

Reasons for Post-closure Monitoring of the Waste Isolation Pilot Plant Repository – 14531

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ABSTRACT

The Waste Isolation Pilot Plant (WIPP) is a geologic repository 2150 feet (650 m) below the surface of the Chihuahuan desert near Carlsbad, New Mexico. WIPP permanently disposes of transuranic waste from national defense programs. The Carlsbad Environmental Monitoring and Research Center (CEMRC), which is part of the New Mexico State University's Engineering Division is an independent oversight organization established in 1991 to conduct independent monitoring of the WIPP site. CEMRC carries out a broad range of sampling and analysis for the nearby deep geologic repository, the Waste Isolation Pilot Plant (WIPP). WIPP is in its fourteenth year of operation, and CEMRC has been monitoring the environment and the operations area since before the first waste arrived for disposal. CEMRC is successfully keeping the regional population informed and confident in the ability of this independent organization to detect any impact from WIPP operations. Local and regional trust is enhanced by CEMRC's publishing its monitoring results showing essentially no releases from WIPP. Monitoring will be required after the permanent closure of the repository. Plans for post-closure monitoring will follow regulatory guidance. The utility of continuing independent monitoring of the site after permanent closure is discussed in terms of it being a potential way of prolonging local and regional awareness of the site.

INTRODUCTION

The Waste Isolation Pilot Plant was sited successfully and has been operating safely and efficiently for fifteen years. Its current high degree of local and regional acceptance was held up as a model relationship between an implementer and a host community in the final report by the Blue Ribbon Commission on America's Nuclear Future [1]. In part, this degree of public acceptance was assured by, and is maintained by, independent oversight.

During the years prior to WIPP's opening and for some time beyond its opening, a New Mexico state-government department based independent "Environmental Evaluation Group" (EEG) served this independent review function.

In 2012, the BRC's Disposal Committee, in its report to the full committee [2], underscored the importance of independent review and monitoring by the EEG for the State of New Mexico in accepting WIPP:

. . . the establishment of the federally-funded, university-housed Environmental Evaluation Group (EEG) was important for gaining the trust of state officials and the local community because it provided an independent and credible source for technical information and review of the WIPP project.

The EEG had as its mission the review of the potential radiation exposures to the public, a scope that was not narrowly defined but included technical evaluations of every aspect of the repository's features, events and processes [3]. As time went on and WIPP operations became routine, the independent review function was narrowed in scope to only monitoring the environment, and was shifted to a New Mexico State University based organization called the Carlsbad Environmental Monitoring and Research Center (CEMRC).

CEMRC has been successful in terms of providing local citizens, civic leaders, and elected officials assurance that there is no risk being posed to their environment by WIPP operations.

This paper will describe WIPP and CEMRC, and then place CEMRC into the contexts provided by recommendations from the Nuclear Energy Agency's Forum on Stakeholder Confidence and also the preliminary recommendations from its Records, Knowledge and Memory Preservation Project (RK&M).

THE WASTE ISOLATION PILOT PLANT AND THE CARLSBAD ENVIRONMENTAL MONITORING AND RESEARCH CENTER

Defense-related transuranic (TRU) and TRU-mixed waste is permanently isolated from the environment at the WIPP. WIPP is a geologic repository 2150 feet (650 m) below the surface of the Chihuahuan desert near Carlsbad, New Mexico (Figures 1 and 2). WIPP has been operating since 1999.



Figure 1. The Waste Isolation Pilot Plant in southeastern New Mexico

The scope of CEMRC monitoring activities is broad, and includes people (whole body counting for the public as well as workers), water (drinking and surface waters), soil, sediment, and air

(ambient as well as WIPP exhaust air) sampling. Routine reporting is done annually. Non-routine results, if they occur, are reported as they are found after review and interpretation.

