Testimony on the Value of the Savannah River Ecology Laboratory

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I have been a member of the faculty at Colorado State University (CSU) for about 45 years. I retired from full-time duty about 2 years ago, but continue to teach and conduct research as a part-time, temporary employee. My field of teaching and research is called "radioecology" which deals with natural and man-made radioactivity in the environment, the movement and accumulation of radioactive materials through the environment and food chains, the effects of radiation on plants and animals, and the assessment of health risks to people exposed to environmental radioactivity. Teaching, research and service have been the primary duties assigned to me at CSU, but I also served as Head of the Department of Radiological Health Sciences from 1998 to 2002. I have had a number of national and international assignments outside of the university over my career and these are briefly summarized in my biographical sketch that accompanies this document.

I have considerable experience working with scientists at the Savannah River Ecology Laboratory (SREL), and spent three years (1982, 1991 and 1992) there conducting full-time research. I also mentored 13 graduate students from CSU who each conducted research projects at SREL over the last 30 years or so. Most of my work at SREL has dealt with the distribution and transport of radioactive contaminants in reactor cooling reservoirs located on the Savannah River Site (SRS). I also spent considerable effort conducting human health risk assessments for various management options of a large, radioactively-contaminated reservoir (Par Pond), which had finished serving its main purpose of cooling hot water from P and R reactors, and which had shown leakage and internal erosion of the dam. I maintain an informal scientific collaboration with Dr. Thomas Hinton, a radioecologist at SREL, but have no financial interest with the laboratory nor with any other organization at the SRS.

My testimony today is intended to provide my personal assessment of the overall value of SREL to the Department of Energy and to science and society in general. The main points I will attempt to make include the following:

- The SRS has enormous ecological, scientific and educational value, in addition to its nationally important programs related to defense, and potential programs related to sustainable energy development.

- There will be a need for environmental assessments at the SRS into the foreseeable future while the government conducts various programs there in the national interest. These programs may include national defense, nuclear fuel fabrication, energy research and production, remediation technologies, etc.

- Portions of this site may be ecologically-threatened by scientifically unwarranted remediation, privatization or new programs that may be ecologically damaging.

- SREL has and can continue to play a critical role at the SRS by providing objective, independent science that contributes information that is vital to decisions on remediation, land management, stewardship and environmental assessments of site activities. SREL research can simultaneously spare valuable ecosystems and save large sums of federal money.

- SREL has a very impressive track record for cost effective, credible research. Unlike some DOE-sponsored laboratories, SREL is a University of Georgia organization that publishes nearly all of its work in peer-reviewed scientific journals without censorship by DOE or other governmentally-affiliated organizations.

- Unique opportunities remain for education (K-12, college, graduate levels and the general public) through SREL outreach programs at the SRS. These opportunities range from basic biology, ecology and numerous environmental sciences to fields with direct application to Site activities such as remediation technology, risk assessment, toxicology, radioecology and geochemistry.

The SRS encompasses over 300 square miles, approximately 85 percent of which is relatively pristine forest lands and aquatic ecosystems (streams, ponds and wetlands). Only about 15 % of the land area has been developed for roads, parking lots, utility lines and industrial structures. The undeveloped land and waters essentially serve as a large buffer zone that protects the public from potential accidents or routine activities that could release radioactive and chemical contaminants to the environment. The buffer zone concept has functioned extremely well, and only very minor amounts of contamination have reached the lands and waterways that surround the SRS. A satellite view of the SRS clearly shows a roughly circular area of green forest surrounded by farmland and otherwise developed land. The SRS buffer zone provides a very rich and diverse flora and fauna that flourishes in the absence of significant human impact. This landscape provides enhanced air and water quality, not only within the boundaries of the SRS, but also in the surrounding landscape. The SRS serves not only as a sanctuary for fish and wildlife, but also as a nursery for plants and animals that can migrate outside the boundaries of the site, enhancing the environmental quality of surrounding areas.

Scientifically, the SRS is of tremendous value because of its largely undeveloped nature and the fact that it is protected from unauthorized human intrusion. This situation provides extremely rare opportunities to study ecosystems that are not impacted by human activities, and those that may be impacted to various degrees by physical, chemical and radiological agents resulting from site operations. This situation led to the designation of a large portion (nearly 200,000 acres) of the SRS in 1972 as a National

Environmental Research Park. The SREL has a distinguished history of over 50 years of existence on the SRS and has provided a tremendous body of knowledge that has contributed to Site operations, science in general, and public education.

