



May 16, 2002

Dear Stakeholder

This correspondence transmits RFCA Stakeholder Focus Group meeting minutes for November 28 and December 12, 2001 (Attachment A)

Attachment B is an article sent from the Rocky Mountain Peace and Justice Center

*Bulletin of the Atomic Scientists, "Lowering the Bar," LeRoy Moore*

The Radiological Soil Action Level (RSAL) Working Group continues to work the comments received for the RSALs Task 3 Report

AlphaTRAC, Inc is working the close-out party for the RFCA Focus Group We will forward the details to you when they have been finalized

You may call either Christine or me if you have any questions, comments, or suggestions concerning the RFCA Stakeholder Focus Group or the upcoming meeting

Sincerely,

C Reed Hodgkin, CCM  
Facilitator / Process Manager



**ADMIN RECORD**

**SW-A-004512**

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**RFCA Stakeholder Focus Group  
Attachment A**

Title November 28 and December 12, 2001 Meeting  
Minutes

Date May 17, 2002

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**RFCA Stakeholder Focus Group  
November 28, 2001  
Meeting Minutes**

**INTRODUCTION & ADMINISTRATIVE**

A participants list for the November 28, 2001 Rocky Flats Cleanup Agreement (RFCA) Stakeholder Focus Group meeting is included in this report as Appendix A

Reed Hodgjn of AlphaTRAC, Inc , meeting facilitator, reviewed the purpose of the RFCA Focus Group and the meeting rules Introductions were made

**AGENDA**

Reed reviewed the agenda

- Facilitator's Report on Focus Group - Interests and Path Forward
- Focus Group Discussion and Decision - Focus Group Role, Path Forward and Topics
- Cleanup Priorities - Group Identification of Options

**FACILITATOR'S REPORT ON FOCUS GROUP – INTERESTS AND PATH FORWARD**

The Focus Group meeting began with Reed's presentation, "Facilitator's Report on Focus Group - Interests and Path Forward "

As promised from the last Focus Group meeting, Reed reflected on discussions and interactions with the Focus Group, had discussions with members, and prepared observations and recommendations for the Focus Group to consider

Reed's observations identified which interests (topical and agency) are operating in the discussion, what barriers exist to reach agreement, and the need for a bounded discussion Reed also conducted an evaluation of how all the interests can be served, the relationship between the Focus Group and other community involvement efforts, and a proposed path forward for the Focus Group

There are various agencies and special interest groups represented in the Focus Group, with differing and important positions So far, RFCA agencies, local governments, the Rocky Flats Citizens Advisory Board (CAB) and wildlife protection interests (represented at this time by the U S Fish and Wildlife Service) continue to discuss different aspects of protecting future generations by getting the best cleanup possible

The RFCA agencies and the U.S. Department of Energy (DOE) have focused on risk and dose compliance, as well as surface water compliance. An effective stewardship program is also noted of high importance to RFCA agencies. Other significant points that RFCA agencies are interested in include working within the available budget and making accommodations for an accelerated closure—all the while, balancing with community priorities.

For the local governments, the areas of emphasis involve protection and removal. Risk protection for residents and Rocky Flats Site (Site) users and protection of water resources are of significant concerns. Removal of surface and subsurface contamination provides a basis for an effective stewardship program.

In terms of protecting future generations, surface and subsurface contamination removal are the main focus.

The CAB finds that surface and subsurface contamination removal to background levels are of importance, as well as a plan for risk protection for residents and Site users.

Wildlife protection interests have particular concern for risk protection involving protection of wildlife, ecosystem, habitat, wildlife workers, and refuge users.

Based on the group discussion, Reed summarized fundamental interests shared by Focus Group members. Mostly, these involved areas of compliance and removal, yet effective stewardship and wildlife/habitat protection remain high on the list.

For compliance and removal activities, fundamental interests remain concerned with risk, dose, and surface water compliance. Removal concerns involve both surface and subsurface contamination. It was noted that the interests would fail to evolve without the commitment of all stakeholders.

From that point, Reed discussed some barriers that the Focus Group is having when trying to reach agreement. These barriers involve available funding, time, and technology. There is a great deal of uncertainty whether there will be adequate funding or if accelerated schedules can be met. Technology, or lack thereof, has been a persistent problem in meeting the needs of the community and agencies for the best possible cleanup. Reed identified one last, but critical barrier—trust. There still is a need to build trust among Focus Group members.

Reed presented a visual on "Interests, Risk, and Budget." Essentially, the visual communicated how risk determinations—interests such as compliance, surface and subsurface contamination and removal, and surface water protection—interplay with

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the budget. Conclusions indicate that all interests can be met to some extent with available budget, but not all interests can be fully met with the available budget.

Next, Reed presented "A Bounded Discussion." If the group moves forward in a bounded discussion, the focus will be on the question

'How can Rocky Flats best be cleaned up with the available budget?'

Reed noted that the immediate driver for a bounded discussion is the schedule on which a cleanup decision for the 903 Pad must occur. Key questions were presented concerning the bounded discussion.

1. Can the Focus Group contribute to the bounded discussion?
2. Can the Focus Group support the interests that are not fully met by the bounded discussion?

Reed's recommendation is "yes to both."

Reed identified another bounded discussion area.

"What are the options for cleaning up Rocky Flats within available budget and how do these options serve the interests at the table?"

Reed suggested evaluating options against the Comprehensive Environmental Restoration and Compensation Liability Act (CERCLA) criteria and interests to help identify the "best option(s)." Once the bounded discussion is in hand, it would be useful to identify options for furthering interests not fully met in the bounded discussion. This could include decisions to reduce risk further or additional source removal. Or it could involve the identification and compilation of information so that stakeholders can pursue options. From this perspective, the Focus Group could evaluate the researched options in a small group setting.

Another important part of the process includes other community involvement operations. These operations tend towards being recommendation-oriented and include the Rocky Flats Coalition of Local Governments (RFCLOG), the CAB, the Stewardship Working Group, one-on-one discussions, and formal public comment.

Based on Reed's evaluation, interaction with these community involvement operations could involve expanding the scope of the Focus Group to directly support these and other recommendation-making groups. The Focus Group could also develop and evaluate options that other groups can use in their recommendation formulation.

To conclude the presentation, Reed provided formal thoughts on the next steps, entitled "A Recommended Path Forward." Path forward objectives range from identification of strategies to evaluation and coordination activities. Specifically, as a recommended path forward, the Focus Group could focus on the following initiatives:

- 1 The Focus Group identifies RSAL strategies and evaluates them against interests
- 2 The Focus Group identifies strategies for moving beyond the bounded discussions
- 3 The Focus Group identifies and the agencies compile information to serve these discussions
- 4 The Focus Group evaluates beyond bounded scenarios against CERCLA criteria and interests
- 5 The Focus Group coordinates with recommendation-making groups so that information and analyses help serve the needs of these groups

Some Focus Group members expressed concern for the lack of agreement among the interests. One Focus Group member noted that pure information exchange would not be adequate when trying to bind discussions. Reed noted that a process for evaluating end-state results and budgetary impacts were other important considerations, in addition to those expressed by the Focus Group.