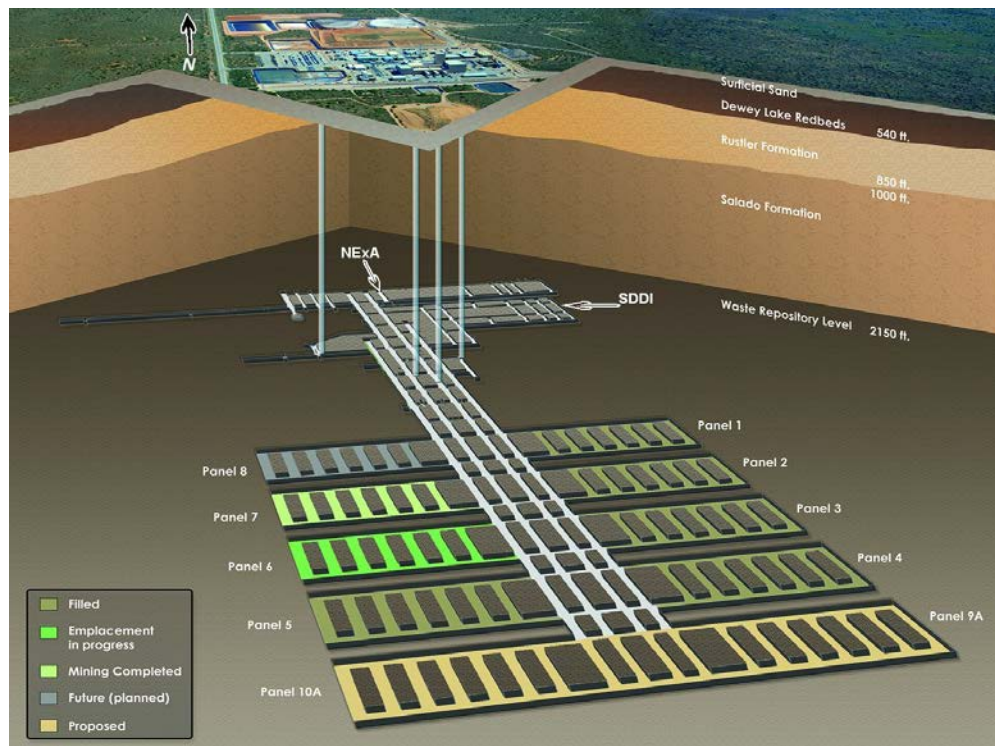


Figure 2. Underground layout of WIPP repository including its proposed expansion to the south (Panels 9A and 10A) and its experimental area at its northern end.

CEMRC was born out of a regional community demand for an independent monitoring program. Its mission is to detect and report radioactive contaminant levels below the regulatory requirements. Public surveys of residents within 160 km of the WIPP site showed concern over radiation in the air, in their own bodies, in drinking water, and last and not least, in soil and surface water. CEMRC therefore monitors all of these categories. A “Lie Down and Be Counted” program performs whole body scans on members of the public, as well as workers. All results are made public through reports and a website.

The purpose of this monitoring is to see if the WIPP is affecting the environment. At this point in time, the conclusions from the monitoring by CEMRC is that WIPP is not affecting the environment, all radioactive species in the air, water and soil are either naturally occurring or are attributable to global fallout.

As an example of a CEMRC data product, Figure 3 shows the ambient air monitoring data for $^{239+240}\text{Pu}$ and ^{241}Am at three sampling locations in the vicinity of the WIPP site. Results are roughly similar for the three locations and show seasonal fluctuation patterns. Figure 4 shows that the $^{239+240}\text{Pu}$ and ^{241}Am levels are well correlated even though neither ^{239}Pu nor ^{240}Pu are immediate progeny of ^{241}Am . Figures 3 and 4 suggest the source of this airborne contamination to be largely wind suspension of weapons-testing contamination present on soils and sediments, and that it is not attributable to the presence of WIPP.