Much of the DOE budget in the past 15 years or so has been devoted to environmental cleanup, or remediation, of radioactively/chemically-contaminated lands. Because most residual, long-lived radionuclides such as cesium-137 and plutonium-239 adhere very strongly to soil particles, their removal from contaminated areas by necessity involves removal of the soil or sediment in which the contamination is located. Thus, most cleanup methods require removal of topsoils on land and sediments in streams and impoundments. The volumes of contaminated soil or sediment can be enormous, and the material needs to be excavated and transported to a disposal location elsewhere. This process is not only extremely costly; it also damages the ecosystem that may be contaminated but is otherwise healthy, and it unavoidably leads to damage to the area designated for disposal of the material (see attached article: "Avoiding destructive remediation at DOE sites," Science 303: 1615-1616 (March 2004)). There have been various DOE estimates of the total cost of such remediation activities, and most have been in the range of 100 to 500 billion dollars. As of about 2003, over $60 billion had been spent on remediation. In many cases, scientific risk assessments supporting the decision to remediate have been done poorly, and sometimes not done at all. Clearly, much of the soil remediation completed in the DOE complex has not actually reduced real health risks to real people. Instead, they have possibly reduced future risks to hypothetical people assumed to use the land in very unrealistic ways. Actually, the cleanup process itself produces risks to cleanup workers, and it has also caused spreading of otherwise stable contamination (Science 303: 1615-1616 (March 2004)).

I believe that the only objective and quantifiable way to determine the necessity of cleanup of contaminated areas is a rigorous, scientific assessment of the human health and ecological risks of proceeding with engineered cleanup, and comparing the results with the same risks of simply protecting and monitoring the area involved. It costs somewhat more to isolate and monitor a contaminated area than to just ignore it, but proceeding with aggressive, engineered soil removal escalates the costs by several orders of magnitude. The risks resulting from leaving contaminated soil or sediment in place generally increases in proportion to the level of contamination, so it is critical to carefully measure and document the levels of each identifiable contaminant in the area of concern as a first step in determining what action, if any, to take. The second action is to use science-based methods of assessing the human health and ecological risks from such documented levels of contamination. If the risks resulting from leaving contamination in place are sufficiently low, and if the costs of, and damage from, cleanup are sufficiently high, then it is difficult to justify action to remediate. The SREL is ideally poised to continue the science needed to make such decisions at the SRS. Just as importantly, SREL has the necessary credibility with the public and the regulatory agencies to have their findings trusted and used in the decision-making process.

It seems instructive at this point to summarize an actual case study at the SRS that involved choosing between alternative approaches to managing a contamination situation that required relatively urgent action. The case study involved Par Pond, a 2,600 acre impoundment that was used for about 30 years to cool hot water from the P and R military production reactors. The reactors were shut down permanently by 1988, so the reservoir was no longer needed for the purpose of cooling. In 1991, there were signs that the dam which created the reservoir was beginning to erode internally and starting to leak. As a safety precaution for people living downstream, the water level was lowered by about 20 feet, which exposed approximately 50% of the area of bottom sediments. The sediments in the reservoir had accumulated radioactive contamination during various periods of reactor operations, but most came from leaking fuel elements in R reactor in the late 1950s and early 1960s. The primary contaminant was cesium-137, a radionuclide with a 30 year half life that tends to be mobile in local ecosystems and which readily accumulates in plants, animals, and potentially in people.

This situation led to the need to examine alternatives for managing Par Pond and its lakebed. On the one hand, the levels of cesium-137 were sufficiently high to generate concern about protecting hypothetical people in the future who might use the area to grow crops, or people who might consume fish living in the reservoir. On the other hand, the 30 year stability and unexploited nature of the reservoir allowed the natural development of 30 shoreline miles of rich wetland/littoral vegetation, a diverse and productive fishery that attracted bald eagles and osprey, American alligators, turtles and other wildlife. It also attracted thousands of waterfowl that found sanctuary from hunters during the winter months. In essence, Par Pond had become a large fish and wildlife refuge of exceptional quality. It was often referred to as one of the “crown jewels” of the many different and exceptional ecosystems of the SRS. Clearly, remediation of the reservoir would destroy this entire ecosystem.

The Par Pond situation did not escape the attention of the regulatory agencies. The Environmental Protection Agency (EPA) declared the exposed lakebed a CERCLA or “SuperFund” site, a designation which imposes a defined protocol for assessing all feasible alternatives for managing the site. The main alternative strategies that were developed and studied included:

1. Draining, breaching the dam, and converting the lakebed to forest or other vegetation cover,
2. Draining, breaching the dam, and excavating and removing the sediments,
3. Draining and attempting to fix the sediments in place, and
4. Repairing the dam and refilling the reservoir to cover the ^{137}Cs-contaminated sediments.