The discussion continued among Focus Group members. It was generally felt that, fundamentally, a willingness to commit to continued discussions, whether considered bounded or unbounded, was needed. Some Focus Group members felt the group's dynamics needed redefining, and a shift away from emphases on what is problematic, wrong, or insufficient to what has actual potential could be beneficial. Another important thought made by a Focus Group member was that local governments were having conversations and that this Focus Group should be positioned to help understand what is needed at the community level, then report back to the local governments the group's respective comments.

The Colorado Department of Public Health and Environment (CDPHE) stated that decisions will have to be made, and soon. CDPHE continues to be willing to participate in the process as it has provided a level of detail not found anywhere else. And it remains important that windows of opportunity are not bogged down by discussions that lack in results.

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## FOCUS GROUP DISCUSSION AND DECISION – FOCUS GROUP ROLE, PATH FORWARD, AND TOPICS

The Focus Group entered a small group discussion format to identify other interests needing to be recognized and to prioritize those interests against CERCLA criteria and existing topics

The small groups reported back to the Focus Group with the following observations, ideas, and comments

- Kaiser-Hill, LLC, the Rocky Mountain Peace and Justice Center, RFCA agencies and citizen interests seemed to be missing
- There existed an interest in complying with and completing RFCA
- Information of where the technology is, what it could be, and how technology would benefit end-state is desired
- When and how the public will have access to the Site is of interest
- A schedule from DOE and Kaiser-Hill regarding environmental restoration is necessary to understand the drivers for arriving at one key element of this process, which is the RSAL
- A matrix of options (past and recent) formed in this group and other venues would help discern which options make sense, which require more work, and to form new or modified options
- More discussion is needed on approaches to the group concerned with future generations
- Discussion needs to take place regarding the potential for more surface cleanup with the existing budget
- Address alignment issues between the CDPHE and the community regarding monitored retrievable storage
- Consider ways to arrive at a "revenue-neutral" basis to get the best clean up possible
- Address, from the regulatory and budgetary standpoint, the storage of low-level waste on the Site

Reed closed out the small group presentations by observing that collaborative discussions were, in fact, occurring. With that comment, Reed transitioned the Focus Group to developing a broad list of cleanup options

## **CLEANUP PRIORITIES – GROUP IDENTIFICATION OF OPTIONS**

Reed asked the Focus Group for a broad list of cleanup options so as to form a basis for the next Focus Group meeting

Reed asked that the Focus Group identify the list of options, then identify the list of questions that need to be addressed in order to evaluate those options against CERCLA criteria and against interests that are on the table. Next, define an order in which these options are going to be evaluated and ask the agencies to compile the information and present it to the Focus Group. During the next meeting, the Focus Group will have some options compiled and an analysis can be conducted for additional questions needing answers through further research. This type of process will promote a system for prioritization, feedback, and provide the framework for the future.

One Focus Group member acknowledged an advantage that the Focus Group possessed. This advantage speaks to the work the Focus Group has already conducted regarding the in-depth knowledge related to contamination pathways and the migration of contamination.

The Colorado Department of Health and Environment (CDPHE) observed that not all Focus Group members thought that contamination pathways and migration issues were completely understood or resolved. In particular, a community member felt that there were uncertainties.

The Focus Group had a conversation providing some framework for investigating cleanup options. The Focus Group still has information needs and still needs to understand regulatory requirements, especially relating to water quality and water pathway. The group wants to maintain some consistency when evaluating options against regulations, DOE expectations, and community needs. The end state vision will fail if the Focus Group does not understand or develop appropriate clean up options.

Reed suggested that AlphaTRAC gather information and options from the Focus Group, as well as document the options from DOE, for the next Focus Group meeting. The point is to find one specific option to address as a pilot option discussion. At the end of the process, for any particular option, the Focus Group would have identified variables and/or sub-options for CERCLA criteria.

## **ADJOURN**

The meeting adjourned at 6:05 p.m.

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**RFCA Stakeholder Focus Group  
November 28, 2001  
Meeting Minutes**

**Appendix A  
Participants List**

Participation List for  
RFOA Focus Group Meeting of 11/28/01

First	Last	Company - Organization
David	Abelson	RFCLOG
Melissa	Anderson	RFCLOG
Christine	Bennett	AlphaTRAC, Inc
John	Ciolek	AlphaTRAC, Inc
John	Corsl	Kaiser-Hill Company, LLC
Rick	DISalvo	US DOE - RFFO
Sam	Dixon	City of Westminster RFCLOG
Shirley	Garcia	City of Broomfield
Steve	Gunderson	CDPHE
Mary	Harlow	City of Westminster
Reed	Hodgin	AlphaTRAC, Inc
Victor	Holm	RFCAB
Jeremy	Karpatkin	US DOE - RFFO
Ken	Korkia	RFCAB
Joe	Legare	DOE
Ann	Lockhart	CDPHE
Tom	Marshall	Rocky Mountain Peace and Justice Center
LeRoy	Moore	RMPJC
Bob	Nininger	Kaiser-Hill Company, LLC
Tim	Rehder	US EPA
Kathleen	Rutherford	CDPHE/HMWMD
Mark	Sattelberg	US Fish and Wildlife Service
Kathy	Schnoor	City of Broomfield
Joel	Selbin	
Dave	Shelton	Kaiser-Hill Company, LLC
Honorable Hank	Stovall	City of Broomfield

**RFCA Stakeholder Focus Group  
December 12, 2001  
Meeting Minutes**

## **INTRODUCTION & ADMINISTRATIVE**

A participants list for the December 12, 2001 Rocky Flats Cleanup Agreement (RFCA) Stakeholder Focus Group meeting is included in this report as Appendix A

Reed Hodgins of AlphaTRAC, Inc, meeting facilitator, reviewed the purpose of the RFCA Focus Group and the meeting rules. Introductions were made.

## **AGENDA**

Reed reviewed the agenda

- Task 3 Peer Review and Wind Tunnel Technical Review – Update
- Timeline for Cleanup and its Affect on Focus Group Decisions
  - Overview of Scope and Schedule – Now Through
  - Fiscal Year 2002 Environmental Remediation Scope
  - How Radionuclide Soil Action Levels (RSALs) and End State Discussions Must Fit Into the Broader Schedule
- Cleanup Funding Overview
  - Recap – Overall Closure Budget and Core Elements
  - Overall Budget for Environmental Remediation Through Closure
- Cleanup Options That Have Been Identified
  - Options for Surface Remediation, Subsurface Remediation, Surface Water Protection, Stewardship
  - For Each Option Baseline Assumptions and Funding Differences Between Options and Baseline

## **RSAL TASK 3 PEER REVIEW AND WIND TUNNEL TECHNICAL REVIEW – UPDATE**

### **Wind Tunnel Peer Review**

Reed informed the Focus Group that all three of the peer reviews for the Wind Tunnel reports were completed and have been sent to the Focus Group and the agencies. Reed asked the agencies about the status of the schedule. The Colorado Department of Health and Environment (CDPHE) responded with a two-week timeframe for completion.