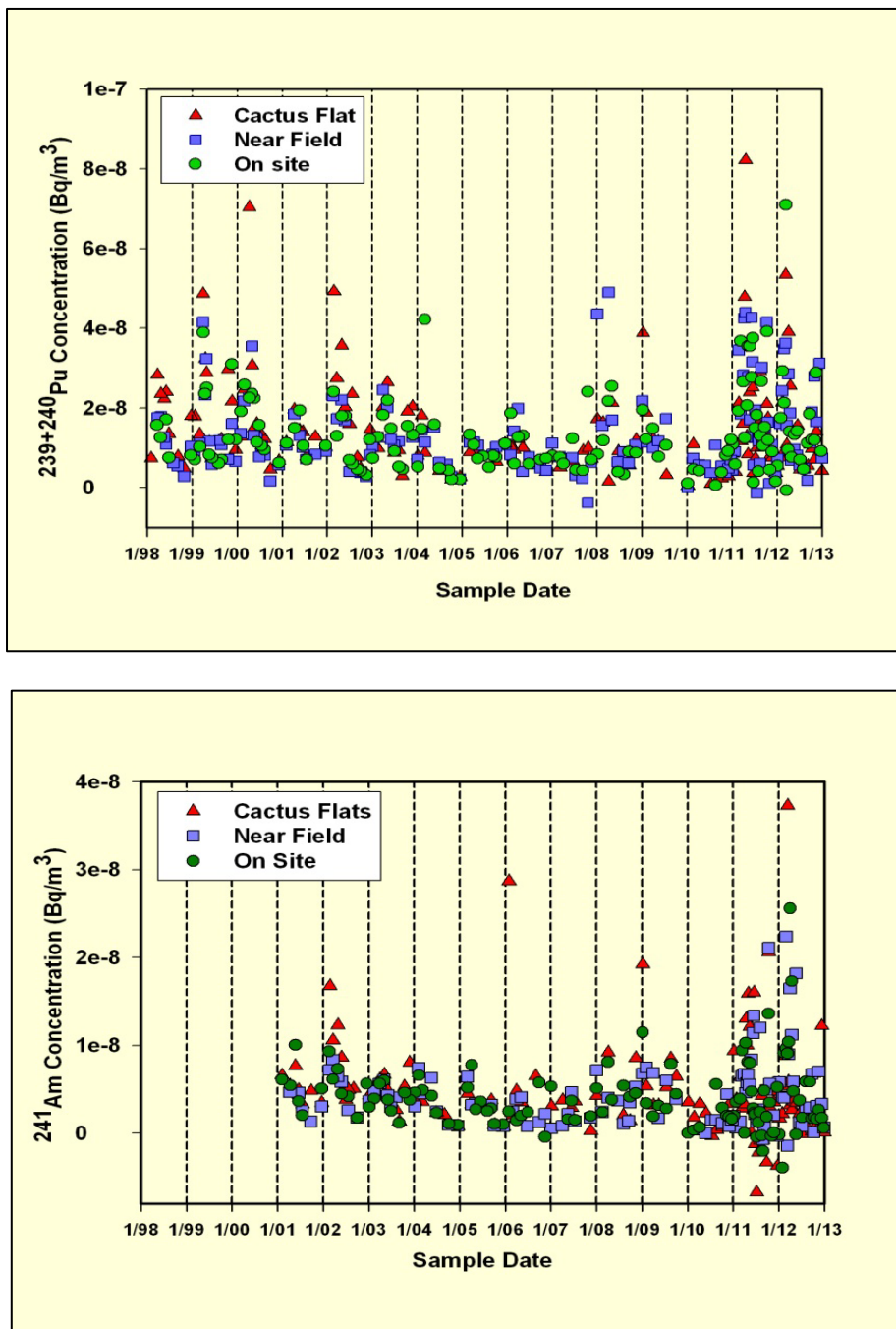


Figure 3. Aerosol activity concentrations of ²³⁹⁺²⁴⁰Pu (top) and ²⁴¹Am (bottom) showing seasonal fluctuations and relatively similar results at all sampling sites, suggesting the predominant source is re-suspended soils contaminated by weapons fallout.

