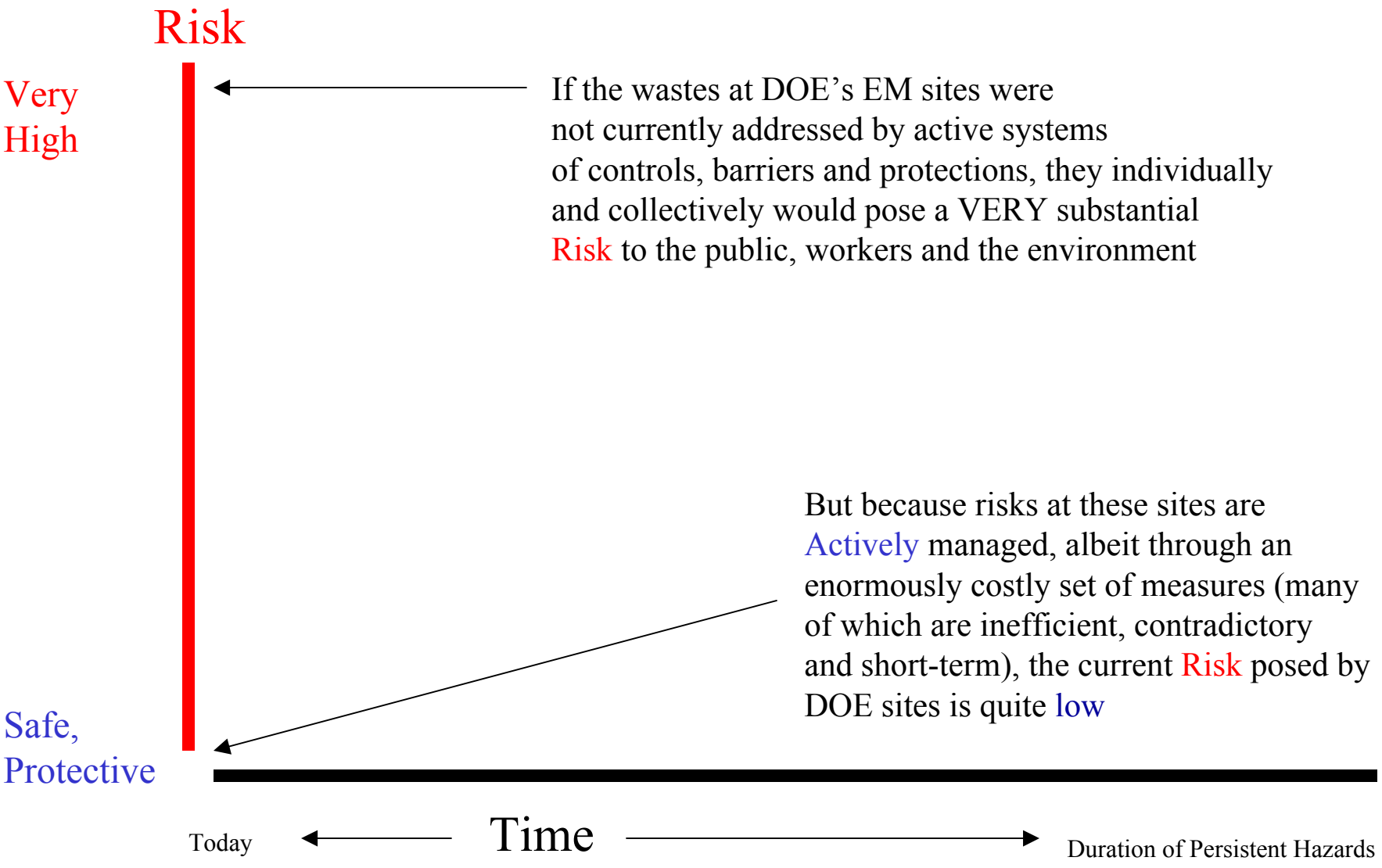
by the

TOP-TO-BOTTOM REVIEW TEAM

The New Start

February 4, 2002

Understanding Sustainable Solutions for DOE Cleanup



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

If the situation today is largely protective

Why the new urgency at DOE?
What is the "real" situation today as it affects the future?

DOE sites are currently safe

but

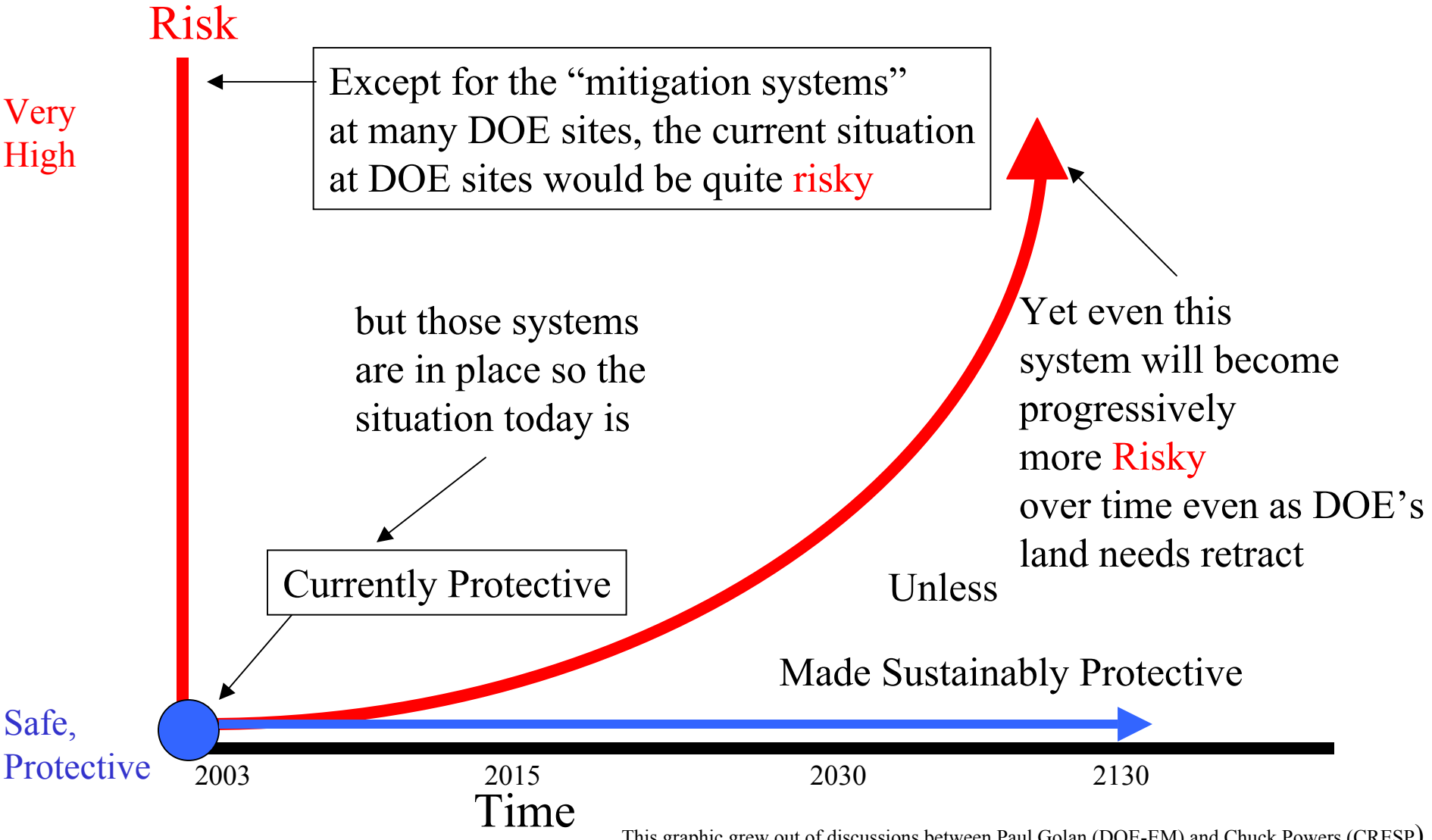
with only ***Modest*** real risk reduction being achieved

unless fundamental changes are made

we anticipate that substantial risks
will arise over time and not be adequately addressed