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### **Task 3 Report Peer Review**

Reviewers have until the end of December 2001 to complete their reviews of the Task 3 Report. AlphaTRAC has corresponded with each of the reviewers to assess the status. The reviewers have all pertinent materials.

A Focus Group member asked how the comments were going to be handled. CDPHE responded by stating that each comment will be considered and resolved, and as a result, the Task 3 Report will more than likely be modified.

### **FACILITATOR'S REPORT ON FOCUS GROUP - INTERESTS AND PATH FORWARD<sup>1</sup>**

Reed presented *RFCA Stakeholder Focus Group* with an emphasis on a focused discussion involving

“What are the options for cleaning up Rocky Flats within the available budget and how do these options serve the interests at the table?”

Acknowledging that this discussion would not meet all of the needs of all parties in the Focus Group, Reed suggested that information could be developed and provided through the Focus Group to help these parties pursue their cleanup interests outside the Focus Group discussion.

Future meeting objectives could involve understanding the schedule and cost bounds associated with the options for the clean up discussion, as well as defining and understanding surface / subsurface tradeoff options, identifying needs for further discussion of surface / subsurface tradeoff options, and to begin brainstorming additional options.

Reed proposed a syllabus for the next several meetings

- Overview, schedule, and choices
- Detailed discussion of surface contamination and options
- Subsurface contamination
- Surface water protection
- Stewardship

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<sup>1</sup> The presentation was sent to the RFCA Stakeholder Focus Group members in a packet on January 24, 2002.

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- Packages of options and draft conceptual agreement
- Conceptual agreement

## Timeline for Cleanup and its Affect on Focus Group / Cleanup Funding Overview<sup>1</sup>

Kaiser-Hill Ltd described the framework for the discussion. The last Focus Group meeting resulted in an understanding that technical options needed to be described, planned for, and funded. Also, there was a conceptual understanding that end state is dependent upon limited resources. To help with this, a funding profile was presented that discussed environmental restoration, and specifically the work upcoming in FY2002. Another document Kaiser-Hill prepared is the broader discussion of all of the site milestones and key targets chronologically to plant closure. This document can be obtained by contacting Kaiser-Hill.

The overall budget for decontamination / decommission, special nuclear material, support, waste, and environmental restoration is 3.96 billion dollars (\$3,963,000,000). The funding period is February 2000 through 2006.

Decontamination / decommission	\$1.7 billion
Special nuclear material	\$127 million
Support	\$978 million
Waste	\$590 million
Environmental restoration	\$468 million

Details on the environmental restoration budget were presented. The budget is divided into seven key areas:

- 1 Source removal - \$114 million
- 2 Studies - \$8.7 million
- 3 Waste Shipment Treatment & Disposal - \$132 million
- 4 Characterization - \$50.4 million
- 5 Monitoring & Long Term Stewardship - \$36.3 million
- 6 Engineered Controls - \$85.9 million
- 7 Planning & Documentation - \$45.3 million

It was noted that the environmental restoration budget included the waste cost associated with environmental restoration.

The studies portion of the environmental restoration budget is being conducted now and includes this Focus Group and its studies, actinide migration, water balance, and the plant configuration studies.

A member of the Focus Group asked what the waste costs were based on. Kaiser-Hill stated that the waste cost was based on assumptions made on how much will be excavated, considering what type of waste it is, and then adding in the actual costs from the Rocky Flat's receiver sites. Specifically, the cost per yard, charged by the receiver sites, was added.

These costs represent baseline costs that are in the contract. It is likely that the most uncertain of the costs are the environmental restoration costs due to the number of assumptions being made.

In general terms, the environmental restoration costs, as all costs, have a regulatory basis. From there, individual decision documents are created that includes planning and documentation for fieldwork, health and safety plans, and labor.

Next, the budget on *FY02 Field Work Schedule & Budgeted Cost* was presented. The chart represented the costs associated with fieldwork only for FY02 totaling \$5,858,000. This budget is associated with the excavation source removal plan.

Given that RSALs are still being worked on, the plan is to begin with IHSS Group 100-4, Building 123 at a cost of \$812,000 in January 2002. Next is the IHSS Group 400-10, Building 664, where there is contaminated soil, at a cost of \$1,147,000. Next is IHSS Group 800-4, Building 886 at a cost of \$1,235,000 and then IHSS Group 800-6, which includes the Building 887 pad, at \$1,163,000. Then the 903 pad will be started in September 2002. The current budget to begin the 903 pad is \$1,500,000.

It was noted that these projects would probably not be affected by the surface RSAL. These activities are subsurface remediation activities.

From the budgetary standpoint, it is critical that discussions find direction and resolution. Resolution will help optimize risk reduction at Rocky Flats.

Next, the Focus Group reviewed an options matrix, which captures the main points that have been discussed with the community to date, including:

- Surface remediation
- Subsurface remediation
- Water quality protection
- Stewardship

Each option included the baseline assumption and cost differences (plus or minus) compared to baseline.

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Life cycle costs and offsite disposal costs could be compared to help examine priorities. Also, using risk as one factor for prioritization, with an emphasis on examining surface versus subsurface tradeoffs, was discussed.

Another budgetary consideration is evaluating cost savings in the near term against life cycle costs relating to the various contamination pathways. Surface water quality standards and stewardship impacts are beyond the scope of this analysis for the next meeting.

### **Cleanup Priorities - Group Identification of Options**

For the next meeting, Reed instructed Focus Group members to develop surface cleanup options, with the objective of having the options clearly identified when the January 12, 2002 meeting adjourns.

### **Adjourn**

The meeting adjourned at 6:00 p.m.

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**RFCA Stakeholder Focus Group  
December 12, 2001  
Meeting Minutes**

**Appendix A  
Participants List**

Participation List for  
RFCA Focus Group Meeting of 12/12/01

First	Last	Company / Organization
David	Abelson	RFCLOG
Melissa	Anderson	RFCLOG
Christine	Bennett	AlphaTRAC, Inc
Kent	Brakken	U S DOE - RFFO
Lane	Butler	Kaiser-Hill Company, LLC
Kimberly	Chleboun	RFCLOG
John	Ciolek	AlphaTRAC, Inc
John	Corsi	Kaiser-Hill Company, LLC
Carol	Deck	Kaiser-Hill Co, LLC
Rick	DiSalvo	US DOE - RFFO
Sam	Dixon	
Shirley	Garcia	City of Broomfield
Steve	Gunderson	CDPHE
Mary	Harlow	City of Westminster
Jerry	Henderson	RFCAB
Reed	Hodgin	AlphaTRAC, Inc
Clark	Johnson	City of Arvada
Jeremy	Karpatkin	US DOE - RFFO
Ken	Korkia	RFCAB
Michelle	Kump	RFCAB
Joe	Legare	DOE
Ann	Lockhart	CDPHE
Tom	Marshall	Rocky Mountain Peace and Justice Center
LeRoy	Moore	RMPJC
Albert	Nelson	City of Westminster
Bob	Nininger	Kaiser-Hill Company, LLC
Tim	Rehder	US EPA
Kathleen	Rutherford	CDPHE/HMWMD
Mark	Sattelberg	US Fish and Wildlife Service
Dave	Shelton	Kaiser-Hill Company, LLC
Carl	Spreng	CDPHE
Honorable Hank	Stovall	City of Broomfield