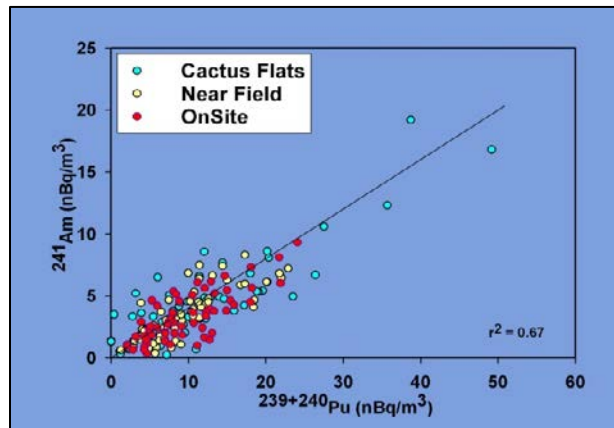


Figure 4. Correlation of $^{239+240}\text{Pu}$ and ^{241}Am , strengthening the suggestion that the predominant source is re-suspended fallout-contaminated soils.

CEMRC AND NEA FORUM ON STAKEHOLDER CONFIDENCE RECOMMENDATIONS

The NEA's Forum on Stakeholder Confidence (FSC) has been reviewing the experiences of various NEA member states in siting nuclear waste management facilities. In no instance was independent environmental monitoring mentioned as a way of providing confidence and gaining trust, although enhanced (meaning locally known and trusted) oversight, and independent review, are mentioned in FSC reports:

Enhanced oversight by local authorities, fully visible to stakeholders, builds public confidence in the decision-making process.

... "Safety – Participation – Local Development" are the main pillars of trust. [4, p. 10]

The Belgian low-level waste disposal facility siting program overcame opposition through employing a "partnership" approach to involve local municipalities in the decision-making processes that are part of siting such a facility (see [5]). Obvious issues inherent in such an approach are the competence of the partners and the maintenance of partner expertise over time. The first issue is addressed through providing them the ability to bring in external experts. The second issue has multiple, but likely all inadequate, approaches offered as solutions:

Local partners have the capability to audit technical issues by using independent expert support. "Independent" expertise in this context is defined as "outside the partnership" and disengaged from the specific stakes. [6, p. 111]

How to maintain the knowledge and expertise achieved by the stakeholders?

The partners are aware that those involved directly in the partnerships develop a degree of knowledge and expertise that may disappear when they leave. At the same time, turnover and renewal are needed. . . . Many methods can be cited for consolidating knowledge: oral history, information technology, cataloguing, and mentoring. . . . [6, pp. 112-113]

The experience of having CEMRC independently monitor WIPP environmental impacts is in line with the FSC observations concerning the trust-building and trust-maintaining benefit of independent oversight by a locally recognized entity. The Belgian "partnership" example, in its

need to pass knowledge and expertise down to new partners as older ones retire or otherwise leave, is not as large a problem for CEMRC since there is a relationship with a university and it provides the employment opportunities and benefits of any university as an employer, hence staff turnover rates are not large and the expertise required is already resident to a significant extent in each new hire, since the education and experience requirements are posted as part of the description of the employment opportunity.

It is perhaps the recognition that since repository projects can be active for a century, that the need to plan for succession in key positions, to preserve knowledge, in such an endeavour is becoming more and more recognized, and has been taken up in another NEA activity, the Records, Knowledge and Memory Preservation Project (RK&M).

The FSC also has written observations of what seems to work in terms of building lasting community relationships and includes WIPP and Carlsbad in one of its observations:

Carlsbad, New Mexico (USA), where the WIPP repository is sited, has already begun to draw the cultural benefits of hosting a highly educated workforce. The local community stakeholders point out that the workers from the national laboratories and contractors are involved in all aspects within the local community. Their involvement enhances and improves the culture within the community. [7, p. 40]

The more interesting part of this observation is that it is based on accounts by local stakeholders. The more interesting thing about this small NEA document is that it gives interesting examples of ways to have a nuclear facility becomes a well-accepted part of a local community, and independent monitoring from within the community, as CEMRC provides in Carlsbad, is one of these recommendations:

Last but not least, when host communities demand training and participate in monitoring site development and operations, they are building their capacity to act as guardians and therefore ensure another layer of defence-in-depth. [7, p. 44]

