



Consortium for Risk Evaluation with Stakeholder Participation II

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FINAL REPORT:
A Summary of Work 2000 – 2006

Submitted by

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Executive Summary

The Consortium for Risk Evaluation II (CRESP II, 2000-2006 DOE Instrument # DE - FG26-00NT 40938) was conducted under a grant from the Department of Energy. Its predecessor was CRESP I (1995-2000); its successor is CRESP III (2006-2011), both of which were/are cooperative agreements.

SCOPE: The CRESP II project has sought to define and assess the technical and regulatory scope and approaches useful for the DOE as it strives to undertake its cleanup and stewardship responsibilities in a protective and cost-effective manner at contaminated sites. The project effort focused on supporting independent and collaborative research, reviews, methods, data gathering and stakeholder participation needed for effective evaluation and communication of DOE-related health, environmental and other risks. The project focused responsively on important cleanup-related challenges at the sites and on the end states which cleanups seek to achieve. The project effort sought to accomplish the outcomes by:

- performing targeted studies on specific risk related issues important to the long-term management of environmental problems;
- contributing to risk evaluation and assessment, or to the development of related methodologies, relevant to risk issues at a number of DOE sites;
- focusing on the collection and analysis of data needed for effective risk evaluation, and on the definition and assessment of relevant technical and regulatory approaches valuable in resolving risk-related issues;
- providing an independent mechanism to support the assessment of DOE's needs for research, to critique current research, and to develop data relevant to the concerns of the public, to support planning and to be responsive to evolving regulatory commitments; and
- supporting efforts to improve working relationships and communications with the public and stakeholders at sites and across the DOE complex.

CRESP II has for 6 years told visitors to its website (www.cresp.org) that “One of the best ways to understand the work of CRESP is to look at the publications of CRESP researchers”. Indeed, the centerpiece of this technical report is the scholarly work produced under CRESP II. (See Attachment B where CRESP II’s achievement of this grant Scope is documented). The results can be seen simply in terms of numbers: The Scholarly Products list includes 174 Peer Reviewed Publications, 26 Submitted and In Press Manuscripts, 117 CRESP Reports, and 210 Presentations, Posters and Abstracts. The products list also includes a substantial number of additional products in the forms of Book Chapters, Books, Proceedings, Symposia, Workshops, and Dissertations and Theses completed. Review of this Scholarly Products list makes available to the reader of this report the real diversity of topics addressed by CRESP II researchers and the varied contexts in which the results of the work conducted under this agreement were conveyed to very diverse audiences. Another characteristic of the products in this list is that they are predominantly the results of collaboration not only among researchers in the same field, but among CRESP and other researchers in very diverse academic fields and among authors drawn into CRESP scholarly work from the Department, the regulator and the stakeholder communities. Finally, although most of the scholarly products published in the peer reviewed literature are contributions to the specific fields of the various journals, a substantial number of the products are reviews and other accounts that provide perspective on the risk-related issues with which the Department is wrestling. In sum, the report of the CRESP II achievement of its grant-defined Scope can be found in this Scholarly Products list.

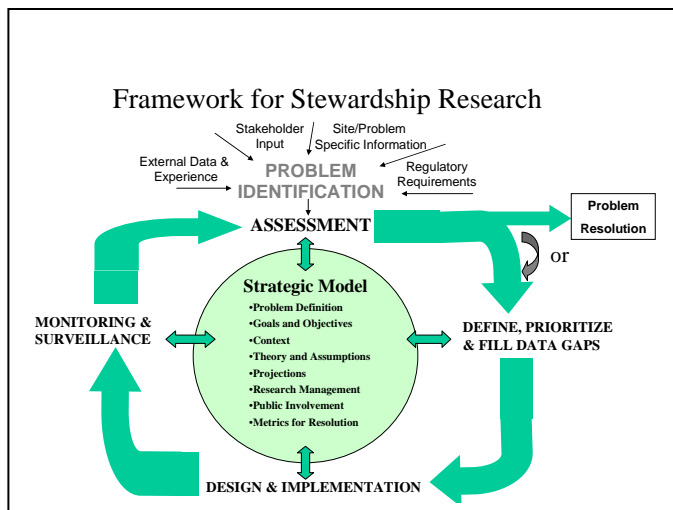
But there is a completely different perspective on CRESP II’s work that we will in the following pages explore in relation to how CRESP II performed its scope and the managerial context in which that work was carried out.