**RFCA Stakeholder Focus Group  
Attachment B**

Title                    Article *Bulletin of the Atomic Scientists,*  
                              "Lowering the Bar," LeRoy Moore

Date                     May 17, 2002

Author                  LeRoy Moore  
                              Rocky Mountain Peace and Justice Center

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## 20 The Bohr letters No more uncertainty

With the release of Niels Bohr's draft letters any doubt about the purpose of Heisenberg's visit to Copenhagen should be erased  
*By Will am Sweet*

## 28 Lowering the bar

The government is determined to save money by lowering the standards for radiation exposure. But how low will it go to get the scientists it wants to justify its actions?  
*By LeRoy Moore*

## 40 Would they if they could?

If the Israeli-Palestinian conflict continues how long will it be before the terrorists are drawn to the use of even deadlier weapons?  
*By Gary Ackerman & Laura Snyder*

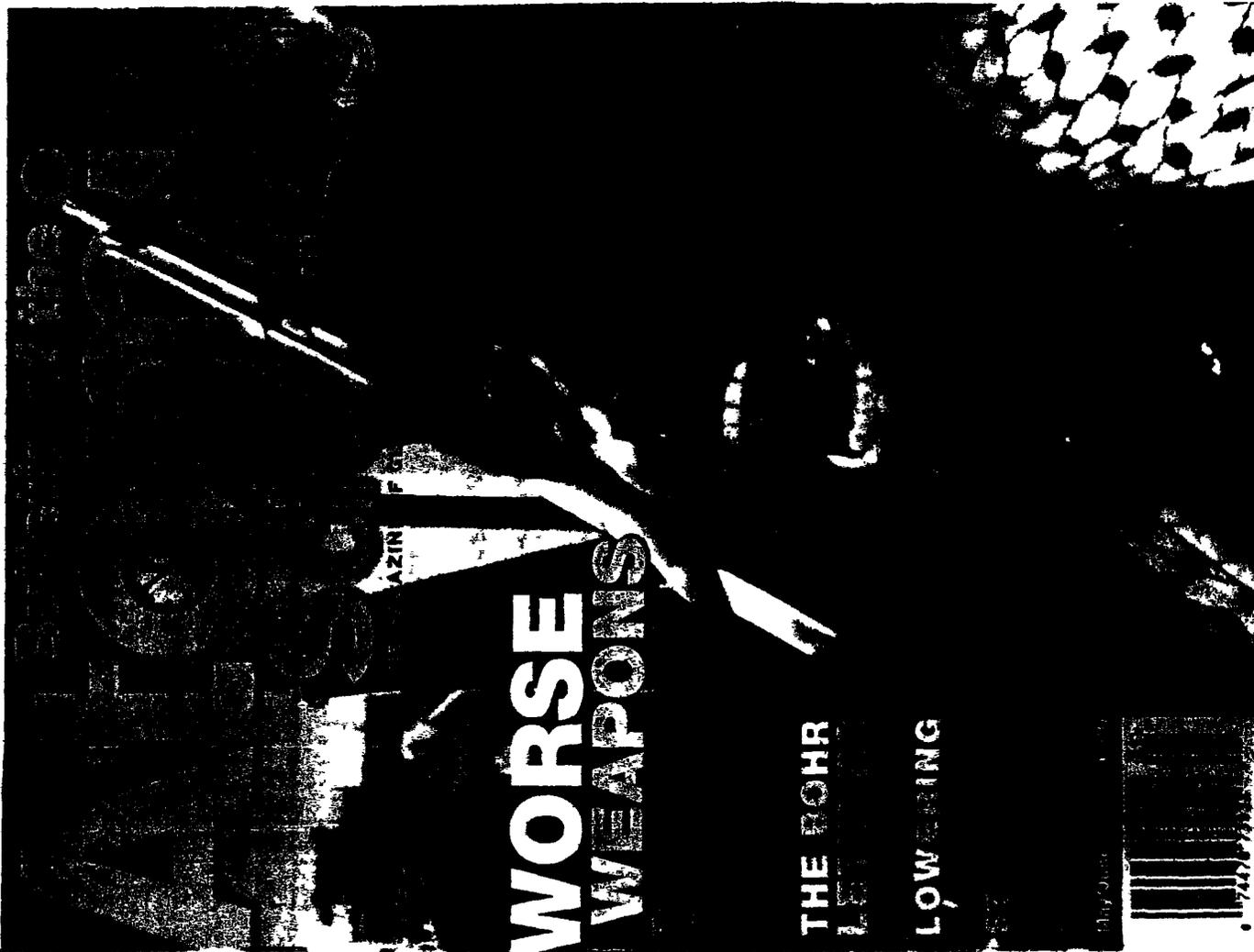
## 49 Megatons to mega problems

Dogged by controversy from the beginning USFC could face bankruptcy—unless says the idea man behind the program the US government gives it a sweetheart subsidy  
*By Terje Langeland*

## 57 Keeping track of anthrax.

The case for a biosecurity convention  
The United States needs to lead the way if bioweapons are to remain out of the hands of terrorists  
*By Michael Barletta, Amy Sands & Jonathan B. Tucke*

The Bulletin was founded in 1945 by Eugene Rabinowitch and Hyman Goldsmith, former members of the Manhattan Project. The Bulletin stands symbol of the threat of global catastrophe, twice at seven minutes to midnight.



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APR 23 1951 AM 11  
The Charles G. Smith  
Fund for Research, U.S.  
Dept. of Health, Education  
and Welfare, Building 36  
Washington, D.C.



## How it all started

In 1943 as part of the Manhattan Project Karl Z. Morgan the father of health physics accepted the task of determining how much ionizing radiation nuclear weapons workers could be exposed to without danger to their health. At the outset he said "We all had all of us a serious misconception in that we adhered universally at that time to the so-called threshold hypothesis meaning that if a dose were low enough cell repair would take place and there would be no resultant damage. In other words, we believed there was a safe level of radiation. By 1949 however the majority of us realized that there really wasn't a so-called safe level of exposure. Convinced that risk increased in exact proportion to dose those responsible for radiation safety rejected the threshold model in favor of the linear no threshold or LNT hypothesis."