Understanding Sustainable Solutions for DOE Cleanup

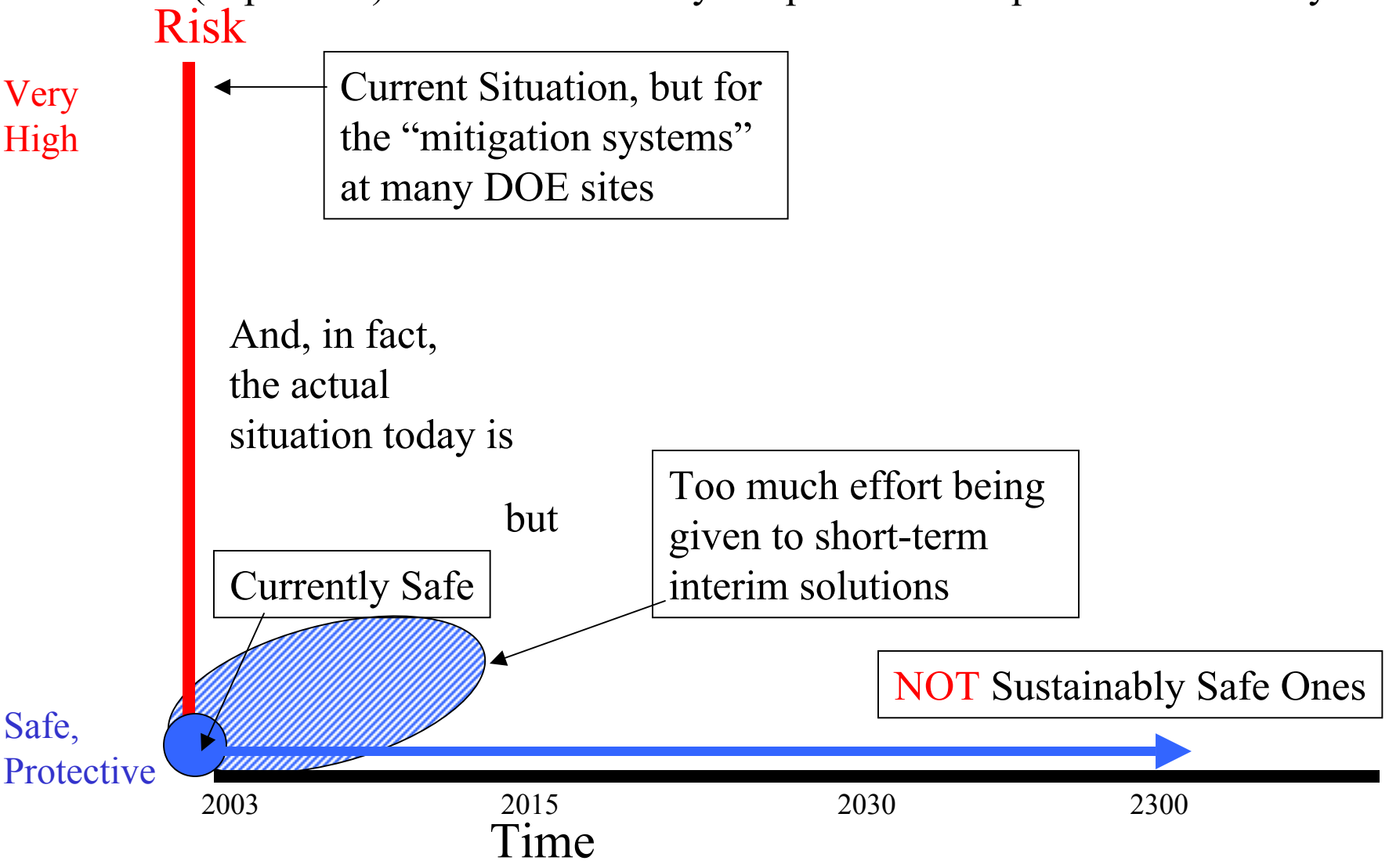
But: 1) the current system is not sustainable w/o remedial planning designed for long-term protection as DOE reduces its footprint



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

Understanding Sustainable Solutions for DOE Cleanup

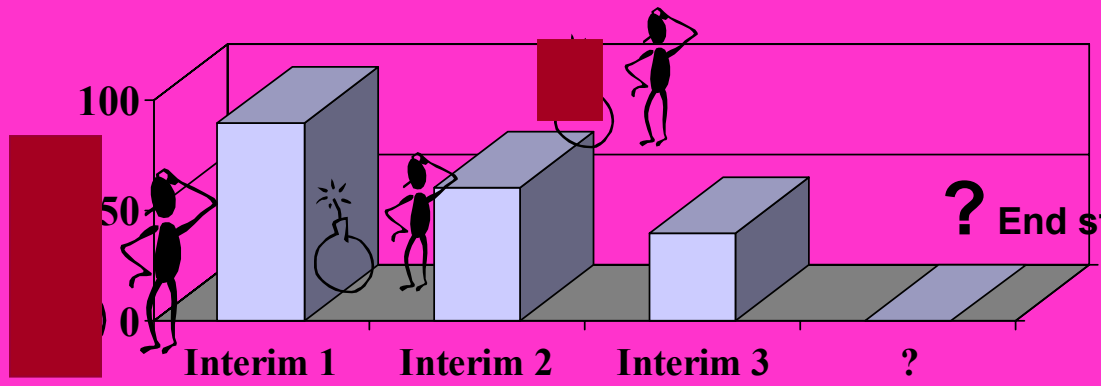
And : 2) major national investment in this cleanup will atrophy; yet current (expensive) interim measures yield partial cleanup not sustainability



Developed by Charles W. Powers

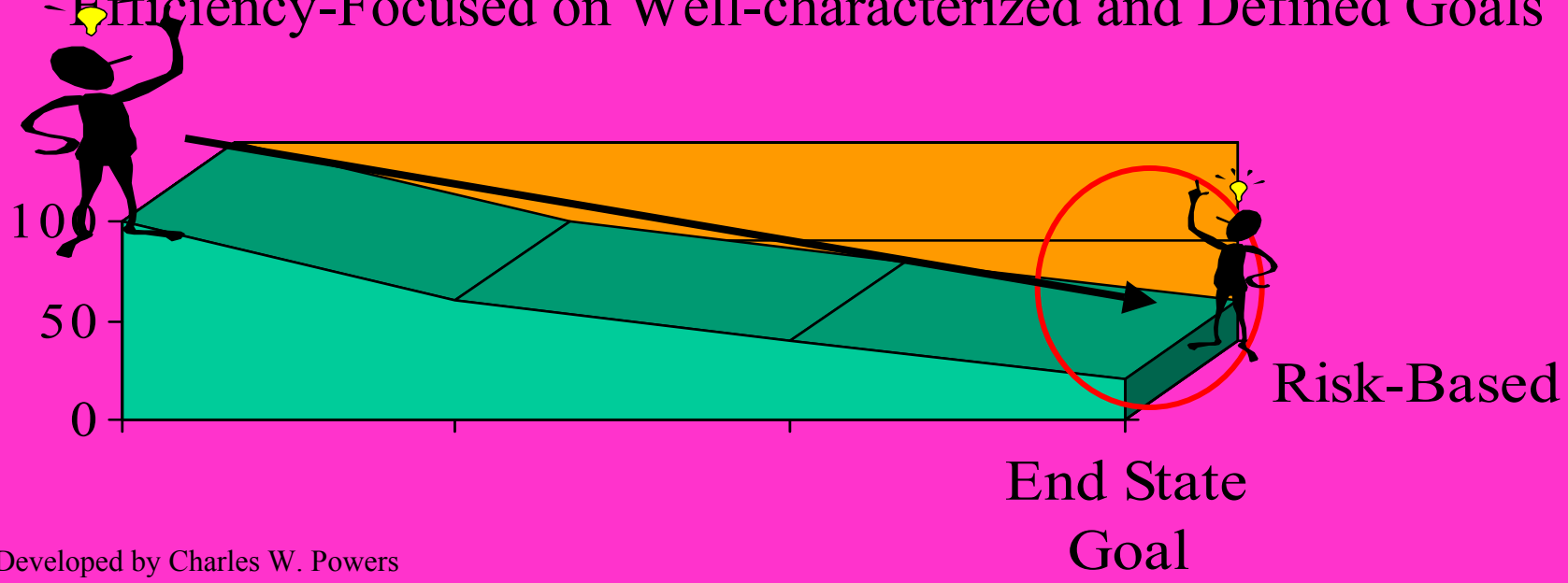
Two Approaches to Risk Reduction

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

CRESP had continued to think along these lines after the August 2001 Presentation to the BRWM and The TTBR

CRESP II: Helping to Rethink the Path Forward to Long-Term Environmental Protection