Three Perspectives at EM During CRESP II: During the period that CRESP II has been at work (2000-2006), the Department’s Office of Environmental Management itself has been through several transitions and has moved through what we at CRESP have viewed as three quite distinct management periods

While CRESP II operated, the Department was led by four Secretaries or Acting Secretaries and the Office of Environmental Management has had three Assistant Secretaries and three Acting Assistant Secretaries. CRESP II itself was initially administered out of the National Environmental Technology Laboratory (NETL) in Morgantown until in 2003 DOE headquarters became the administering unit. There has been similar turnover in the leadership of the various EM offices to whom CRESP II has reported.

The management approaches that have operated in those three periods have differed dramatically. CRESP II always operated as a grant; its program and operating procedures were always conducted within the spirit and policies governing the grant as its form of federal assistance agreement. During this period CRESP II provided annual status reports accompanying its annual continuation applications (see Appendix I). The specific issues confronting the Department and the management objectives and methods shaped the context in which CRESP II undertook to carry out its Scope in different budget periods.

A. In the Fall of 2000, the dominant focus of the new CRESP II – and of the Department’s expectations for it – was primarily to develop the conceptual basis for relating EM’s prior focus on remediation to its new Stewardship focus and to the intense work then being done by the Department to define (through roadmaps and other approaches) stewardship and the technologies needed to achieve it. This emphasis was specifically found in the language of CRESP II’s scope and was focused for CRESP leadership in a visit to CRESP headquarters by the then Deputy Assistant Secretary for Science and Technology, Gerald Boyd just before CRESP II began.



The extent to which this “Stewardship” focus dominated the initial CRESP II research and development is seen in a key image – collaboratively developed by CRESP leadership following Boyd’s visit. That graphic was the centerpiece of a presentation made just 20 days after CRESP II began by the Principal Investigator to a meeting convened by NETL in Morgantown, WV, the home of CRESP II’s new reporting relationship.

Presentation by Charles W. Powers, Executive Director CRESP & PI CRESP II at the Long-term Stewardship Implementation Session of the Industry Partnerships for Environmental Science and Technology Conference National Energy Technology Laboratory Morgantown, West Virginia October 18, 2000.

B. With a new Administration in the early months of 2001, a shift in EM focus was apparent although its actual form awaited the catalyst of the Office’s “Top to Bottom Review” (February 2002) and of the initiatives that followed that report. Two themes dominated the period from mid-2002 to the Spring of

2005: 1) a new focus on tying remedial project definition to risk (based on relative or comparative risk and using risk as the basis for compliance) and symbolized in the appointment of an End States Project team beginning in late 2002 and adoption in August 2003 of the Department's Risk-Based End States policy [DOE P455.1] and the work products related to it; and 2) emphasis [in the Congress and the Department] on EM project acceleration and completion – with a commitment to achieve work in shorter time frames and with a sharp demarcation between EM's own work and that which would belong to a site's post-EM legacy management. This EM leadership was committed to telescoping EM completion dates at the largest EM sites and to achieving closure at the “smaller” EM sites as best symbolized in the EM “Focus Project” and its effort to clarify closure baselines. CRESPII members were appointed to both of these Projects. And CRESPII's research work informed and sometimes transformed the concepts used in this era (see below).

C. Beginning in the Spring of 2005 and rapidly evolving to the present are what appear to be several new Departmental foci: 1) a focus on the processes and people needed to achieve excellence in project management, including much sharper definition at the inception of a project (at CD-0) of project goals and purposes; and 2) a commitment to sort out the root causes of why the Department so regularly fails to execute its project plans, particularly among its largest construction projects involving the use of new or rarely-used technologies. This second focal area is being aimed primarily at problems at the largest EM sites. There is also a related but distinct third unresolved issue currently being addressed: how to bring work at EM sites to a conclusion in ways that achieve **both** technical finality and orderly organizational transition to the entity responsible for its legacy management (to OLM, to one of the other DOE offices engaged in continuing missions, or to a non-DOE entity). Achieving clarity about those transitional responsibilities remains a major Departmental challenge.