Morgan headed the newly created Health Physics Division at Oak Ridge National Laboratory from its creation in 1943 until his retirement in 1972. He became very influential in both the International Commission on Radiological Protection (ICRP) and the US National Council on Radiation Protection and Measurements (NCRP) the principal bodies that recommend standards for



Karl Z. Morgan, the "father of health physics."

permissible exposure to radiation. Both bodies adopted the LNT approach for calculating risk making it the orthodox of the nuclear establishment. It is a heuristic device that simplifies the range of exceedingly diverse and complex data regarding radiation effects—long term malignancy in utero process es, effects among different sub populations genetic change repair actions and so on.

The no-threshold approach was first applied to radiation exposure standards as a result of Hermann Muller's discovery in the 1920s of genetic mutations in fruit flies exposed to radiation work for which he received the 1946 Nobel Prize in medicine. By the time World War II began more stringent protective measures were needed. But once he rejected the LNT in favor of the supra-linear approach he had moved beyond the establishment paradigm and the industry ostracized him for it.

Morgan went on to lead an active lifelong campaign against exposure to low-dose radiation testifying in numerous lawsuits as an expert witness helping to win key cases. The two cases he deemed most significant *Silkwood v Kerr-McGee Corporation* in 1979 and *Allen v United States* in 1984 showed respectively that there is no such thing as a safe dose of radiation and that the US government knew about the hazards of fallout from bomb tests at the Nevada Test Site but failed to inform or to protect exposed populations.

Morgan died in 1999. Within the limits of the LNT or LeRoy Moore, a consultant with the Rocky Mountain Peace and Justice Center in Boulder Colorado is the author of the *Citizen's Guide to Rocky Flats* (1992). He is currently collaborating with Robert Del Trascas on an illustrated oral history of Rocky Flats.

the history of establishing standards for permissible radiation exposure has followed a trajectory similar to Morgan's most notably in response to evidence of harm at levels regarded as safe. (See figure below) In truth the LNT orthodoxy is a politically expedient middle ground between the extremes of those who insist there is a threshold and those who find supralinear effects. Researchers who have found supralinear effects have at times challenged the LNT hypothesis as not sufficiently stringent. Today standards based on LNT methodology are under attack for being too conservative.

## Efforts to relax the standards

In the new push to relax radiation exposure standards influential voices in science and government assert that exposure to radiation at very low doses causes no detectable harm—a few even claim it is beneficial—a concept known as hormesis. Relaxing standards these critics point out will reduce the costs of disposing of nuclear waste cleaning up contaminated sites building more bombs and reviving nuclear power—all they say without hurting anyone's health.

Leading the charge in the political realm is New Mexico Republican Sen. Pete Domenici. We regulate exposure to low levels of radiation using a so called linear no-threshold model the premise of which is that there is no safe level of exposure and we spend over \$5 billion each year to clean contaminated (Energy Department) sites to levels below 5 percent of background. He complained. Accordingly he asked the General Accounting Office (GAO) to prepare a report on the scientific basis of existing radiation standards. And he authored legislation to create within the Energy Department the 10 year Low Dose Radiation Research Program—to under

stand how radiation affects genomes and cells so that for the first time we can develop radiation protection standards that are based on actual risk. This program he told the National Academy of Engineers in February 2001 offers our best hope for in re-assessing our understanding on which better standards eventually can be based.

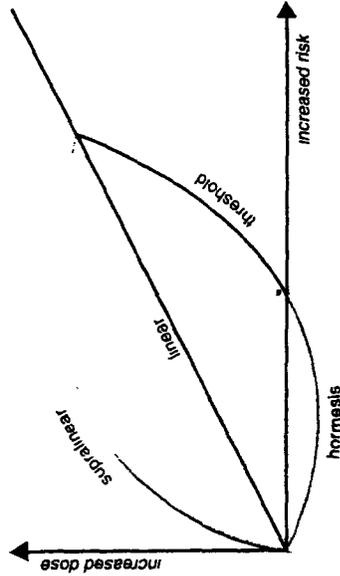
Both of these Domenici efforts—the GAO report and the Energy Department study—seem aimed at relaxing radiation standards. Another effort is the National Academy of Sciences BEIR VII (Biological Effects of Ionizing Radiation) study. Professional societies especially the Health Physics Society also play a role.

## The Health Physics Society

Current US efforts to relax radiation exposure standards have their roots in the culture of professional nuclear societies which consist primarily of people who have a stake in perpetuating the nuclear enterprise.

Of these professional groups the Health Physics Society has most actively questioned the LNT approach. In 1996 it took the official position that there is substantial scientific evidence that the LNT model is an

## Comparing standards



oversimplification of the dose response relationship and results in an overestimation of health risks in the low dose range. The first half of this statement that LNT oversimplifies the dose response relationship is certainly true. But to assert that it results in the overestimation of low dose health risks does not follow. Nevertheless the statement goes on to specify that risks at exposures below 5 rem a year or 10 rem in a lifetime are either too small to be observed or are non-existent.

When the society met in Denver in July 2000 Roger Clarke president of the International Commission on Radiological Protection a invited speaker was given a hostile reception. He told a journalist that the society insists that low doses of radiation have no effect and might even have beneficial effect. I was being castigated for not making a statement that I agreed. He was repeatedly called upon to recognize the scientific proof of a threshold. I do not mean to be flippanant but I found the majority of the [members] to have a closed mind.

The International Commission recommends that nuclear workers be exposed to no more than 2 rem a year—a dose the society's 1996 statement treats as probably inconsequen-

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ual The Commission, says Clarke assumes that there is some risk and that you have to find acceptable level of risk. We look at the mechanisms by which radiation can cause changes in a cell which may lead to cancer. At that level (2 rem), you can measure damage to DNA.

Assertions that the LNT overstates harm from low-dose exposure were countered recently by scientists from the Radiation Effects Research Foundation (RERF), the body responsible for research on the Japanese A bomb survivors. In analyzing 7,000 cancer cases among 50,000 bomb survivors whose estimated dose was less than 3 rem, RERF found "convincible evidence that the linear risk estimates are appropriate."

This is a challenge from a formidable source, because current risk-estimate standards are based primarily on the A bomb survivor data. Critics say having standards on survivors data may seriously underestimate risks to exposed populations because survivors typically remained in a one-time high-dose exposure, were the healthiest members of the population, and had their doses estimated (and re-estimated) only years later.

Karl Morgan, who helped found the Health Physics Society in 1953, lured to regret that the society he had envisioned as a professional and scientific organization to protect people from exposure to ionizing radi-

tion had become a labor union for the nuclear industry. He dates the change from around 1972 when D. W. Moeller then the society's president, told his fellow health physicists, "Let's put our mouth where our money is."

The GAO's "consensus" The GAO issued its report, *Radiation Protection Standards: Scientific Basis Inconclusive*, in a June 2000 letter to Domenici. The report examined the scientific basis of current U.S. radiation exposure standards as well as how supplementing those standards may affect the costs of nuclear waste cleanup and disposal.