The Roles for Risk in DOE Cleanup

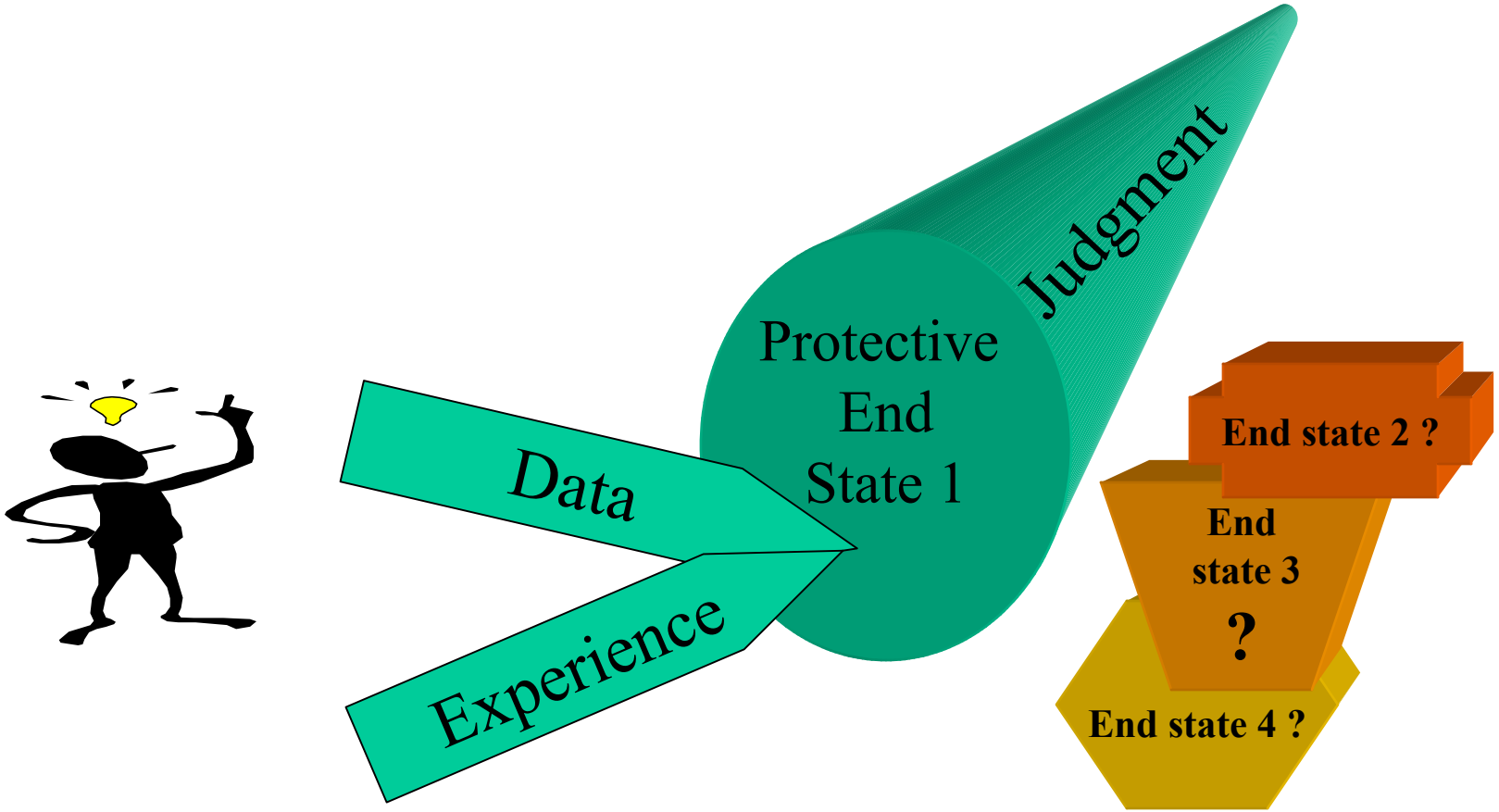
Risk–based End States
A Copernican Revolution?
It depends on what we mean

A Presentation given at the National Govenors Asscіation and National Association of Attorneys General Meeting November 10, 2002

by Charles W. Powers, PI CRESP II

The entire effort depends on learning:

When do we know enough competently to "imagine"
an end state and exercise wise judgment about its effectiveness
-- and when are we "simply imagining things"?



Site Specific

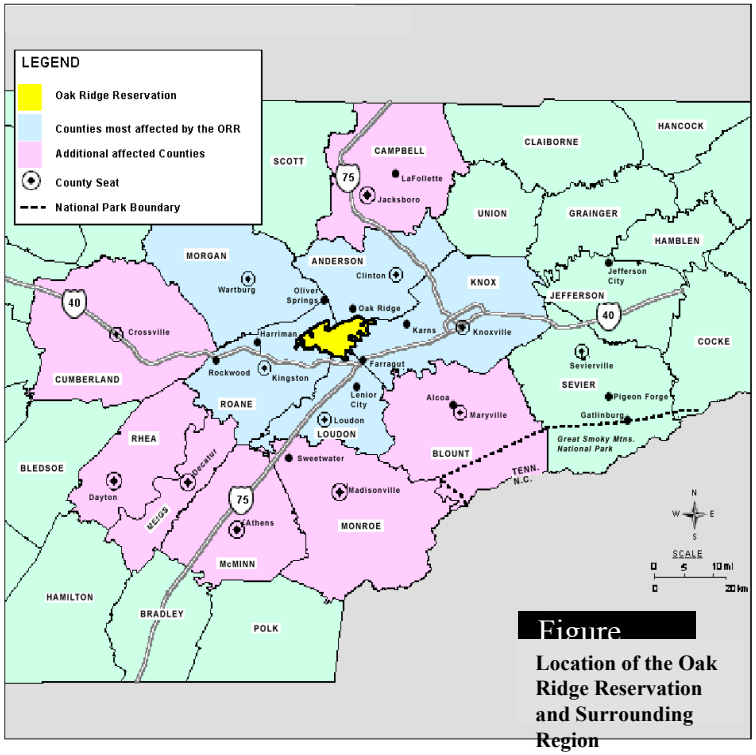
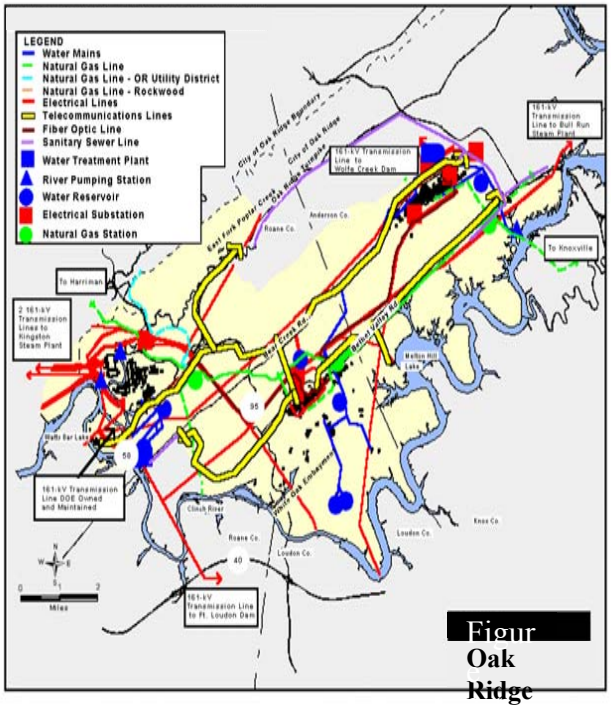
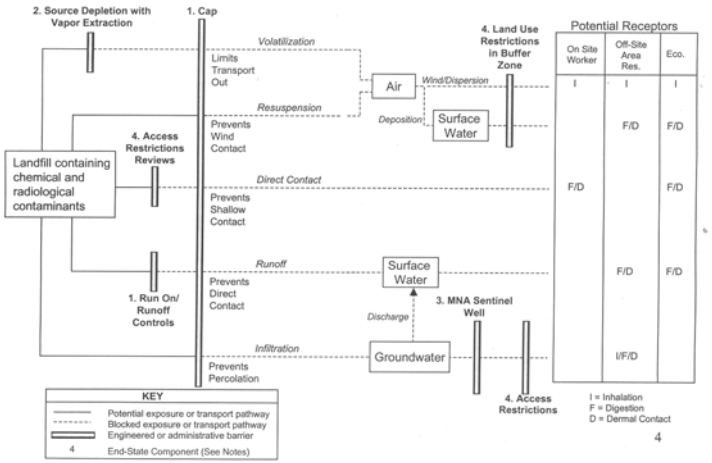