The primary purpose of the remainder of this technical report, however, is to illustrate how, in its conduct of a series of major projects and pursuit of projects themes, CRESPII has addressed the issues central to each and all of these three EM leadership and policy direction changes – since each represents a different perspective on the enduring EM problem of conducting publicly acceptable risk-informed cleanup at the largest and most complex waste sites in the nation. CRESPII has not been three different entities whose work was molded to the different management persona. Precisely the opposite is the case. CRESPII has achieved continuity of leadership, of research focus and productivity while at the same time actively working to use specific aspects of its research and review talents in diverse EM efforts to explore different ways of achieving the Office's very difficult mission.

To be sure, CRESPII itself has undergone some change. Vanderbilt University, which had joined CRESPII in late 1999, became a major institution among the Consortium's members – and indeed, for CRESPIII is now the lead institution. In CRESPII the role of University of Washington was nearly equal to that of Rutgers and RWJMS. However, in CRESPIII, the role of University of Washington decreased steadily, while that of the University of Alaska increased markedly because of CRESPIII's role in Amchitka. By the end of CRESPIII, the role of both University of Washington and University of Alaska ceased. Legal researchers from New York University became important to CRESPIII work in the final 18 months of CRESPIII as the relationship between regulatory and technical policy became more central. **Still, the Management Board with which CRESPIII began in 2000 remained essentially the same throughout the six years.** That Board was sufficiently broad to oversee the diverse projects of CRESPIII, and had the same composition, with the exception of the member from the University of Washington. The original 5 Centers of Expertise each continued to do distinctive work, but fidelity to the original CRESPIII Scope that is the primary subject of this report was more often achieved by an unprecedented cooperation and enhancement of work achieved by the interdisciplinary wedding of diverse sciences and technologies in successful projects and reports.

CRESP II - the middle term of three CRESP-DOE Agreements: CRESP II can itself also be viewed as transitional. CRESP I made very substantial contributions (most particularly at SRS) but clearly had to “learn” the challenges of the EM complex and to sort out which Consortium’s structures would best help it address those challenges. CRESP II brought a more experienced group of researchers who more directly engaged the issues at, for example, RL, OR and Idaho. But as the conceptual focus shifted to life-cycle costing and to closure at the smaller EM sites, CRESP took on larger and more cross-cutting assignments in doing the science and fostering the communications required. (A description of how different parties requesting CRESP I and CRESP II involvement and work led to productive CRESP successes is summarized in the final entry of Appendix I.) Then as the end of the CRESP II grant approached, CRESP leadership began to articulate an even broader vision of how the EM challenges were impacting and impacted by discontinuities in the nation’s efforts to conduct nuclear waste management generally – and key elements of that articulation have become the basis for the new CRESP III agreement. Some examples: First, we learned from the CRESP II experience that there are three different “modes” of review work to be done by an independent technical consortium such as CRESP. And that typology, exemplified by different types of CRESP II work, should become the basis for a much more highly developed review function in CRESP III. Second, our own evolved understanding of how to achieve stakeholder involvement/collaboration in the definition, conduct and review of technical issues that are the center of controversy should improve our ability in CRESP III to apply what we learned from the Amchitka project to even more complex scientific challenges and controversies at sites struggling to overcome technical and regulatory paralysis. Third, our earlier work on contaminant leaching has evolved into a much broader conception of the evaluation of waste forms in the context of Contaminant Isolation System Performance – and has already allowed CRESP III to play a pivotal role in the December 2006 workshop at SRNL on Cementitious Materials for Waste Treatment, Disposal, Remediation and Decommissioning. Fourth, the new CRESP III assignment to make “root causes” a major strategic analysis initiative has, we believe, evolved out of quite diverse CRESP II findings (about short comings in engineering, economic evaluation, contractual mechanism selection and oversight organization) on which the EM now wants CRESP researchers to expand.

Examples of CRESP II Projects and Themes to Address Key DOE Issues: We have selected 5 CRESP II example projects and/or themes to illustrate what we have just reported about the continuity of CRESP II work in the midst of managerial change at EM and how we believe that work should inform better utilization of the learning from CRESP I and II. We briefly summarize here each of these 5 projects or themes. The more complete rendering of each project or theme is found in the Attachment links (C-G) where links are found to the “story” as reported in the relevant scholarly research and review products.