Option 1 initially looked feasible, and a generic, “paper” risk assessment by a non-SRS affiliated laboratory suggested acceptable risks for a hypothetical self-sufficient site resident who farmed the lakebed and subsisted on foods grown there. However, SREL research by scientists who made actual measurements on the lakebed contradicted the earlier study. Site-specific research showed the ^{137}Cs to be taken up by food crops to a much greater extent than did the generic “paper” risk assessment, leading to a hypothetical risk that could exceed the EPA-unacceptable threshold of 10^{-4} by a factor of about 30. The 10^{-4} threshold means a one chance in 10,000 of getting fatal cancer from the exposure to radiation. This meant that option 1 was an unacceptable management strategy.

Option 3, fixing the ^{137}Cs in place was not considered feasible, due to unproven technologies for doing so, and very high costs. That left options 2 and 4 for further consideration. Option 4, repairing the dam and refilling the reservoir initially looked unfavorable due to the cost, estimated at 10-15 million dollars. However, when option 2, excavating and transporting the sediments elsewhere was examined, the cost estimate exceeded 4 **billion** dollars! Furthermore, option 2 would have destroyed the Par Pond ecosystem and would have created serious water quality problems downstream due to erosion of sediments before the soil became stabilized with vegetation. At this point, option 4 appeared to be the best solution, but then the question arose as to the effects of the ^{137}Cs radiation exposure to plants, animals, and hypothetical fishermen who might consume fish from the reservoir. Again, SREL research and assessment provided the answers. The radiation dose rates to plants and animals living in Par Pond would be well under the DOE protection guidelines (0.1 or 1.0 rad/day, depending on species), and the risk to the hypothetical fisherman consuming fish from the reservoir would also be under the EPA risk guideline of 10^{-4}. Furthermore, decades of SREL research on the Par Pond biota showed no indication of radiation effects. On the contrary, the plants and animals living in the reservoir were diverse, robust and self-sustaining.

In the end, the decision was made to pursue option 4, repairing the dam and refilling the reservoir. The dam repair and enhancement was completed at a cost of about 12 million dollars. The reservoir was refilled and the ecosystem was almost fully recovered within about 5 years. The cost to repair the dam was less than 1% of the cost of option 2, engineered cleanup. The cost for the SREL research which supported option 4 was approximately $200,000, or at least 800 times less than the cost of engineered sediment removal. A final way in which SREL contributed to this sensible decision was to provide tours of Par Pond for personnel affiliated with state and federal regulatory agencies. Actually seeing the ecosystem in person and talking with scientists having first-hand knowledge gave key people a far different impression than just reviewing piles of documents. I believe that this kind of success story can be repeated many times over in the future, leading to preservation of ecologically-valuable areas and saving large sums of money as well. However, a decision such as this requires detailed scientific information directly relevant to the problem, and the information needs to be generated by an independent, credible laboratory. SREL is that kind of laboratory.

In conclusion, I believe the following points are true and relevant to the current funding crisis for the SREL:

- The SRS is of great social, ecological, scientific and educational value. SREL should be funded to continue and even expand its role as an independent scientific organization that plays a key role in the long-term stewardship of the SRS.

- SREL research has saved the government far more money than it has received. The Par Pond example alone proves this notion.

- SREL research over the last 50 years has demonstrated time and again how nuclear activities can be compatible with a high degree of environmental quality.

- SREL's work is credible to other scientists, regulators and the general public because it is an independent scientific/academic organization with an excellent reputation for integrity, high-quality work, productivity and educational outreach activities.

- Some of the SREL research will be essential to the generation of public and political support for commercial nuclear power, which is expected to be a significant part of the solution to our over-dependence on foreign oil and global warming.

- In terms of cost per scientific publication, the SREL has been one of the most, if not the most, cost-efficient environmental research laboratory in the DOE complex.

- Largely as a result of SREL research, the SRS is probably the most well-characterized site in the DOE complex. This will continue to save time and resources in the planning process for new missions and providing required environmental regulatory documents, if SREL's "corporate knowledge" is retained through restored funding.

- SREL provides training unique to environmental problems of military and industrial sites. Students and visiting faculty from colleges in every state have come to SREL for hands-on experience. Few, if any, other sites in the DOE complex can offer this kind of training in a truly academic atmosphere.

- The funding needed to maintain the infrastructure of SREL is relatively trivial, while the costs of shutting it down are not.

I fully believe that shutting down the SREL is a serious mistake that is not in the national best interest. I sincerely hope that this is realized before it is too late, and that funding for the laboratory can be restored.