Figure
Location of the Oak Ridge Reservation and Surrounding Region



Figur
Oak Ridge Reservati

Example Post-Completion Conceptual Site Model

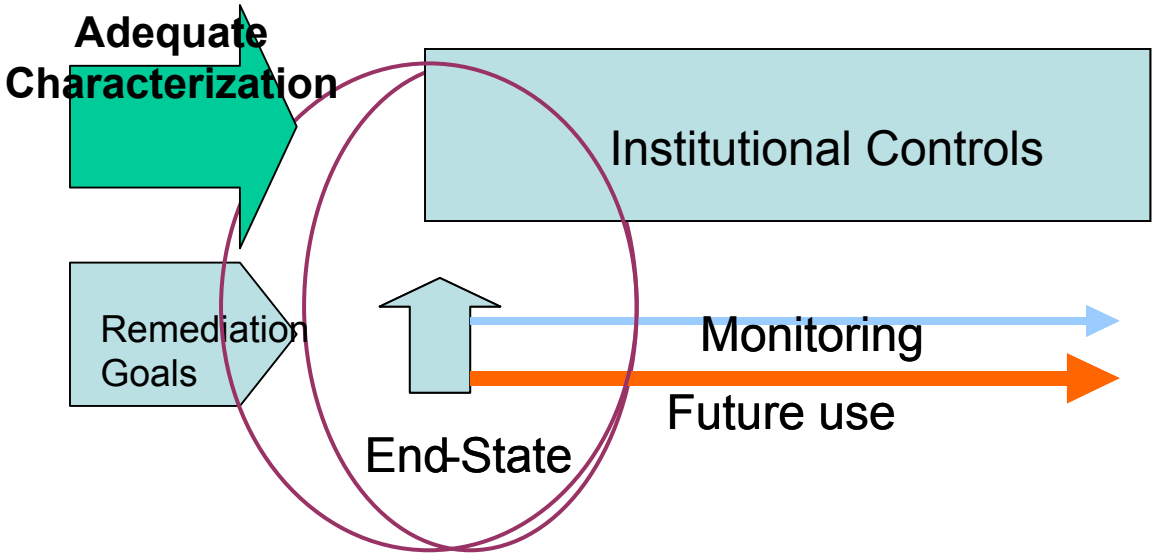


That is not a rhetorical question

What would we have to have to do risk-based end-states?

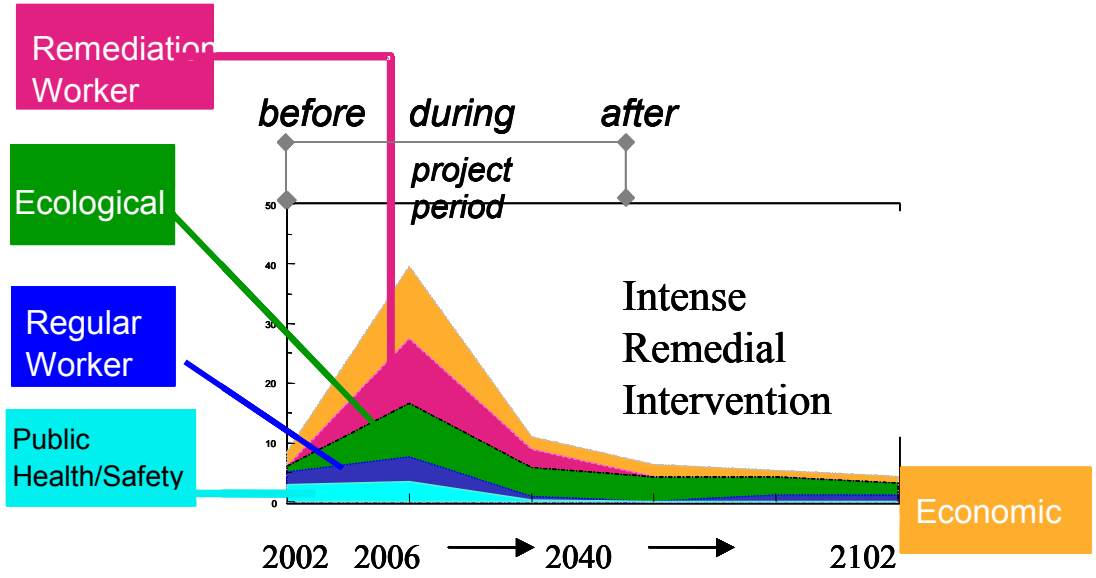
We would Possess:

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

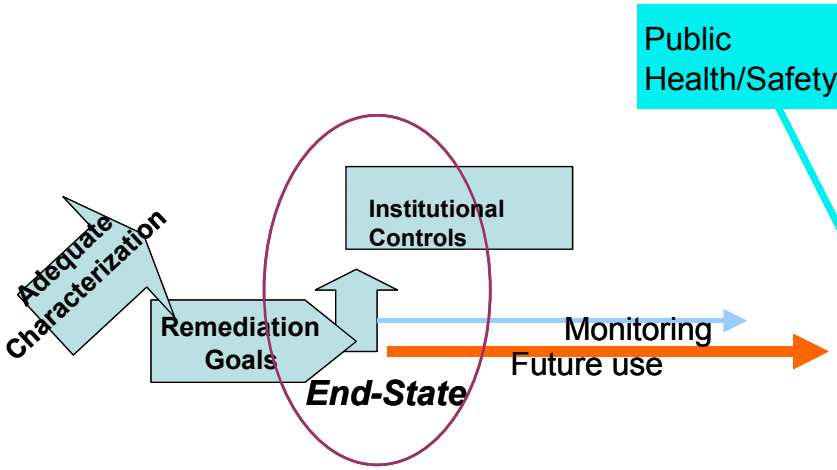


We think these are the basic elements

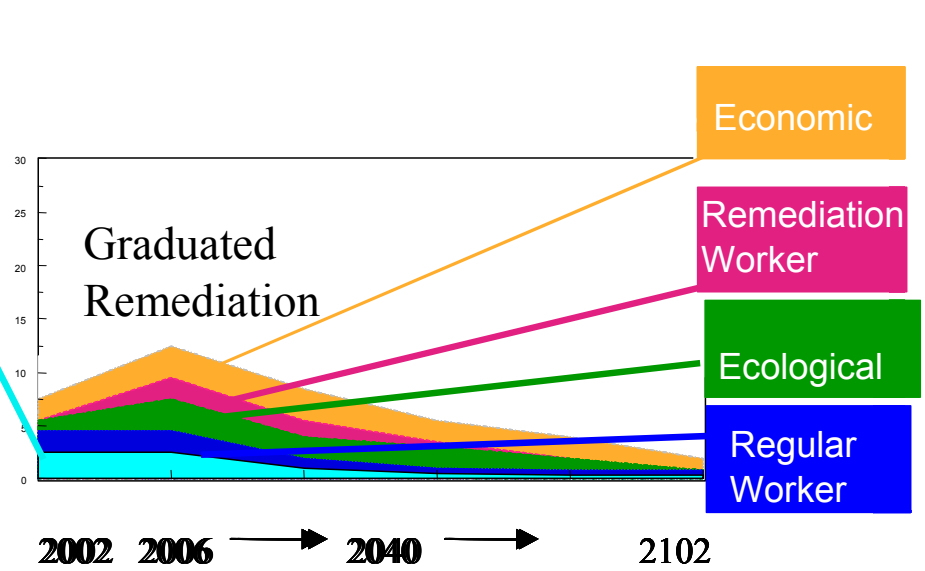
Developed by Charles W. Powers



What Best Achieves A Risk-based End State?



Developed by Charles W. Powers



U.S. Department of Energy
Washington, D.C.

POLICY
DOE P 455.1
Approved 7-15-03

Subject: USE OF RISK-BASED END STATES

PURPOSE AND SCOPE:

The purpose of this policy is to focus the Department line management officials on conducting cleanup that is aimed at, and achieves, clearly defined, risk-based end states. Risk-based end states 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.

The Department of Energy (DOE) is striving to improve the effectiveness of the cleanup program by focusing our efforts on clearly articulated and technically defensible and achievable goals. These goals should be grounded in the vision for the site at the end of the cleanup effort (the "end state"), which in turn should be driven by the expected future land use. The Department will complete cleanup work quicker, safer, and more efficiently when a vision of risk-based end states drives its site assessment, remedy selection, and actions to assure long-term protectiveness. With this approach, we can focus our cleanup efforts so that they are both cost effective and protective.

This policy is intended to be consistent with and emphasizes the provisions in the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), the Resource Conservation and Recovery Act (RCRA), and the Atomic Energy Act, that either explicitly or implicitly authorize the consideration of future land use and risk in making cleanup decisions. Emphasis is needed because there has been uneven progress at DOE sites in implementing cleanup strategies that integrate both risk and future use considerations. This risk-based end state approach attempts to gain a common acceptance of the site-wide post-remediation future prior to individual remedy evaluation and selection actions.