1. *Amchitka*. For CRESP, this project started in 2000 – two months before CRESP II began. DOE EM-1, under intense congressional and Alaska state criticism for the Department’s failure to provide a publicly-accepted empirical base for its proposed Amchitka subsurface/marine stewardship plan, encouraged CRESP to respond to the State’s invitation to it to seek technical clarification. EM’s own 2002 transition with its drive to achieve closure at small sites coincided with a CRESP sponsored workshop in February 2002 in Fairbanks. That successfully crystallized all the technical and stakeholder issues related to the Amchitka subsurface and fostered a new technical dialogue among all the parties. Within two months of that workshop, a draft document became the July 2002 DOE-State Letter of Intent (LOI) on Amchitka that set agreed conditions for Amchitka subsurface closure that explicitly gave CRESP responsibility for: a) achieving broad agreement on a scientific plan; and b) carrying out that plan through an on-site multi-disciplinary assessment. Both tasks were

to be completed by FY2005. Consensus on the resulting scientific plan (2003) preceded active consultation among all affected parties and led to an expedition to the remote island to gather physical and biotic samples/data (2004). Analysis of data and samples, incorporated in a substantial report reviewed by the CRESPPeer Review Committee, put CRESPP in a position in the summer of 2005 to report results that were well-publicized and accepted by all parties – empirical results indicating no current risk, and meeting all the LOI requirements (on schedule and in scope).

In December 2005, OLM and EM made a new request that the Report’s data and additional CRESPP data, be incorporated into a draft biomonitoring plan for OLM’s use in setting out the stewardship plan specified by the LOI, a request that was consistent with CRESPP’s fifth year plan. CRESPP provided the biomonitoring plan 45 days later (January 2006). CRESPP then participated, at the State’s request, in a report by it, OLM and CRESPP on the agreed path forward to the Alaska public (February 2006).

Thirteen articles on various aspects of the Amchitka project by CRESPP researchers (most by the project’s biological director Joanna Burger) have been published or are in press, although we highlight in Attachment C only the two that chart how the Amchitka project evolved fundamentally new approaches to integrating stakeholder collaboration/involvement with a complex research definition and implementation process. CRESPP believes that it was this stakeholder collaboration that led to acceptance of the science base and consensus on the bioindicators for biomonitoring. (See Attachment C)

2. *Risk-Based End States.* In October 2002, CRESPP was asked by EM-1 to participate in the EM project to develop a technical basis for a Departmental policy on risk and end states (risk-based end states). In the first months of that project, EM RBES Project leader, David Geiser, asked CRESPP to develop a complex-wide mapping and conceptual site model program for use in all site RBES reports. At the time, these tools were, if they were used at all, being used in incompatible ways at EM site. The resulting CRESPP approach for mapping and conceptual site model integration was directly incorporated into the guidance for the July 2003 Departmental RBES policy. Additionally CRESPP was asked to, and did, develop a literature compendium on risk and risk management to be used by sites and stakeholders as they worked to put the RBES process into context of the broader risk literature (The compendium is still found on the EM web). Then, as EM sites began to develop their draft RBES reports in the late fall of 2003, all of CRESPP’s leadership participated in the iterative reviews of those site RBES submissions and, in Spring 2004, conducted a complex-wide teleconference workshop primarily to facilitate the use of the mapping/conceptual site model program. (See Attachment E where the CRESPP reviews of the RBES documents are compiled.)

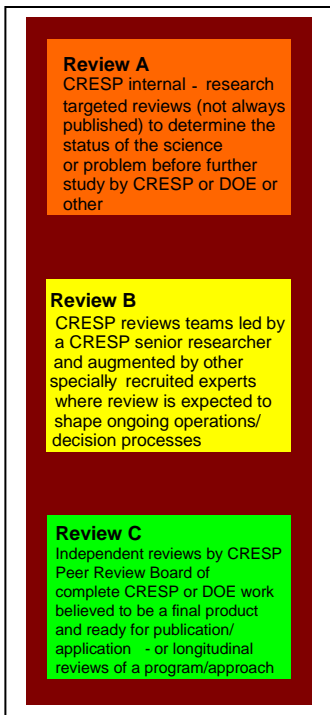
In the initial RBES drafts developed by the Idaho Site, the site’s two most complex cleanup challenges (remediation and disposition of calcine in calcine bins and the identification of remedial options and post-remediation monitoring for the buried waste in the SDA) were not addressed. Idaho stakeholder and regulatory opposition to the RBES was strong. In the Fall of 2004, CRESPP agreed on how work with the site’s management to develop an appropriate format for using risk to evaluate these two complex site problems; it welcomed a resolution adopted simultaneously by the Idaho CAB stating that the CAB wanted to wait for the CRESPP reports before opining in the RBES context on remedial options for these two site problems. Following concepts developed in the NAS 2005 Risk and Decision report, CRESPP produced, in the late spring of 2005, two preliminary but