The report indicates that very low dose exposure may result in stochastic effects that could induce cancer. And it seems eminently objective in what it says regarding the LNT approach. "Some say the model is overly conservative and that below certain exposure levels, there is no risk of cancer from radiation. Others say that the model may underestimate the risk. In fact, Specialists do not agree; there is a spectrum of scientific opinion."

Given these findings, the report's conclusion seems inescapable: U.S. regulatory standards to protect the public from the potential health risks of nuclear radiation lack a conclusively verified scientific basis. Conclusive evidence of radiation effects is lacking below a total of about 5,000 to 10,000 millirem (5 to 10 rem), according to the scientific literature. We examined and a consensus of scientists whose views we obtained."

Because the report

San Jose, California, is a member of radiation standards.

nowhere specifies what studies or doses examined or the persons whose concepts were considered, identifying its sources required me to file the equivalent of a Freedom of Information Act request. In response to my effort, I finally received copies of source documents used, as well as a list of 84 people with pertinent technical knowledge whose views were obtained.

I contacted some of the people on the GAO's list of those "whose views were obtained" to see if they agreed with the GAO's consensus conclusion. Here are their responses:

• Roger Clarke and Roger Cox of RERF's National Radiological Protection Board (Clarke is also president of the NCRP). Neither of us has a record of formal consultation with U.S. GAO on radiation science. They referred me to NCRP's 1993 report, *Risk of Radiation-Induced Cancer in Low Doses and Low Dose Rates*, which does not support the GAO contention (it says that exact childhood cancers will result from in utero exposure as low as 1 to 2 rem). As noted earlier

will always result in cell death or be completely repaired."

• Steve Wing of the Department of Epidemiology University of North Carolina told me: "There is good evidence for in utero exposures causing childhood cancer at doses below 5-10 rem and for excess cancer deaths among workers with recorded doses of less than 5 rem/year. I am not part of their consensus."

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Clark maintains that at an exposure level of only 2 rem (well below the GAO number) you can measure damage to DNA.

• John Till, president of Risk Assessment Corporation, a member of ICRP and NCRP: "I do not concur with the conclusions of the report and do not understand how my views on low dose radiation could be misinterpreted so badly."

• Arthur C. Upton M.D., BEIR V chair and head of the committee that produced the recent NCRP Report 136 reaffirming the validity of the LNT approach said he had no recollection of the GAO consulting with him; he believes that the GAO consensus is questionable.

• John Boice of the International Epidemiology Institute, a member of NCRP ICRP and UNSCEAR (the United Nations Scientific Committee on the Effects of Atomic Radiation) also does not concur with the GAO conclusion: "I believe our standards are based on sound science and reflect a strong scientific basis. There is enough cellular and animal data to support the use of linearity at the low levels for protection purposes."

• Charles Land of the National Cancer Institute provided several reasons for questioning the GAO conclusion, including one about epidemiology: "Lack of statistical significance means that one can't prove that something exists; it is no way implies that the thing doesn't exist. Much of the argument for thresholds is based on this fallacy."

• Charles Menhold, past president of NCRP: "Extrapolation of the effects seen at high doses in the Japanese survivors cannot be used to estimate effects at low doses. Therefore a model must be adopted which reflects information on molecular biology, and animal data. Using this information certainly implies a great deal of uncertainty but at this time no one has been able to demonstrate that a two-strand break in a DNA strand

board, the GAO report becomes an apology for reducing costs by relaxing standards. With its questionable consensus this report looks like a political tract written to provide Domenici with the results he wanted.

The low-dose study

In October 1997 thanks to legislation authored by Domenici, the Energy Department initiated the Low Dose Radiation Research Program a 10 year \$200 million project to help resolve the low dose problem. The program is housed in Energy's Office of Biological and Environmental Research (BER). Its managers say that researchers using advances in molecular biology and instrumentation will be able to evaluate biological changes at levels of radiation exposure and biological organization that previously were not measurable. They "will be able to determine if low doses of radiation pose a greater or lesser health risk than currently assumed and their work may lead to major paradigm shifts in radiation protection and biology."

The goal of the program is to provide new scientific information that can be used in the development of future radiobiological regulatory policy. Toward this end, the program sponsors research in the following areas:

- Radiation-induced versus normal oxidative damage.
- Adaptive responses. In other words, does low-dose exposure induce a response that enables cells to withstand the effects of additional exposure?
- Thresholds. Are there levels below which adverse effects do not occur or are repairable by normal processes?
- Genetic susceptibility. Are some individuals or groups genetically more sensitive to damage from low-dose exposure?

Impressive as it may appear this

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research agenda does not address important issues including the question of cumulative effects from multiple sources of radiation or synergistic effects from radioactive and non-radioactive toxins. And while the program examines genetic susceptibility it appears to exclude research on the genetic effects of low dose exposure, which as noted earlier provided the original foundation for the LNT approach.

The bigger problem with the program may be that it is an Energy Department program. The Department personnel identify needed research, award contracts, organize peer reviews and monitor work in progress—all to ensure a balanced research portfolio focused on DOE, BER and program missions. Of the 44 grants made so far, nearly half support research being done by Energy personnel at Energy facilities. Some of the other researchers also have ties to the department.

While the project studies the effects of radiation exposure, affected populations at nuclear facilities wear dosimeters with their identification badges to track their radiation exposure.



ations are conspicuous by their absence. An advisory committee appointed by Energy provides a façade of public involvement. But actual public participation is limited to visits to the program's Web site. When I asked a prominent scientist who often criticizes Energy Department activities why he wasn't paying more attention to the project, he told me: "Nothing that comes out of a DOE run study on radiation effects will have credibility."

Because of the inherent conflict of interest, Jim Thomas, former research director for the Hanford Education Action League, maintains that the department should have nothing to do with this research. The funding should be transferred elsewhere. [Energy] facing an astronomical cleanup mortgage has everything to gain from lowering standards. It has a direct conflict of interest.

During fiscal years 1999 and 2000, the program was partly funded from the department's Environmental Management or cleanup budget. In other words, for roughly a year and a half of the program's expected life of 10 years, Energy was using cleanup funds to explore whether the standards that make cleanup costly should be relaxed.

Nonetheless, based on my own observations during a three-day research report session in Arlington, Virginia, the LNT approach for calculating risk was confirmed by several studies. Some studies showed supralinear effects, and the one explicit attempt to demonstrate hormesis proved a failure. The verdict on adaptive response—that cells irradiated with very low doses resist or can be enabled to resist adverse effects from further exposure—was mixed. Several reports demonstrated the bystander effect—the result of a direct radioactive hit on a cell adverse by affecting neighboring cells.

The results so far suggest that trying to establish a threshold is futile.

Without greater public accountability, the Low Dose Radiation Research Program will lack credibility. It should be separated from the Energy Department and transferred to an independent entity, perhaps a non-governmental one. Perhaps a major university where it would continue to be publicly funded. To help ensure that the program is held accountable to the taxpayers, its ultimate funders, people from affected populations should be involved in designing and overseeing the research agenda.