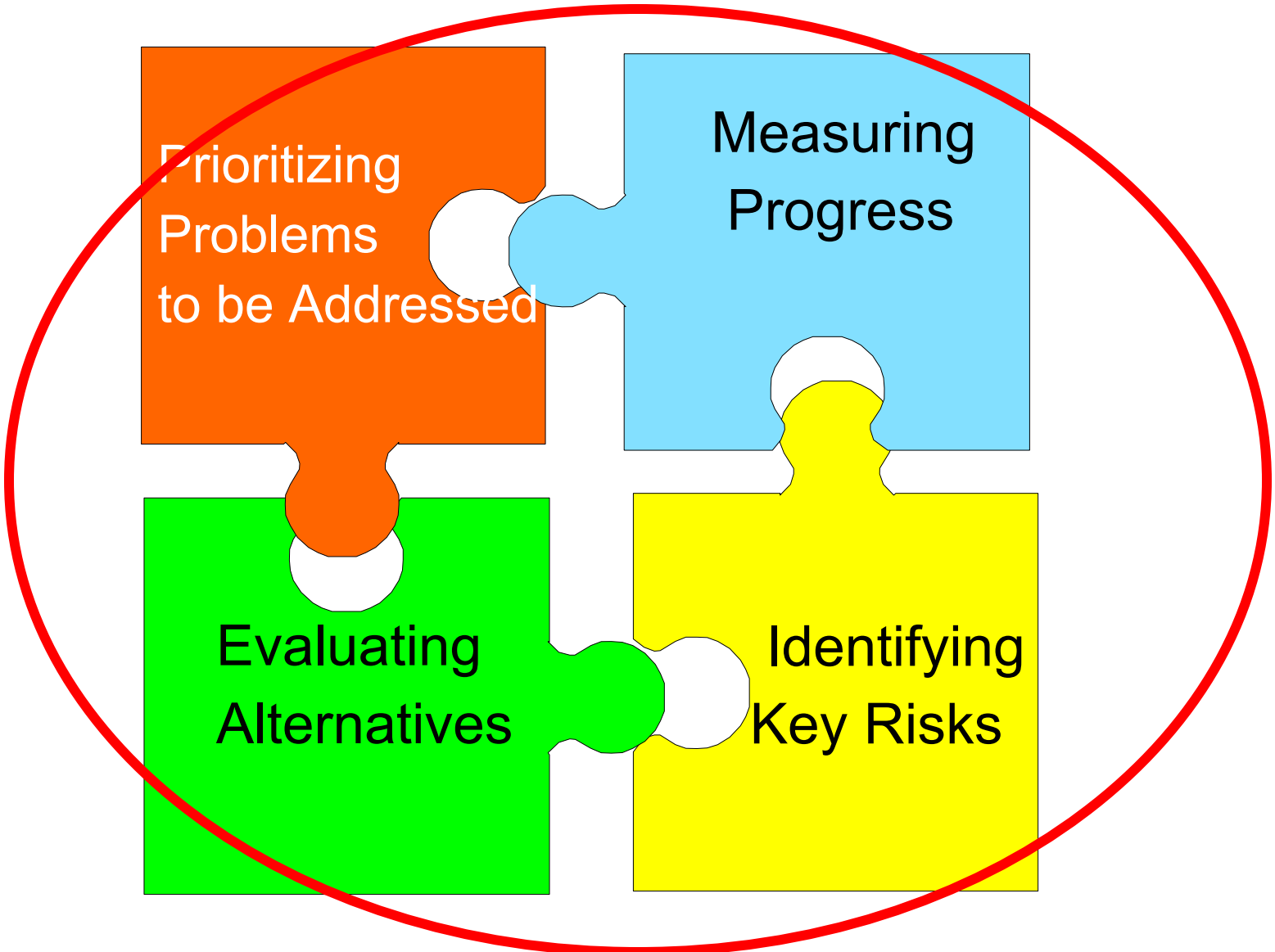
This approach applies to all sites currently undergoing cleanup, including those under the authority of the National Nuclear Security Administration. It is recognized that individual sites are at different stages of cleanup, have attained these goals to varying degrees, and may have operational constraints. Once sites develop their risk-based end state vision, they will re-evaluate their cleanup activities and strategic approaches to determine if it is appropriate to change site baseline documents and renegotiate agreements. Sites will then work with their regulators to modify, as needed, their cleanup strategies, cleanup agreements and baselines. Consistent with those modifications, sites will update their cleanup baselines and associated performance plans to reflect the risk-based end state vision of the site.

DISTRIBUTION:
All Departmental Elements

INITIATED BY:
Office of Environmental Management

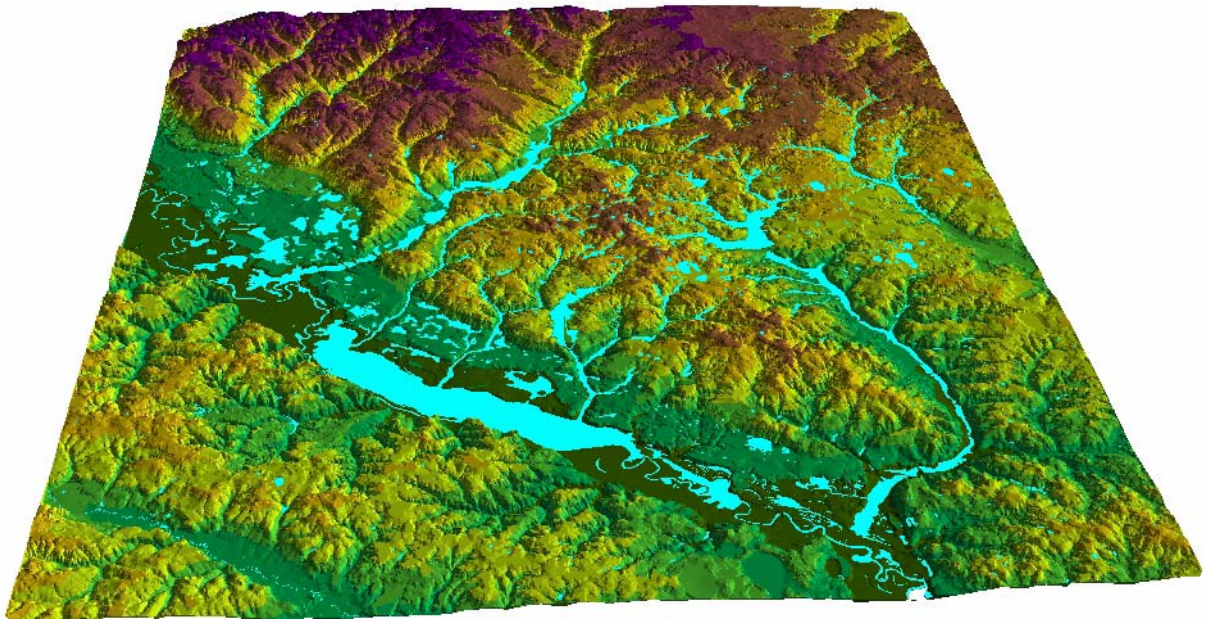
- "… focus the Department …on conducting cleanup that is aimed at, and achieves, clearly defined, risk-based end states."