extensive risk evaluation reports on these two Idaho site problems. RBES work in EM, already slowing in 2004, was abandoned in 2005. Yet these distinctive CRESPI Idaho reports, widely viewed as concretely exemplifying a new model for risk-informed remedial decision making, were rigorously evaluated by the Idaho CAB in July of 2005. The resulting Idaho CAB resolutions (#'s 123 and 124) call for the regular use of the model found in the CRESPI reports and requested that future DOE reports to the CAB adopt the format CRESPI had used.

We highlight CRESPI work on the RBES in this period because substantial CRESPI effort was devoted to RBES processes. We note that CRESPI raised significant concerns about some of the key concepts and approaches used during the evolution of the RBES policy, its initial Guidance document, the draft Implementation Policy document. Specifically CRESPI recommended the entire program use the concept "risk-informed" rather than "risk-based", substitute the term "alternative" for the term "variance", and ask for regulatory and stakeholder "involvement and collaboration" rather than "concurrence". It also strongly recommended that the RBES program be piloted before it was promulgated and that the timeframes allowed for preparation and submission of RBES documents be much longer than those originally specified. A number of these suggestions later became part of the 12/23/03 addendum to the RBES Guidance. Happily, in the midst of, and subsequent to, the significant controversy about RBES and a later EM management de-emphasis of it, CRESPI's technical work, particularly on the Compendium and the Mapping/Conceptual Site models, survived. And the model developed in the Idaho risk evaluation reviews (and stakeholder acceptance of it) concretely demonstrates a way to achieve more disciplined use of risk concepts in DOE remedial decisions in the future through the use of a different framework and concepts. We also note that the lead authors of the two Idaho studies were each graduate students when the primary work was done, actively backed up by very senior interdisciplinary team of CRESPI researchers. This fact adds another, specifically educational, dimension to the process by which CRESPI itself was learning how to improve the way risk is used – a dimension that is given increased emphasis in the training/educational component of CRESPI III (See Attachment D).

3. *Review.* Since the first drafts of the concept paper (1994) from which the competitively-selected CRESPI I proposal was developed, independent review has been a key element of the CRESPI program. Initially the review mechanism was simply the separate CRESPI Independent Peer Review Committee whose primary function was to review CRESPI researcher work when employment of that work in EM decisions was anticipated to occur before its validity was assured through regular publication of the work's results in the regular peer reviewed literature. A second designated function of the Committee was to respond to formal requests by the Department for reviews primarily of programmatic EM initiatives. CRESPI I had developed clear protocols for the Peer Review Committee's work and recruited a diverse world-class team of reviewers (five of whom were/are members of the National Academies [three NAE members and two IOM members]). Almost all members of that Committee agreed to stay on in CRESPI II.

At the outset of CRESPI II, this same simple organizational division between CRESPI review and research processes persisted despite the fact that other types of CRESPI review had evolved. By 2002, more frequent requests for new forms of CRESPI review, reviews done more naturally and effectively when led by CRESPI researchers, had developed. For example, EM-1's requested review of the options for assessing the ecological impacts of Peconic Creek mercury led to a CRESPI researcher review that, after its public presentation, became a peer reviewed paper itself ("The



Peconic River: Concerns associated with different risk evaluations for fish consumption”). In 2003, DOE’s request that all of CRESP researchers be involved in the iterative reviews of RBES drafts (see above) crystallized the fact that the simple division between CRESP research and CRESP peer review was no longer accurate. Yet, in 2004 the continuing importance of the separate Peer Review Committee was dramatized by the need for three separate reviews of CRESP Amchitka work. (The initial Amchitka Science Plan, the major Amchitka Report and later Biomonitoring Plan were all given Peer Review Committee reviews that published as part of the CRESP Amchitka effort on the CRESP web). While these reviews were being conducted, CRESP Researcher David Kosson was simultaneously asked to chair a key ORP panel on its preliminary closure Performance Assessment for the C-Tank Farms at Hanford – and Kosson was supported in that role by the CRESP grant. In the ensuing two years, the pace of requests for diverse types of CRESP review quickened. CRESP was asked to provide a researcher to participate in the development of criteria for, and then in the selection of, remedial technologies for Hanford groundwater

