

Cleanup, not cover-up, at Rocky Flats

The interesting article by David Clark, David Janecky, and Leonard Lane (PHYSICS TODAY, September 2006, page 34) about the cleanup at Rocky Flats noted advances in understanding radioactivity migration and pointed to a high level of stakeholder participation in planning. However, it also raised some questions for me.

Were percolation tests done to check the isolation of deep groundwater from the top 30 meters? The presence of what the authors call "highly impermeable bedrock" between the deep and shallow waters could be expected to protect the deep water table, but was it checked? The authors say, "Approximately 90 percent of the radioactive inventory was in the top 12 cm of the soil." They also state that "the work focused on removing soil contaminated . . . down to one meter below the surface, and replacing it with fresh soil; soil contaminated at depths greater than one meter was allowed to remain in place, even at higher concentrations. To decontaminate the concrete walls of buildings, workers used a variety of techniques." I believe it was implied that the 903 Pad was demolished and the fragments removed along with the chemical drums that sat on it. How geographically dense were the post-remediation soil samples in the pad area and downstream of it?

The article also mentioned that some control measures will require regular maintenance. How long? Ten half-lives of plutonium? Who is in charge of it, and who is paying for it?

How were the removals disposed of? Were they encapsulated? Are they secure from natural and human influence? Did the stakeholders understand and have any influence on the methods used and the final disposal? If so, I would agree with the authors that the

full involvement and sign-off of stakeholders are a key advance in dealing with the problems involved with such a difficult undertaking. It is striking that the Yucca Mountain nuclear waste storage facility has not yet been able to get the agreement of its stakeholders after a much longer passage of time.

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The article "Science-Based Cleanup of Rocky Flats" demonstrates a clear conflict of interest. For the record, the authors worked for Kaiser-Hill Co, the US Department of Energy contractor responsible for cleaning up Rocky Flats; their neutrality is suspect. Independent, scientific reviews of the cleanup have been written by contractors that neighboring municipalities hired, by a consortium of water users, and by DOE-hired experts.¹⁻³ All the reviewers expressed concern about the effectiveness of the remediation.

Plutonium dioxide is known to exist on the site as a finely dispersed solid. In that form it can be carried as part of a colloidal suspension in the groundwater. It will also be suspended in the air if burrowing animals bring it up from the contaminated rubble left on the site. Additionally, no independent evaluation has been conducted of the bedrock under the 10-square-mile site, which is in an earthquake zone. It is questionable that an area of this size will have no fractures in the event of an earthquake. Two unlined 20-acre, 40-foot-deep landfills were left on the site, covered by only a few feet of soil. Not only do they contain radioactive materials but also other carcinogens such as compounds of beryllium and volatile organic compounds that will eventually contaminate the groundwater.

Rocky Flats will be opened to the public for general recreation, and I shudder to think of children playing at this site. As a former member of the Rocky Flats Citizens Advisory Board and a chemist, I find this unacceptable. This isn't a cleanup, it's a cover-up.

References

1. GEI Consultants Inc, *Interim Measurel*

Interim Remedial Action: For Groundwater at the Rocky Flats (rep. prepared for the city of Westminster and the city and county of Broomfield, CO), Glastonbury, CT (10 February 2005).

2. S. F. Dwyer, *Review of the Original Landfill Closure Design, Specifications, and CQAP for the Rocky Flats Environmental Technology Site, Golden, Colorado* (rep. prepared for the Woman Creek Reservoir Authority), Sandia National Laboratories, Albuquerque, NM (23 May 2005).
3. Muller Engineering Co Inc, *Walnut Creek Drainages Pond Reconfiguration Review* (rep. prepared for the city and county of Broomfield, CO), Muller Engineering Co Inc, Lakewood, CO (28 March 2005).

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Clark, Janecky, and Lane reply:

The letters from William Alschuler and Anne Fenerty raise many interesting points; we will address the major ones. Of particular relevance is the unprecedented stakeholder involvement that enabled the cleanup of Rocky Flats. Although there were many perspectives surrounding issues such as cleanup levels, dirty demolition, landfill capping, and 903 Pad remediation, all organizations helped advance the removal of plutonium and reduction of the risks to metropolitan Denver.

An example of stakeholder involvement and communications was the formulation of actinide cleanup levels. Many stakeholders were concerned by the original radionuclide soil action level (RSAL) of 651 picocuries per gram of plutonium, acceptable under Superfund regulations. Intense community concern prompted the Department of Energy (DOE) to fund a citizens' group to reexamine RSALs; though members did not reach consensus, they helped emphasize protection of surface water that could leave the site during the necessary trade-off between cleanup of more highly contaminated surface soils and the disturbance of vegetation, streams, and soils. That extensive public process developed a much reduced RSAL for surface soil (50 pCi/g) while allowing for more residual contamination at depth beneath old building sites—an approach that had wide support. As Fenerty's letter implies, not

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every stakeholder concern could be satisfied. The containerized waste was sent to two disposal facilities, one DOE's and one commercial.