Finally a recognition that Evaluation and Management Involves all four Tasks



Needed:
Geographic Integration

At the site and complex level



Attachment 2

U.S. DEPARTMENT OF ENERGY

GUIDANCE FOR DEVELOPING A SITE-SPECIFIC RISK-BASED END STATE VISION

September 11, 2003

Attachment 2

How to Develop an RBES Vision

DOE Policy P 455.1

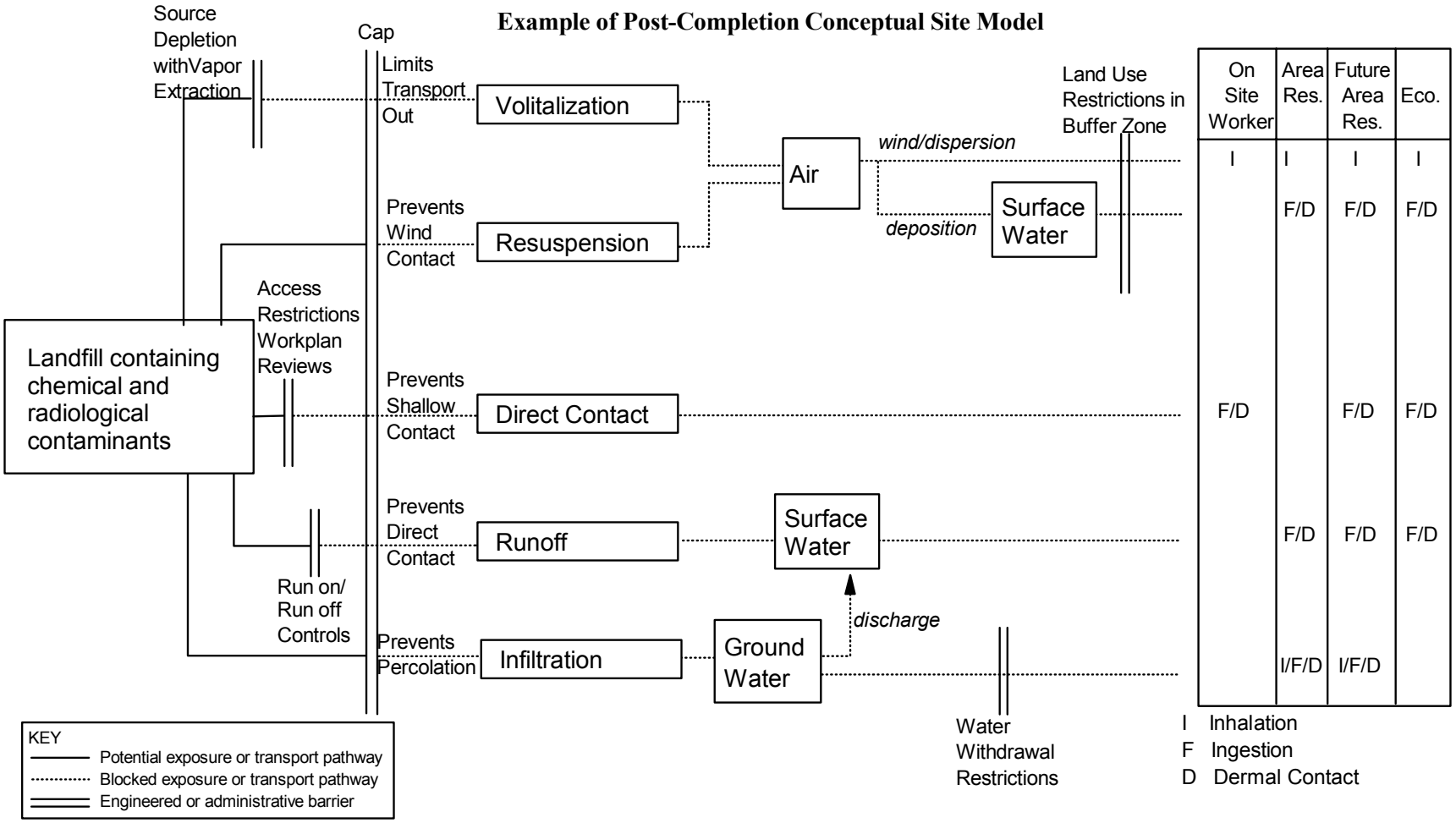
- **"End states are the basis for exposure scenarios developed in baseline risk assessments that help establish acceptable exposure levels for use in developing remedial alternatives in the feasibility study."**

- "Risk reduction measures, life-cycle costs, uncertainties, and other relevant policy factors of the decision shall be made visible in site cleanup strategies and remedy decision documents."

- **"End states should be based on an integrated site-wide perspective (including the current and future use of surrounding land), rather than on isolated operable units or release sites."**

- **"This is not a license to do less at individual release sites, but rather to better link narrowly considered decisions to a larger perspective."**

Example of Post-Completion Conceptual Site Model



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.

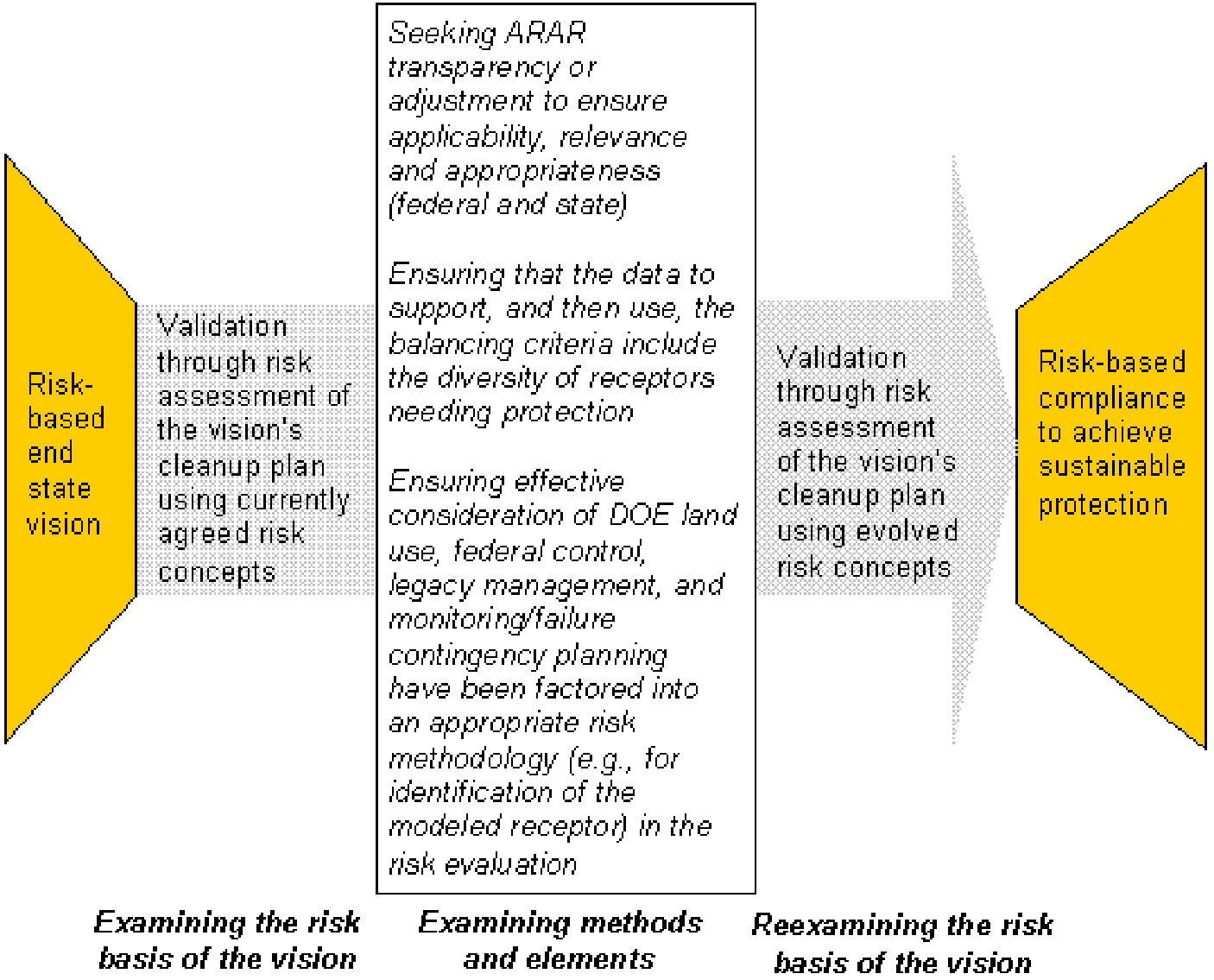
38 Sites are now working to follow the policy and its guidance for RBES visions

Why? It is fundamental - as Congress and all of DOE's "advisors" and many of its regulators have said for more than a decade - for DOE to understand the risks (at the site and the complex level) and to depict them in a common and transparent way.

It is doing so now in a context where EM's risk work is part of a Departmental policy. It does so in a context where the Office of Legacy Management policies now augments other DOE PSO's and and provides the Department with a function wholly devoted to sustainable followup of active remediation .

It does so in a context where DOE policies now require transparency between current management and future management of DOE Properties, non-DOE properties and properties to be transferred Elsewhere.

Is the Institutional Machinery evolving to link the RBES ideal with the the institutional prerequisites? It is very early and there are signals both ways.



Because of special problems posed by DOE Cleanup, this implementation may involve substantial new interaction with regulators

How do you build the kind of risk-based approach that will achieve these new expectations for a robust risk-based end-states approach?