CEMRC AND NEA RECORDS, KNOWLEDGE & MEMORY PRESERVATION PROJECT RECOMMENDATIONS

The work of the FSC has pointed to issues with the need to preserve local knowledge in order to assure continuing support in host communities. FSC has acknowledged the need for, and potential local utility of, long-term markers as part of the way communities stay aware of closed nuclear waste disposal facilities:

“Memorialisation” means that both physical and cultural markers identify the site and tell its story, so that people will grasp and remember what is there. [7, p. 44]

A new project was created within the NEA to address the technical aspects of this need to preserve memory of a radioactive waste disposal site over the longer term: The Records, Knowledge and Memory Preservation (RK&M) Project.

The RK&M Project is winding up its first phase, and planning its second phase since its work is complex, a good start has been made to bring together NEA member country views on the underlying issues, and approaches to address them, but its work in building international consensus recommendations is not done.

Preliminary RK&M recommendations and observations suggest that local interest in a given project needs to be maintained, through providing local value, as the FSC observed, as part of a defence-in-depth strategy. The example of CEMRC, the local community's as well as the state's independent safety watchdog, is exemplary in this sense.

However, there has been little discussion to this point about what would help maintain community, regional, or state interest past the time of permanent closure of the facility. The question naturally arises as to what monitoring ought to be continued, independently, after the WIPP facility closes and is decommissioned.

Environmental Protection Agency (EPA) regulations under 40CFR194.42 require monitoring during disposal system operations and post-closure monitoring once the shafts are backfilled and sealed until a point in time when the EPA Administrator is convinced there are no significant concerns to be addressed by further monitoring. To meet these regulatory requirements, decommissioning must show there is no unacceptable level of contamination around or near the former working facilities.

After the regulatory requirements have been met, will the local, regional, and state public still desire independent environmental monitoring to provide assurance of its continuing safety?

Perhaps the strategy of the operator should be to promise and fund continuing this independent assurance for a significant time into the future. This could avoid objections to the decommissioning process's making the site publicly accessible, with only underground-exploration controls remaining in place.

What should be monitored, and how frequently, for a closed repository system? That answer, in a generic sense, ought to be informed by the post-closure safety case and its description of the more likely pathways for radionuclide migration and release. In the specific instance of a closed repository in rock salt, however, the salt will eventually move to encapsulate the waste and heal all excavation and closure-construction damage, so the only credible pathways in the longer term are those caused by human intrusion.

As long as there is monitoring, there will likely be no human intrusion. Therefore, even though there may be no environmental monitoring required for regulatory purposes, there are several ancillary, but not unimportant, purposes that may be served by continuing a monitoring campaign at some level: providing a degree of defense-in-depth suggested by the FSC: The first is that it keeps the memory of the repository alive. The second is that it assures detection of attempts at excavation on the site. The third is that it provides a continuing basis for local and regional societal confidence to see results of periodic tests on ground and drinking waters, soil, and ambient air.

Important to assuring the preservation of knowledge and skills in the locality, region, or state is the opportunity to make this environmental monitoring program into a training ground for scientists and technicians who, through the associated university, obtain degrees and certifications for monitoring nuclear facilities elsewhere, thus contributing to the overall radiological monitoring capability of the nation while also contributing to the worldwide database of ambient radioactivity levels.

CONCLUSIONS

The example set by CEMRC in terms of a locally operating pool of expertise that provides independent evaluation of the impacts of the nearby nuclear waste disposal facility, WIPP, is instructive and worthy of emulation. Not only does CEMRC provide local, regional and state-wide confidence in the on-going safety of this operating facility, it also presents an opportunity to add local, regional, state and even national value to the waste disposal facility, even long after it is permanently closed. The confidence-enhancing and value-adding roles CEMRC plays are in line with some of the recommendations coming from the work of two standing committees of the Nuclear Energy Agency. The possible continuation of this independent activity beyond the time of repository closure can potentially add defence-in-depth to ensure post-closure safety is maintained as long as society's technical activities and institutions remain similar to what they are today.

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