### BEIR VII

The BEIR studies administered by the National Academy of Sciences carry enormous influence in the radiation standards world, because they purview the latest findings on low dose effects. BEIR V was published in 1990 (BEIR VI dealt with radon). In 1996, Energy, the Environmental Protection Agency and the Nuclear Regulatory Commission, the principal federal agencies responsible for setting U.S. radiation exposure standards, asked the academy to consider doing a BEIR VII—an update on low dose exposure—looking at topics like LNT, thresholds, hormesis and adaptive response.

In December 1997, when it appeared that the academy would go ahead, Jacqueline Berardinelli, deputy director of the Office of Policy & Public Private Initiatives of the Colorado Department of Public Health and Environment, proposed that it include a national public participation effort. She wanted to see input from the full range of affected parties at key policy decision-making points during the process, including framing scientific questions in ways that will identify and respond to community concerns and uncertainties about potential exposures to radiation.

Her proposal was rejected in favor of following established procedures for academy studies, even though the academy's practice of secrecy particularly its closed meetings had led in the past to a series of federal court rulings that it had to abide by the openness requirements of the 1972 Federal Advisory Committee Act (FACA).

In November 1997, however, Congress exempted the academy from FACA's open meeting requirements if it agreed to:

- post the names and brief biographies of appointees to or candidacies for its research committees
  - take public comment on candidacies before they were appointed
  - avoid appointees with a conflict of interest unless the academy deemed it impossible and
  - ensure that membership on committees was fairly balanced.
- These were the rules in place in January 1998 when the academy announced it would proceed with the BEIR VII study.

Public interest groups were concerned. The Alliance for Nuclear Accountability, a network of 34 groups that monitor environmental and health issues at nuclear weapons sites, called for open meetings, robust public participation and a balanced committee, and it nominated 11 radiation health specialists well respected among impacted publics.

When the 16-member BEIR VII committee was announced on May 17, 1999, however, none of the groups nominated had been chosen and in fact the committee looked decidedly unbalanced. The public had 20 days to comment on nominees even as the first meeting was scheduled for late June in conjunction with a meeting of the Health Physics Society.

On June 22, the last day for comment, representatives of 78 groups and 44 individuals sent a letter to the academy accusing it of violating the law in three areas:

- Committee balance. The com-

mittee the letter said was packed with allies of the nuclear industry standards. It included no known adherent of the LNT approach and no one who advocated more stringent standards.

Public comment. The academy had failed to permit public comment on the prospective appointments prior to their being made and it had refused to provide full dossiers of appointees.

Conflict of interest. The academy had denied requests to make BEIR VII member conflict of interest forms available, as well as declined to disclose possible conflicts of interest promptly and publicly as required by law.

The letter pointed out specific conflicts of particular appointees then concluded by urging the academy to start over in the interest of forming a panel that could be independent, balanced, free of impermissible conflicts and in compliance with law.

The next day the academy announced that it was postponing the committee's initial meeting to allow a review of questions of committee balance and conflict of interest. Actually, only the public meeting was postponed; a closed meeting was held as planned.

Several weeks later, in August 10, the academy revealed that it had



Cleanup at Rocky Flats would cost the government less money if radiation standards were raised.

dropped one person whose bias had been singled out, and added five new members.

Critics were not assuaged. Many groups complained that the changes were essentially cosmetic and that the academy was continuing to flout legal requirements. On August 30, eight radiation scientists wrote saying that the credibility of the committee's work would be severely compromised as a consequence of its current composition. Such a result will damage the reputation of science in the public's view and cast doubt on the integrity of public health policy.

The BEIR VII panel held its first public meeting on September 2, 1999. In the weeks following the academy dropped five provisional committee members and added one new person resulting in a committee of 15 confirmed members, one provisional.

On October 24, 1999, a letter from 116 public interest groups and 14 individuals declared. Reducing a committee of 20 that has no one from the other side or the middle of the debate to a committee of 16 that still has nobody from the other side or middle of the debate cures nothing in terms of the fundamental violation of balance requirements.

In early November 1999, the academy finalized the BEIR VII committee by ending the provisional status of an appointee. Critics said had

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only increased committee imbalance  
As for continued violations of law  
the academy cannot itself be sued  
But if a court deems the process ille-  
gal government agencies can be or-  
dered not to use results from the  
study

Meanwhile, a letter from the Insti-  
tute for Energy and Environmental  
Research and 70 signatories chal-  
lenged the BEIR VII committee to en-  
large the scope of its research to in-  
clude a number of neglected topics.  
Subsequent correspondence leaves  
unclear whether the committee will  
explore these topics.<sup>10</sup>

Originally expected to be a three-  
year endeavor completed by late  
2001 the study has been extended  
for two additional years in order to  
analyze new information being devel-  
oped on doses received by the Japan-  
ese A-bomb survivors. In the end the  
controversy about BEIR VII may be  
as much about the scope of its work  
as about committee composition or  
the legality of the process.

**The question of cost**

The ICRP's Roger Clarke thinks of  
costs to replace the LNT model with  
a threshold approach reflects the de-  
sire to lower the cost of cleaning up  
contaminated nuclear sites. "Some  
people think that too much money is  
being spent to achieve  
low levels of residual contamination."  
They want "a threshold in the  
dose-response relationship in order  
to reduce the expenditures."<sup>11</sup>

Assuming current standards don't  
change, however, what will it cost to  
clean up Energy Department sites?  
Estimates made since 1988 have  
ranged from \$63 billion to \$400 bil-  
lion (in 1996 dollars).<sup>12</sup> One Energy  
Department official, Donald H  
Alexander said in an NPR news  
broadcast on June 17 1992, "If our  
cleanup is required to go to the very  
significantly low levels that we re-  
cently being driven to, it would  
cost the United States a trillion dol-  
lars or more

But this estimate was four times  
Energy's own best estimate in its  
1996 *Baseline Environmental Man-  
agement Report* which said a 75  
year program would cost between  
\$189 billion and \$265 billion.<sup>13</sup> This  
estimate assumes compliance with  
existing standards and use of current  
technology and land-use plans. While  
not a small number the midpoint in  
that range, \$217 billion, represents  
only 6.7 percent of the \$5.5 trillion  
(in 1996 dollars) the United States  
spends to conserve, deploy, and oper-  
ate nuclear weapons and their deliv-  
ery systems from 1940 through  
1996.<sup>14</sup> Some critics believe a more  
realistic estimate would top out at  
\$400 billion, or about 7.3 percent of  
the \$5.5 trillion, but they also say the  
cleanup program is overly expensive  
because it is being poorly managed.<sup>15</sup>  
Some believe that cleaning Energy  
Department sites to meet current  
health and safety requirements may  
still challenge unsuspecting future  
generations, both because current ex-  
posure standards are not protective  
enough and because Energy general-  
ly favors containment rather than re-  
moval of contaminants. Regarding  
the latter a recent National Research  
Council report suggested "that con-  
tainment measures are likely to fail."<sup>16</sup>  
As for standards that may be ineffi-  
ciently protective, cleanup costs dis-  
crepancy by comparison to possible physical  
costs in the cells and organs of peo-  
ple exposed to contaminants left be-  
hind and the eventual costs of their  
health care.