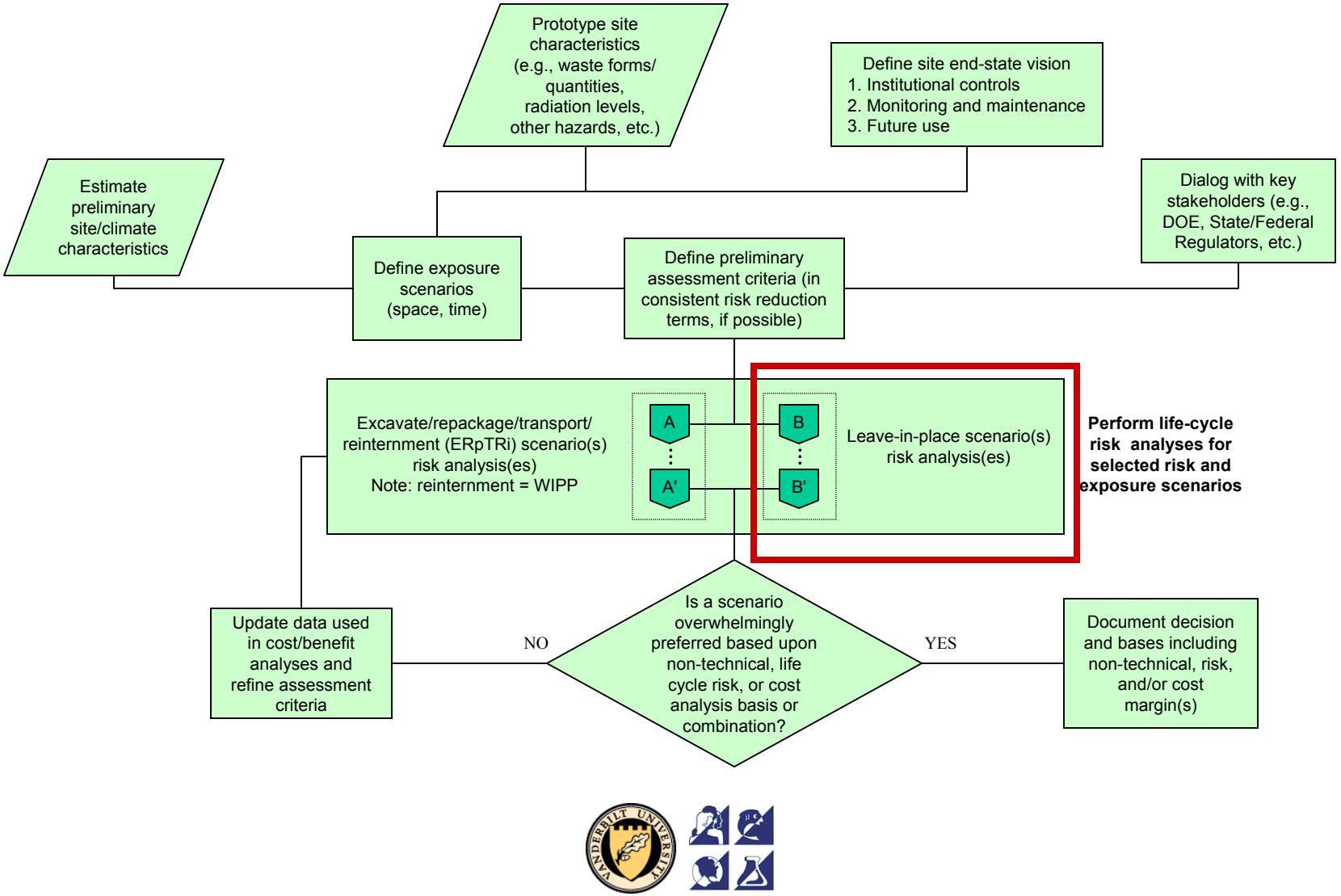
1. What is required to institutionalize a template that integrates risk comparison, including current and future risks
2. Should wastes classification be based on hazard (activity) AND mobility, not just hazard (as suggested by the NCRP)?
3. What should be the relevance of the EIS with upper, lower and central tendency estimates of risk as a path for RBES implementation?
4. Should risk estimates and risk communication include i) individual-based risk, ii) population-based risk, iii) estimated loss of life (e.g., person-years) as a consequence of decisions? How would this perspective be related to regulatory approaches?
5. Exposure scenarios remain essential. How can they be understood to be hypothetical, constructed reasonably, and contain sufficient information in a form for interested parties to estimate risk for other scenarios (i.e., so that specific scenarios explored are EXAMPLES)? If they were, contributions from drinking water consumption, agricultural use, proximity, etc. might be included in addition to scenario-based multi-media aggregate data.

Additional Discussion Points:

* Questions Originally Developed by Dave Kosson

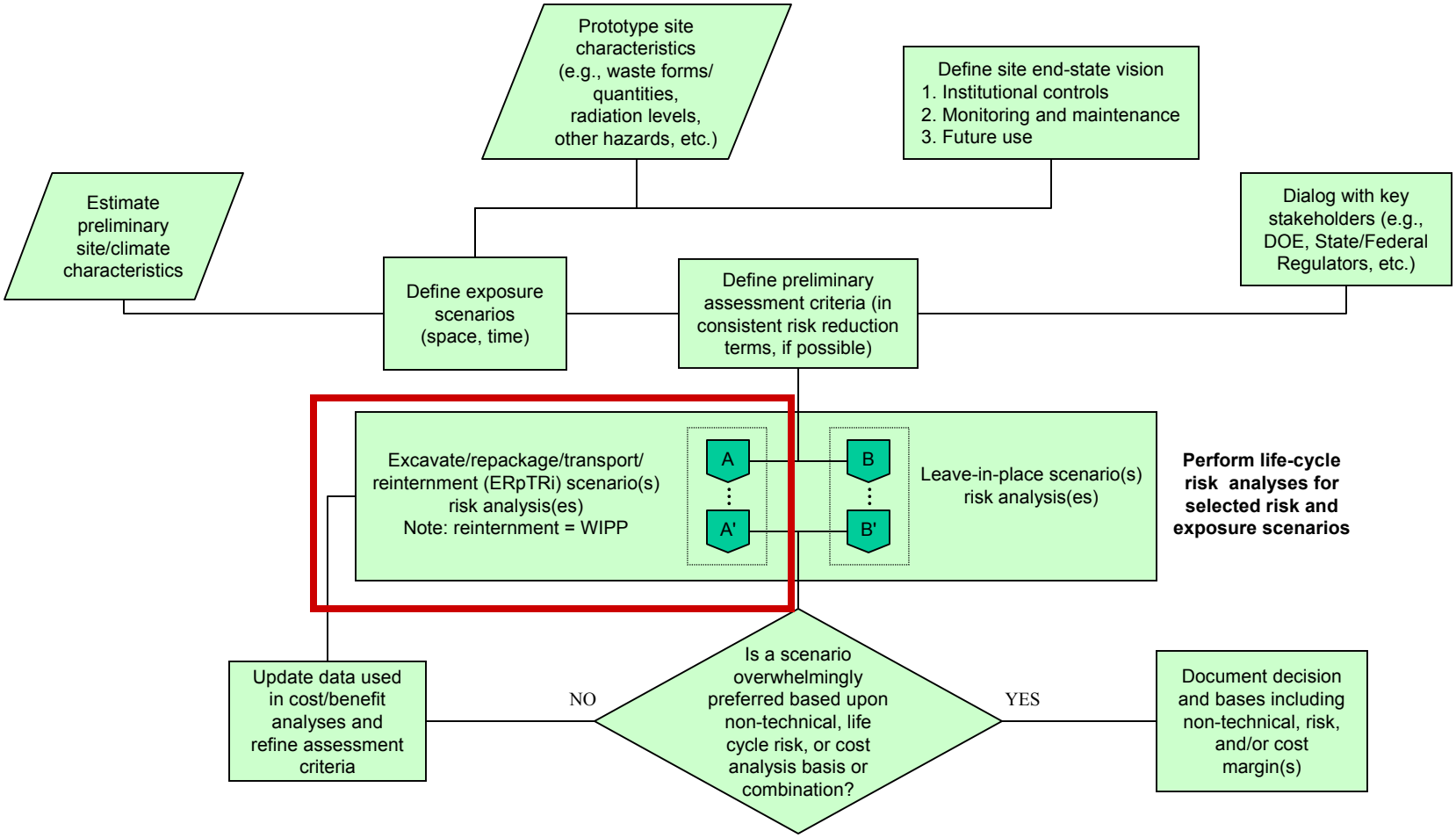
We need a risk-risk template for the major cleanup dilemmas

