Maintenance of Inactive Hanford Facilities:

Procedures and Challenges

Research Report

prepared by
John Abbotts, Katherine B. Ertell, Tim K. Takaro
Departments of Environmental Health (JA, TKT) and Medicine (KBE, TKT)
University of Washington, Seattle
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SUMMARY AND CONCLUSIONS

We previously conducted an evaluation of health and safety standards for the Hanford building leasing program, and our evaluation led to recommendations that the U.S. Department of Energy, Richland Operations Office (DOE/RL) accepted and implemented [Abbotts et al. 2002]. That evaluation developed in part because of a DOE/Headquarters Special Review of facility disposition practices, including those related to building leasing, at DOE's Oak Ridge site. Among other conclusions, our evaluation found that Hanford had avoided the more serious leasing problems at Oak Ridge, and in addition had implemented procedural improvements over a time period of a few years.

That same DOE Special Review identified other problems with facility disposition at Oak Ridge, including an "abandon in place" approach for inactive facilities. We started the present evaluation with a question that in hindsight seems naïve: Did Hanford follow an abandon in place policy?

A qualification is that our evaluation was based on a review of documents; we do not have the access nor the capability to conduct physical examinations of buildings. With that qualification, we found ample evidence that DOE/RL is well aware of the pitfalls of abandon in place:

- A 1993 report from the U.S. General Accounting Office (GAO) was critical of DOE practices related to inactive facilities. However, this same GAO report noted that DOE had already begun to analyze conditions of inactive Hanford facilities.

- In 1996, amendments to the Tri-Party Agreement established procedures for disposition of "key" Hanford facilities (defined by the amendments), including provisions for surveillance and maintenance of inactive facilities.

- Review of remediation planning documents for B Reactor, a "key" facility, and Building 313, which is not considered a "key" facility, indicated in both cases an appreciation of the detrimental effects of building deterioration.

- In addition, we note that the Hanford "Lessons Learned" web site includes a summary of the lessons learned from the evaluation at Oak Ridge, including the negative consequences of "abandon in place."

At the same time, challenges to maintaining inactive facilities at Hanford remain, although they are more subtle. Allocating funds for surveillance and maintenance will prove cost effective over the long term in many cases. However, limits in immediate budgets may also limit surveillance and maintenance activities. Moreover, managers may face a need to balance conflicting considerations with facilities expected to be demolished in the near term. As long as demolition proceeds on schedule, then it may be cost-effective to defer immediate maintenance requirements. But as a facility remains in place, ages and deteriorates, surveillance and maintenance may become necessary before demolition. Achieving a safe and cost-effective balance is particularly challenging when plans for building transition shift over time as has been the case for many buildings in the 300 Area (e.g., Building 313, which was to be demolished by 2012, rescheduled for 6 years later, and now possibly back on an accelerated schedule.)

Moreover, DOE/RL recently released a draft Performance Management Plan for Accelerated Cleanup at Hanford. In a short section on Hanford infrastructure, the draft Plan includes the following remarks:

"We will manage the infrastructure to extend its useful life only to the extent required for on-going operations. We will allow systems to run to failure whenever such an approach does not endanger personnel or the environment." [USDOE/RL 2002b, p. 46]

This last sentence above does imply an "abandon in place" policy, but under significant and specified conditions. Such conditions seem consistent with the recommendations of the Special Review at Oak Ridge, that if it was necessary to use an abandon in place approach, then the approach should be limited to low-hazard facilities. Thus, the commitment in the draft Performance Management Plan to allow systems to "run to failure" will require analysis and management attention to ensure that this approach meets the goal of avoiding danger to personnel or the environment. Specifically, such analysis should include thorough surveys for hazardous materials such as radionuclides, asbestos, and beryllium that may become more available for exposures as facilities deteriorate.

We began this project some time before the Performance Management Plan, but the issuance of the draft Plan in May 2002 provided an opportunity to share these findings. DOE/RL invited public comments on the draft Plan, with a deadline of July 1. Accordingly, we offered material from this Summary and Conclusions section as comments, limited to the draft Plan's remarks on Infrastructure, in the spirit of being helpful rather than critical [Takaro and Abbotts 2002].

DETAILED INFORMATION

1993 General Accounting Office Report

A 1993 Report from the U.S. General Accounting Office (GAO), "Department of Energy: Cleaning Up Inactive Facilities Will Be Difficult," described the importance of maintenance for inactive facilities. The report conclusions noted that,

"DOE has made important strides in changing its approach for answering the challenges presented by the growing number of inactive facilities. For example, the Department is beginning to realize that (1) inactive facilities can present real dangers to workers in and around them and (2) the way it closes and maintains inactive facilities will influence the cost and dangers of cleaning them up." [USGAO 1993, p. 13]

But GAO also had significant criticisms:
"However, DOE is only in the preliminary stages of planning and conducting cleanup work for all of its inactive facilities. The Department does not know the number of its facilities that are inactive but not yet transferred to EM, the full extent of the dangers they pose, or the cost of improving their safety until they can be decontaminated and decommissioned.... Without such information, DOE management cannot know if it is adequately prepared for the challenges of dealing with these facilities." [Ibid.]