remediation. And CRESP was asked to form a committee to review Pilot Studies in support of steam reforming processes for treating Sodium-Bearing Wastes (SBW) at the Idaho National Laboratory. Finally, an influential Michael Greenberg/Henry Mayer article summarizing and drawing conclusions from earlier CRESP research on EM management problems (“End State Land Uses, Sustainable Protective Systems, and Risk Management: A Challenge for Multi-Generational Stewards”), seems closer to a review than to primary research. Late in CRESP II, and in preparation for CRESP III, CRESP developed a typology (see graphic) of three distinct types of review to be performed under the aegis of the Consortium. Specific protocols to guide reviews of each type are being formulated under CRESP III – and it is clear that as CRESP evolves, the review function will continue to grow in importance. (See Attachment E)

4. Land Use and Related Concepts. No area of CRESP II work better illustrates the synergisms of evolved multi-disciplinary work that its work on land use. The search for better mechanisms both to 1) discern and apply “best and highest use” under the circumstances of radioactive and chemical waste contamination, and yet 2) discern simultaneously the likelihood of land use acceptance by measuring evolving public preferences have been enduring CRESP goals since early in CRESP I. They remained major themes throughout the CRESP II grant period. But CRESP II brought additional conceptual development to the themes as its researchers explored the bridging role of land use concepts to resolve long-standing discontinuities in EM cleanup: the remediation/stewardship (including institutional controls) dichotomy, the remediation/Natural Resource Damages dichotomy and the dichotomy between human and ecological health, especially as it shapes physical as compared to biomonitoring approaches. Hence, in diverse ways, CRESP researchers have long sought ways to make the selection of accepted land use much more central to the articulation of a complete system for accepted and risk-protective DOE cleanup – and expect these same concepts will be needed in the future if/when new nuclear facilities are selected and constructed.

Several CRESP examples of integrating land use with other EM challenges will suffice. In Attachment F are found a significant number of multi-authored CRESP products each of which addresses some aspect of the land use related dichotomies just described. As CRESP II began, it published a widely-read report from CRESP senior researchers (later published in 2003 as “Shifting priorities at the Department of Energy's bomb factories: Balancing protection of human and ecological health”). This study entered the then national debate generated by a highly-publicized Competitive Enterprise Institute paper that called for "setting as a policy priority the isolation and conservation of DOE sites for their rich ecological diversity” (Nelson 2001). Throughout CRESP II, CRESP researchers pursued the issue of land use and risk from diverse perspectives and published prodigiously, typically in multi-authored articles. Most of these studies were initially informed by work conducted in CRESP I and published in CRESP II in a series of survey research studies at four DOE sites to determine stakeholder views on ecological service preferences and land use. CRESP II continued to do studies and surveys to assess public views about risk and typically its impact on land use. The relationship between monitoring and biomonitoring as a way of informing the public about risks associated with residual wastes being left, likely in perpetuity, at EM sites led to an extensive CRESP literature on biomonitoring, some of which is captured in Attachment F, but more of which appears in Attachment I. Concerns about offsite seepage are one aspect of this issue; a second is how to keep publics away from such residual wastes and those concerns are addressed by CRESP II scholarly products on institutional controls. These two streams of work came together in a CRESP convened workshop (“The Real Obstacle to Site Completion Credible Post-Remediation Sustainable Protection at Contaminated Sites with Residual Waste”) held in Washington DC in January of 2006. The workshop involved senior officials from EPA and DOE leaders from EM, EH, NNSA (see www.cresp.org).

Finally, land use determination issues are often hostage to the uncertainties associated with the possible future imposition of Natural Resource Damages at sites as a second CERCLA liability. Typically these liabilities are treated sequentially and separately and the result is dichotomies between the selected remediation and responses to NRD liability. CRESP’s work on this dichotomy issue came together by pursuing it from economic, ecological risk and legal perspectives and has evolved an approach first suggested by EH a decade earlier that sought to integrate the two liability responses. A key issue is how that approach fits CERCLA requirements. CRESP first employed its evolved approach in a conference on EM NRD held in 2005 at the Fernald site where the integration of remediation and NRD has been an explicit site management goal. Selected products for the land use issues writ large in CRESP work are found in Attachment F.