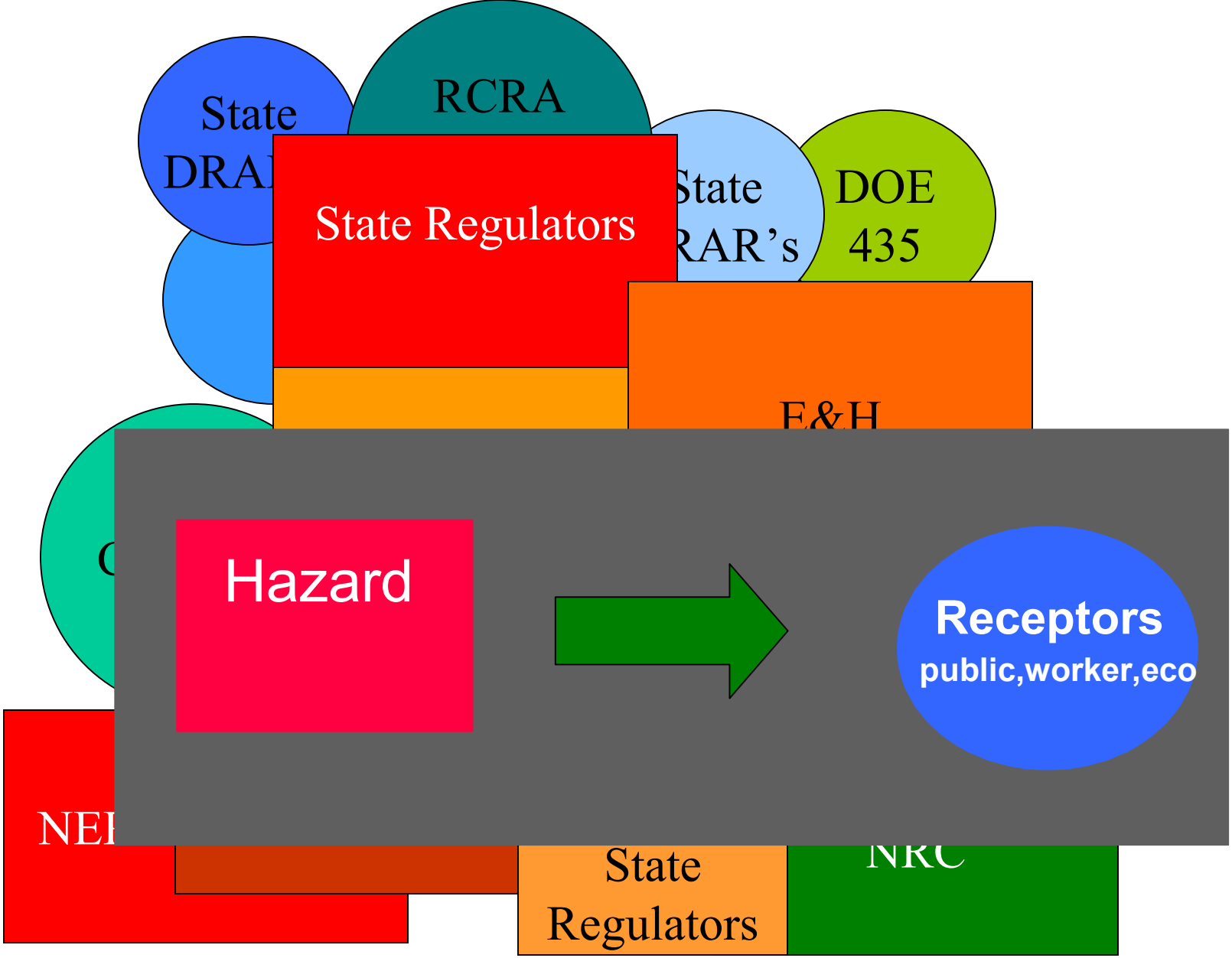
DOE Buried TRU Waste Reg.—Draft Risk Evaluation Framework



We need a risk-risk template for the major cleanup dilemmas

DOE Buried TRU Waste Reg.—Draft Risk Evaluation Framework





Can Risk Help Make the Voices Cohere?

Several Suggestions/Recommendations

Given the history of diverse support for a complete
"risk picture" of the DOE complex, the RBES policy
and the RBES visions it is generating could be a very
significant step forward in the evolution of DOE cleanups.
It is impossible to imagine how use of the various risk criteria
included in federal and state waste laws will ever be more than
hortatory exhortations unless complete CSM's give rise to technically
rigorous RBES'

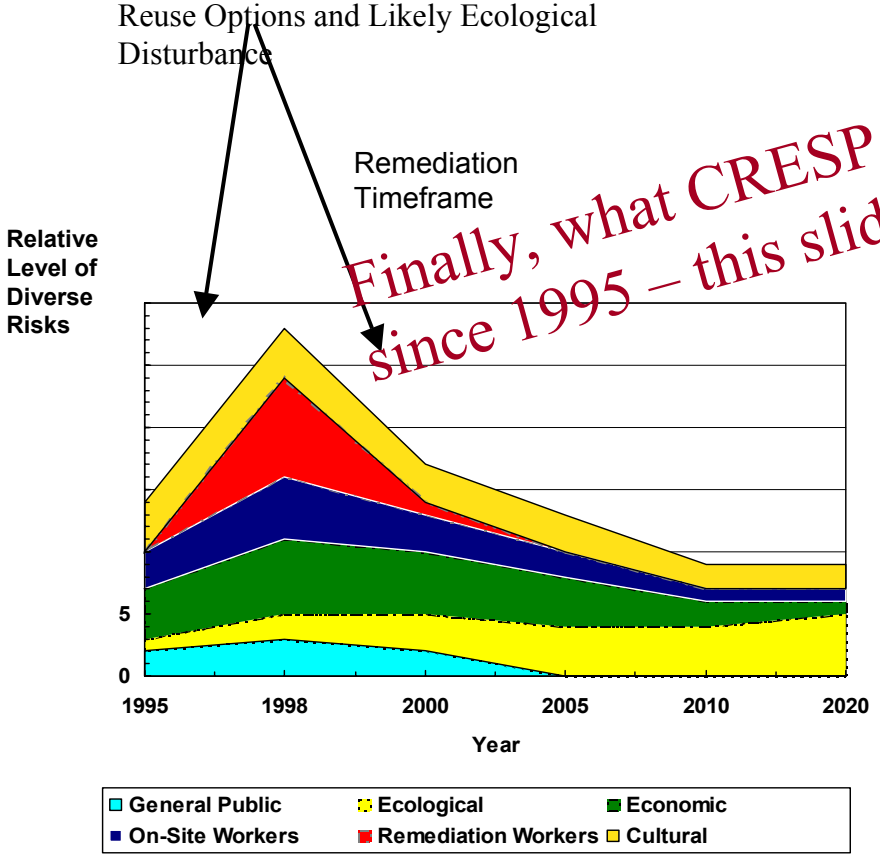
Because of the public vetting and transparency required,
EIS' may be a particularly effective way to translate what
is learned from the RBES initiative into new regulatory agreements.
This may be especially important in the evaluation of HLW
and buried TRU alternatives.

Risk-based and End States are/should be glued together in any technically
serious effort to characterize what is and what should be at a site

Does Data Availability and Presentation Matter?

Risk Patterns, Over Time for Affected Groups, of Remedial Option A:

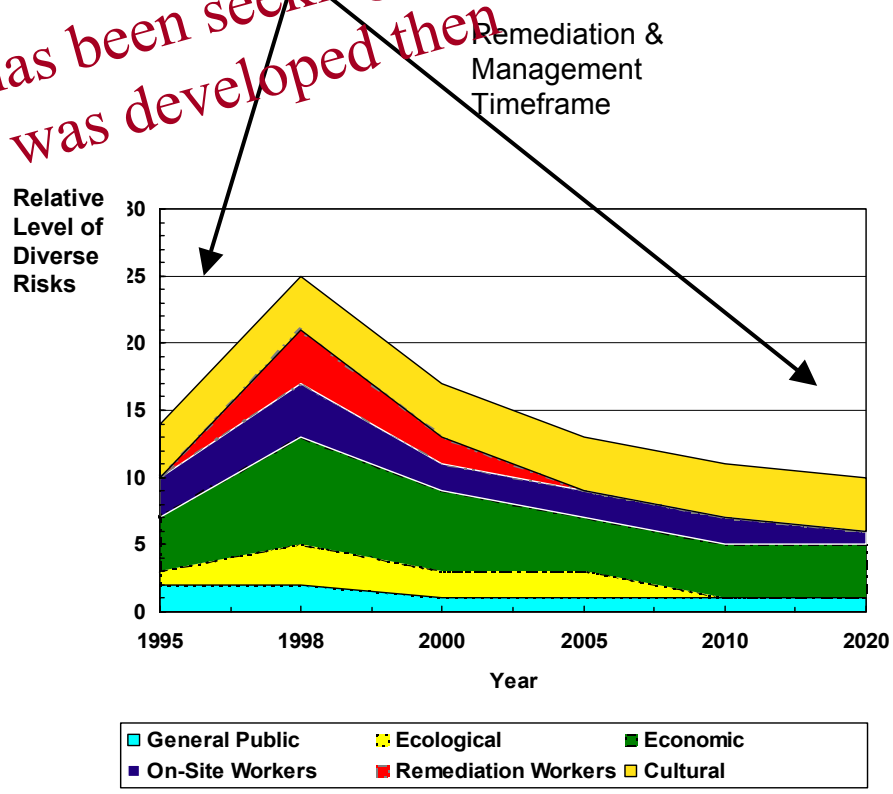
Remediation Addresses Most Risks, Achieves Permanent Remedy which Permits Limited but Significant Reuse Options and Likely Ecological Disturbance



Risk Patterns, Over Time for Affected Groups, of Remedial Option B:

Remediation Addresses Acute Risks, but Manages Remainder in Place and Achieves Acceptable Risk Reduction through Institutional Controls & Limited or Prohibited Reuse Options

Finally, what CRESP has been seeking since 1995 – this slide was developed then



Helping Stakeholders to See the Consequences of their Concerns