As the report noted, as DOE program offices such as those for energy research and defense programs determined that inactive facilities are no longer needed, those facilities are formally transferred to the Office of Environmental Management (EM) for remediation. Remediation of inactive facilities can involve several steps, including deactivation, maintenance, characterizing hazards, decontamination, and decommissioning for other use or demolition.

But GAO identified multiple problems with DOE's national program:

"DOE does not have an accurate estimate of the likely scope and cost of its inactive facilities program over the next 30 years. In early 1992, DOE estimated that it might close 1,700 facilities during the next 30 years and that cleanup costs would be $54 billion. However, during March 1992 budget hearings, DOE's former Assistant Secretary for [EM] projected that the Department might ultimately close as many as 7,000 facilities. The former Assistant Secretary, who directed DOE's cleanup of inactive facilities, did not estimate the cost of dealing with these facilities." [Ibid., pp. 1-2]

"Inadequate maintenance and DOE's past emphasis on production over environmental cleanup are presenting several problems for DOE's inactive facilities program. Before DOE created the Office of Environmental Restoration and Waste Management (EM) in 1989, the Department's general approach for managing inactive facilities was to do the minimum steps needed to safely close and maintain them. As a result, many of DOE's inactive facilities are in poor and hazardous condition and will need considerable deactivation work and maintenance, such as roof repairs and electrical work, while they wait for the Department to start decontamination and decommissioning."

"In addition, some of DOE's aging facilities have been abandoned with hazardous materials still in them, have not been characterized, or have been only partially decontaminated, raising the potential for increases in the cost of the inactive facilities program."
[Ibid., p. 2]

GAO noted that for many of the Department's inactive facilities, their poor physical condition and/or the hazardous materials they contain presented serious risks to individuals who work in and around them. The condition of specific inactive facilities depends on such factors as weather conditions, facility age and operating history, and DOE construction techniques and maintenance practices.

The report's recommendations covered two general areas. To improve effectiveness of the program for inactive facilities, GAO recommended that DOE resolve disagreements among different DOE offices on the criteria for transferring facilities to EM, and also more effectively consolidate responsibilities for inactive facilities, from deactivation through decommissioning. To improve knowledge of inactive facilities, GAO recommended that DOE more comprehensively identify inactive facilities, determine the physical conditions and potential dangers posed by such facilities, and prepare cost estimates and schedules for implementing adequate maintenance programs at inactive facilities until they can be decontaminated and decommissioned. [Ibid., pp. 13-14]

The GAO report was addressed to DOE programs complex-wide, but also identified problems at specific sites, including Hanford. In the most tragic case,
"At Hanford, years of inadequate maintenance and deteriorating conditions contributed to an April 1992 fatality at an inactive reactor building. Specifically, a Hanford worker fell to his death when a concrete roof panel of the 48-year-old reactor building he was inspecting collapsed. The building's roof panels were weakened because DOE had stopped protecting them against the weather. The worker was unfamiliar with the condition of the roof and climbed onto it without a safety line, which could have caught his fall." [Ibid., p. 6]

According to GAO, DOE's accident investigation report on the fatality noted that during the 27 years the building had been inactive, the Department had removed equipment from the building and demolished nearby structures. However, repair projects had generally been deferred because of higher priority work elsewhere on site. Although the accident occurred on the roof, other hazards existed at the building. For example, DOE investigators found an exposed high voltage electrical line that had been left unmarked for about a year after it had been reported. A worker unfamiliar with the hazard could easily have been electrocuted.

GAO reported that as a result of the 1992 fatality, DOE contractors began a study of the physical condition of Hanford inactive facilities [Ibid., p. 7]. According to GAO, other facilities were older than their design life and were deteriorating rapidly while awaiting decontamination and decommissioning. Hanford inactive facilities that had not been transferred to EM were not receiving maintenance consistent with DOE orders, which required that all contaminated facilities have a formal surveillance, inspection, and maintenance program to keep them safe. Along with the building where the 1992 fatality occurred, other Hanford inactive facilities also contained active electrical equipment that could jeopardize workers entering the buildings. In one building, a leak in the roof allowed water to drip on an electrical box, and in another area of the same building, water from a leaking roof ran down a wall near a severed electrical cable.

Roofs of some Hanford inactive facilities were crumbling, with concrete and reinforcing rods from the roofs scattered over the floor or the ground outside. With some facilities, although a program office retained responsibility, the office was no longer maintaining them. [Ibid., p. 6]

In addition, "An August 1996 accident at Hanford illustrates how unexpected nuclear and chemical reactions can occur at contaminated inactive facilities, causing explosions, and possibly, radioactive releases and injuries [Ibid., p. 8]." During decontamination and decommissioning, nuclear research equipment exploded, spreading caustic lithium acetate through a building. DOE contractors contributed to the explosion by eliminating, part way through the project, an interim work step that was intended to remove remaining lithium. The contractors eliminated this work step without determining how much lithium remained in the equipment or considering the likelihood of dangerous chemical reactions during subsequent cleanup work.