Most of the site (3900 of 6200 acres) has been transferred to the Interior Department to become a national wildlife refuge. The former industrial area will remain restricted and under DOE jurisdiction. The cleanup has significantly reduced risk, but ongoing monitoring and maintenance by the DOE Office of Legacy Management remain vital to ensuring long-term protection of human health and the environment. In addition, the US Congress approved legislation in 2004 creating the Rocky Flats Stewardship Council to focus on issues central to the site's post-closure care and management.

Regarding independence, anyone in the US who has experience and expertise with plutonium has been funded at some time by DOE, including us and the Rocky Flats Citizens Advisory Board. As scientists, we always hope that our science is brought out in public discussions and then used to improve the technical basis for decision making, so that decisions will be more transparent, repeatable, and thus scientifically defensible. Describing the value, process, and results of our participation was a major driver in developing the article for *PHYSICS TODAY*. For us, the invitation to become involved in cleaning up Rocky Flats was an ultimate opportunity for science in the public interest. We remain committed to working with all participants—site contractors, regulators, governments, stakeholder organizations, individuals, and the international scientific community.

Rocky Flats, the largest, most complex environmental cleanup in US history, was completed nearly 50 years sooner and \$30 billion lower than initial estimates. The cleanup removed plutonium and reduced risks to metropolitan Denver. It was many things, but through broad-ranging community participation, it is certainly not a cover-up.

Additional resources

- ▶ US Department of Energy, Office of Legacy Management, <http://www.lm.doe.gov>.
- ▶ US DOE, Office of Legacy Management, Rocky Flats site, http://www.lm.doe.gov/land/sites/co/rocky_flats/rocky.html.
- ▶ Rocky Flats Stewardship Council, <http://www.rockyflatssc.org/index.html>.
- ▶ National Research Council, Commission on Geosciences, Environment, and Resources, *Long-Term Institu-*

tional Management of US Department of Energy Legacy Waste Sites (2000), National Academy Press, Washington, DC (2000), http://books.nap.edu/openbook.php?record_id=9949&page=R1.

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Weighing the need to accommodate women in physics

Vicente Aboites (*PHYSICS TODAY*, December 2006, page 10) asks for a logical answer to “why it is important to have more women as physicists . . . or any other profession.” This letter is an effort to provide one.

Today more than half the class in a typical US medical school is female, and many people feel that women make better physicians than men. The increase in the numbers of female medical students represents a dramatic change from a few decades ago, when women were actively discouraged from pursuing a medical career and when female physicians were regarded as odd, threatening, and unfeminine. Books have been written about how the change took place, but surely factors like aggressive antidiscrimination policies and the development of a generation of role models were very important.

We who work in educational institutions have a duty not only to foster the development of our academic fields, but to ensure that students have every opportunity to reach their highest potential. Given the example of medicine, surely the default hypothesis is that women have the talent and energy to merit much increased representation in any male-dominated academic field. Their entry is inhibited by factors like those that kept women out of medicine for so long. It is, in fact, very difficult to discover what the barriers to entry are. But many fields in addition to medicine have demonstrated that active support and encouragement can allow women to overcome obstacles and develop their innate interests and talents in new areas.

I do not believe there exists any magic percentage for women in any pursuit, including physics. But I do

think that many women who have the talent, intrinsic desire, and interest to take up physics are discouraged from doing so, and that the sources of their discouragement are complex. The highest calling of a university is to give all students a freer path.

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I fear that the discussion of women in physics is turning away from one of the most important points—the women in physics. As a female PhD candidate in nuclear physics, I have been waist deep in this issue for almost my entire scholastic career, and I disapprove of many of the methods being used to bring more women into physics or to help retain them in the field. How easily we can advocate the use of preferential treatment to help the women “catch up,” but we can just as easily forget what that action does to the very people we are trying to help.

I do not want to be treated preferentially. I do not want to be the token woman, the one who receives attention in the form of stares, heads nodded knowingly, and whispers about “why she was really hired.” I want to work hard, and struggle through difficulties, and earn every single thing I get.

Coercing an increase in diversity through preferential treatment of the minority in question—women, in this case—directly subverts the goal by introducing the idea that we suffer some handicap that must be accounted for. Thus, my value as a student, teacher, researcher, or job applicant will seem lower if I am a member of that minority. Either I will end up being forced to accept the underlying argument that I am worth less than my “obviously” more successful male counterparts, or I will have to work much harder to stand out, effectively making extra effort just to be equal. Either way, preferential treatment, even with the noblest intentions, is destructive and detrimental to my career and my own self-worth.

We cannot continue to argue about what is best for the women and minorities in physics if we do not acknowledge that each individual has the most important opinion on the issue of her own future.

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Nothing so clearly indicates how far the physics community still has to go to