5. Waste Forms. Some of CRESP’s II’s most basic scientific work has addressed fundamental issues about the matrices into which DOE wastes are placed and why. Determining what generic waste forms, and the specific formulations of them, are needed to contain different waste streams (direct and separated), represents one of the major technical challenges for EM. CRESP has sought to develop an improved understanding of the ability of waste forms to remain in tact and effective – under diverse thermal and wetting conditions - and to determine whether, should forecasted waste form durability and effectiveness prove wrong, subsequent intervention could reestablish needed protection. Evaluation of waste forms and performance assessments for waste forms and associated waste isolation systems was an increasingly important focal area for CRESP II. This included development of improved methodologies for establishing waste form performance criteria and evaluating long-term constituent retention. The following were specific activities carried out as part

of this effort: a) Leadership of a team reviewing the Waste Management Area C preliminary performance assessment for closure of single shell tanks at the Office of River Protection, Hanford site. This review included consideration of the final amount and forms of wastes remaining in and around high level waste tanks after closure. (See Attachment E); b) Carrying out a laboratory-based experimental program in coordination with the Office of River Protection and Pacific Northwest National Laboratory to understand constituent retention characteristics of a cement-stabilized waste form (“cast stone”) that was considered prototypical of treated secondary wastes from the Hanford Waste Treatment Plant. This program included gathering data on constituent retention, comparing results obtained under typical short term test under conditions (< 60 days) with more prolonged testing (>1 year) and testing under different environmental conditions. These experimental results currently are being used as part of CRESPIII to develop a better modeling basis for waste form behavior. c) Development of testing and evaluation protocols for leaching assessment of waste forms. This development effort was leveraged with on-going research supported by USEPA and European Union research and regulatory agencies. [The resulting testing protocols are currently being further developed and finalized by USEPA for inclusion as standard methods, providing an alternative to TCLP testing for many applications]; d) Development and demonstration of methodologies for evaluating the long-term structural integrity of cement stabilized waste forms and concrete containment facilities. This effort included modification and application of commercial finite-element modeling software to include multi-physics (mechanical stresses, thermal stresses, moisture variation, carbonation) effects on crack evolution; e) Evaluation of the efficacy of institutional controls at previously closed hazardous and radioactive waste sites with recommendations for improving the integration and combined performance of institutional controls and engineered barriers as a complete waste isolation system (See Attachment F). f) Convening and completion of an CRESPIII Review of Pilot Studies in Support of Steam Reforming Processes for treating Sodium-Bearing Wastes (SBW) at the Idaho National Laboratory. (See Attachment E). As noted earlier, all of this waste form work culminated at the end of CRESPII in the initiation of development of a major workshop on cementitious waste forms in conjunction with Savannah River National Laboratory on December 11-14, 2006. (This workshop effort itself was, of course, part of CRESPIII). And the work has involved multiple briefings and working meetings with NRC, DOE-ORP and others on opportunities and approaches to improving waste form performance characterization, and as a consequence, also actual waste form performance. (See Attachment G for CRESPIII waste form work not found in other attachments)

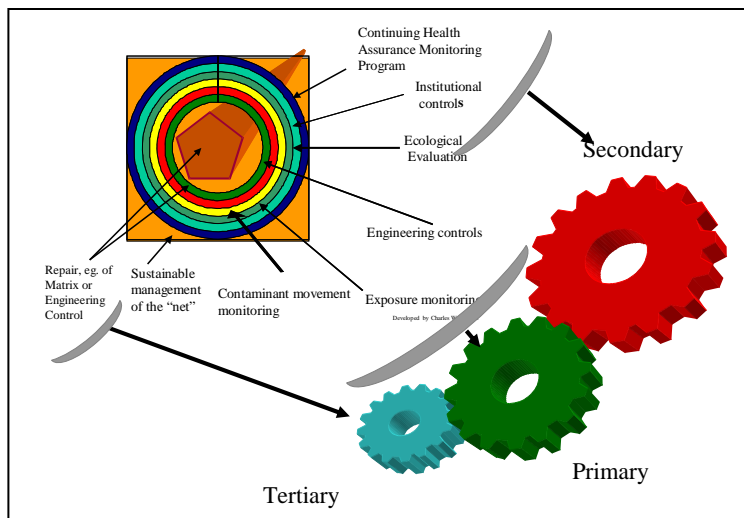
Conclusion:

This technical report and its several Attachments and Appendix provide an account of an institution that, we believe, has for six years maintained its focus on competent, interdisciplinary, risk-informing research and review work addressing a wide variety of the most perplexing EM problems. We could have chosen five other projects or themes. In fact, two Attachments (H and I) provide the reader with substantial additional direction to CRESPIII work in both Human and Ecological Risk (Attachment H) and a broad literature addressing a set of economic policy issues associated a) with the economic impacts of EM work on contiguous communities and regions and b) with the estimation and institutional issues associated with project cost control (Attachment I). In all of this work CRESPIII typically begins with the development or exploration of data and that work consistently informs broader strategic issues in cleanup and sustainable protection. In the course of its work, CRESPIII believes we have provided the Department, its stakeholders and the wider remediation and technical communities a large body of significant original scientific and

technical work. We have also provided concrete instances where technical advances and effective involvement/communication has allowed the affected stakeholders to engage the science and appropriate its implications. For example, CRESP believes that the integration of remedial and natural resource damage concerns – in the context of the effective use of mechanisms to secure effective monitoring and long-term land use commitments - represent the only way successfully to address the most serious challenges at EM’s largest sites (most notably Hanford and Savannah River). We expect the same lessons could be usefully applied to the efforts to create a geologic repository at Yucca Mountain, other repositories and other new and end-of-use nuclear facilities in a world where expanded nuclear energy generation appears to most depend on acceptance of an integrated nuclear waste management system.

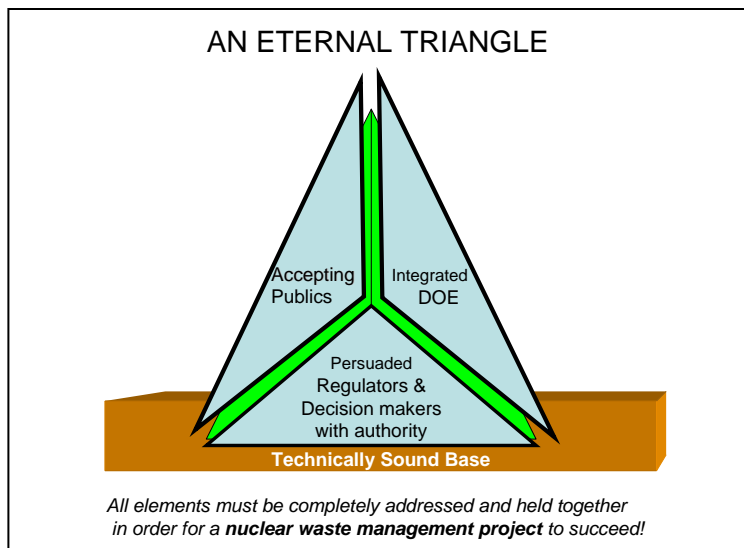
In conclusion, CRESP II began with a complicated image of its Framework for Stewardship Research that we depicted early in this Executive Summary. It believes that much of what it has learned in the ensuing six years can now be captured by two somewhat less complicated images.

The first image depicts the way in which completed remediation or waste form selection relates to the other elements of containment and protection.



The second image depicts the eternal triangle of the three factors that, when they sit astride a sound technical base, must coexist in order for technical solutions to nuclear waste management problems to be accepted.

Much of what CRESP II has learned is captured in these two images. For the rest, there are more than 500 scholarly products listed in this report, most of which are available either in abstract or complete form from www.cresp.org.



Available on CD-ROM

ATTACHMENT A

CRESP II Fact sheet

General Information on: Founders, Consortium Members, Mission, Research, Stakeholders, Peer Review, Management Board.

ATTACHMENT B

CRESP II Scholarly Products 2000 - 2006

ATTACHMENT C

The Amchitka Project

Amchitka Science Plan

Amchitka Report and Addendum

Biomonitoring Plan

Amchitka Peer Review Reports

Stakeholder Involvement

ATTACHMENT D

The RBES Project

Literature Guide

Geospatial Mapping Tool

CRESP Comments to Site Specific Idaho Site Reports

ATTACHMENT E

CRESP Reviews

ATTACHMENT F

Landuse Documents

ATTACHMENT G

Waste Form Definition

ATTACHMENT H

Selected Studies in Human and Ecological Risk

ATTACHMENT I

Economic Policy and Impacts of DOE Cleanup Sites and Activities

APPENDIX 1

Project Status Report Year 1

Project Status Report Year 2

Project Status Report Year 3

Project Status Report Year 4

A Summary of CRESP II Productivity and Successes