**The wrong debate**

The current debate about low-dose  
exposures, sparked by self-appointed  
nuclear professionals, pits advocates  
of a threshold against adherents of  
the linear no-threshold orthodoxy.  
But the evidence for equivalence of  
effects seems to suggest that the debate  
that needs to occur is between dis-  
ciples of the linear orthodoxy and ad-  
vocates of the more cautious supra-  
linear model. The guiding principle

for this debate needs to be that radi-  
ation exposure standards exist to pro-  
tect not the industry but the public.  
Decisions should be made in the  
company of those who have been or  
will be impacted—miners, produc-  
tion and testing workers, nearby res-  
idents, downwinders, people with a  
stake in their own survival and, final-  
ly those who understand that future  
generations depend for their security  
on the decisions made today.  
Organizations like the ICRP  
NCRP and UNSCEAR should at an  
early date bring into their decision  
making structure representatives of  
affected populations. These groups  
should work together to develop a  
plan on how to involve the affected  
publics directly in the task of propos-  
ing and adopting standards for per-  
missible exposure. More democracy  
will mean less damage all across the  
board.<sup>17</sup>

1. Karl Z. Morgan, quoted in Robert Dal  
Tredici, *At Work in the Field of the Bomb*  
(New York: Harper & Row, 1987), pp.  
132-33; the Swedish radiologist B. M. Svendsen  
said an international group in 1958 that  
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ation. Quoted in Rosalind Wiseman, *No Inven-  
sible Danger* (London: The Women's Press,  
1983), p. 38.

2. J. Samuel Walker, *Formidably Dour: A  
History of Radiation Protection in the Twen-  
ties Century* (Berkeley: University of Califor-  
nia Press, 2000), pp. 16-17.

3. Morgan in Dal Tredici, pp. 133-34.

4. Karl Z. Morgan and Ken M. Peterson,  
*The Angry Gander: One Man's Walk through  
the Nuclear Age* (Norman: University of Ok-  
lahoma Press, 1999), pp. 145-152.

5. A February 23 1995 letter to the author  
from Dr. Charles B. Mohrhead, then president  
of NCRP, illustrates the LNT approach on the  
grounds that it requires no safety "scientific  
opinion and avoids the threshold and repre-  
sented terms.

6. See H. Jack Gagner et al., *Dose Reduc-  
ing: A Critical Review of the Department of  
Energy's Environmental Research* (Washing-  
ton, D.C.: Physicians for Social Responsibility  
1992), p. 32.

7. See Pen V. Dunsmuir, *A New Nuclear  
Paradigm*, speech at Harvard University Oc-  
tober 31, 1997 (<http://www.anses.gov/anthracite/anthracite.html>).

8. See Pen V. Dunsmuir, speech to Nation-  
al Academy of Engineering Symposium, No-  
vember 1997; *The Option for the 21st Cen-  
tury*, California, February 9 2001.

9. "Radiation Risk in Perspective," *Nuclear  
Statement of the Health Physics Society* Jan-  
uary 1996, available at [www.hps.org](http://www.hps.org).

10. Katy Human, "The Radiation Debate,  
*Boulder Daily Camera*, July 2, 2000.

11. Roger Clarke, personal communication,  
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12. Human, "The Radiation Debate."  
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Doses among Atomic Bomb Survivors," *Radi-  
ation Research* August 2000 (vol. 54 no. 2),  
pp. 181-186.

13. Steve Wang et al. "The Relevance of  
Occupational Epidemiology to Radiation Pro-  
tection Standards," *New Scientist* 1999 (vol.  
9 no. 2), pp. 131-31.

14. J. Z. Morgan, *Health Physics: An  
Introduction to Environmental and Health  
Physics*, 1992 (vol. 2), pp. 149-201. See  
Morgan, *The Angry Gander*, pp. 109-101. See  
also L. Miller et al., "A Tribute to Karl Z.  
Morgan," *Health Physics*, June 1999 (vol. 76,  
no. 3), pp. 599-603.

15. *Radiation Protection Standards: Scen-  
ario-based Assessment* (GPO: 2000-08-  
152), June 20, 2000. For more on the  
1991 to the author from Richard L. Hamner,  
GAO chief quality officer.

16. Roger Carr and Roger Clarke, personal  
communication, July 6, 2001.

17. John T.H. personal communication,  
May 20, 2001.

21. Arthur C. Upson, personal communica-  
tion, January 24, 2001.

**ERRATA**

Please note the following errors regarding certain statements

Page 33, column 2, final sentence of final full paragraph "However it will also be expensive -39  
Page 33 column 3 final phrase of first full paragraph major paradigm shifts in radiation protection  
and biology 31

Page 33, column 3 first sentence of second full paragraph that can be used in the development of  
future regulation risk regulatory policy -32  
Page 34 column 4 first full paragraph end of second sentence. focused on DOE, BLM and Program  
initiatives 33

Once these corrections are made all subsequent references notes should be numbered one higher than  
they presently are

Page 35 column 1 first full paragraph "Following established procedures for academy studies 36 The  
reference number appears at the wrong place in the text, attributing to Mr Puckler things he never said

30. GAO pp 28 29  
31 Low Dose Radiation Research Program, Overview Prepared for the Low Dose Radiation Research  
Program Advisory Committee U.S. DOE, Office of Biological and Environmental Research, Life Sciences  
Division, August 2000, p 1  
32. DOE Low Dose Radiation Research Program Coordinator David Thomasson personal communication  
June 15 2001  
33 Ibid.

36. Jerome Pucklin to Berradini January 22 1998

Monitor November 18 1997 p. 4 Guidelines  
for implementing the revisions are applied out  
as a NAS internal document, Internal Policy  
on Compliance with Section 15 of the Federal  
Advisory Committee Act.

37 Daniel Hirsch et al. "The Radiation  
Study Director," BEIR VII, National Research  
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38 Steve Wang et al. "The Relevance of  
Occupational Epidemiology to Radiation Pro-  
tection Standards," *New Scientist* 1999 (vol.  
9 no. 2), pp. 131-31.

39 David Hirsch et al. "The Radiation  
Study Director," BEIR VII, National Research  
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40 For the full correspondence see  
[www.iaea.org/infocentre/updates/iaea.html](http://www.iaea.org/infocentre/updates/iaea.html)

41 Roger H. Clarke, "Control of Low  
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43 Energy Department, Office of En-  
vironmental and Environmental Research, Life Sci-  
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45 M. Flomenberg and A. M. Mikhlin, "A  
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ics*, April 2001 (vol. 80, no. 4) p. 353

46. Tom Lombard et al., *Low-Dose Rates from  
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