1997 Evaluation at Oak Ridge

More recently, DOE's Headquarters Office of Environment, Safety, and Health in 1997 reviewed and evaluated safety management in facility disposition programs at the East Tennessee Technology Park (ETTP), a large site managed by the Department's Oak Ridge Operations Office (OR). [USDOE/EH 1997] The review addressed safety management aspects associated with efforts to remediate, maintain, and reuse ETTP facilities that were no longer required for their original mission. Much of the special review dealt with issues related to the leasing of buildings and equipment within ETTP. But the review also had critical comments on facility disposition in general:

"[T]he decontamination and decommissioning program has not been successful in the maintenance or timely disposition of higher-risk buildings (i.e., buildings that were determined to present the greatest environmental, safety, and health risks based on a prioritization process that considered building conditions and the quantities and types of hazardous materials they contain)."

"EM and OR management expressed concern with the lack of progress in the decontamination and decommissioning of ETTP facilities when compared to allocated resources in the last four years." [Ibid., p. 1]

"The concern related to the lack of progress toward mitigation of the highest risk buildings ... is exacerbated by recent decisions to place higher-risk facilities in an 'abandoned-in-place' status to reduce the costs of surveillance and maintenance and control access. Contrary to DOE and site policy, these facilities are not adequately maintained, although they contain significant hazards, such as radioactive contamination, hazardous chemicals, and asbestos, that have not been completely removed or stabilized. Allowing hazardous facilities to deteriorate in an accelerated manner increases the hazards to workers and the environment, as well as the cost, difficulty, and dangers associated with eventual decontamination and decommissioning." [Ibid., p. 2]

The Headquarters special review noted that within the previous two years, Oak Ridge had applied to ETTP an abandon-in-place approach, which was implemented to reduce surveillance and maintenance costs and to limit access. Of more than 130 ETTP facilities identified as containing hazardous materials, 82 had been placed in the abandon-in-place category. The special review focused on surveillance and maintenance for five ETTP facilities, two of which

had been abandoned in place. With regard to those latter two buildings, the special review characterized one as "deteriorating rapidly" [Ibid., p. 10] and the other as "in an advanced state of degradation [Ibid., p. 13]."

The special review cited the 1993 GAO report, noted that DOE had not taken action in the intervening years to prevent deterioration at some ETTP buildings, and reported that the deterioration of inactive buildings would increase costs and hazards of future decontamination and decommissioning efforts [Ibid., p. 14]. The review also noted that the two buildings examined had been designated for abandon-in-place despite their inclusion among the top five risk-ranked radiologically contaminated buildings for decontamination and demolition [Ibid., p. 15].

"Opportunities for Improvement" identified by the special review included the following:

"Ensure adequate surveillance and maintenance, including prioritization of the maintenance of roofs on shutdown high-risk or hazardous facilities, to assure the safety of workers in or near the facilities and to allow safe and cost-effective final disposition." [Ibid., p. 31]

"Strictly limit the 'abandon-in-place' concept (if it must be used) to low-hazard buildings that can be demolished from the exterior, such as office buildings, warehouses, or smoke stacks." [Ibid., p. 32]

Procedures in the Tri-Party Agreement

As noted in the GAO report cited above, during 1992 DOE began to survey the physical condition of Hanford inactive facilities. In 1996, DOE and regulatory agencies amended the agreement for remediation at Hanford by identifying procedures for facility transition, surveillance and maintenance, and disposition. The applicable document is the Hanford Federal Facility Agreement and Consent Order, negotiated in 1989 and amended several times since. This document is informally designated the Tri-Party Agreement (TPA), reflecting the U.S. Department of Energy as "responsible party" for remediation, and the U.S. Environmental Protection Agency and Washington state Department of Ecology as joint regulatory agencies.

The Fifth and Sixth Amendments to the TPA, February 1996, added Section 8, Facility Decommissioning Process. This section defines the process by which DOE, with involvement of the lead regulatory agencies, will take a facility from operational status to its end state condition (final disposition) at Hanford. The TPA notes that this process is designed to integrate DOE national guidance and to ensure compliance with environmental regulations. [The current version of Section 8.0 is described in USDOE et al. 1998]

The process is accomplished by completion of phases designated Facility Transition, Surveillance and Maintenance, and Disposition. The section applies to "key facilities," which are identified as the PUREX Plant, B Plant, UO_3 Plant, U Plant, REDOX Building (all of which are former reprocessing facilities), the Plutonium Finishing Plant, the Fast Flux Test Facility, and the 9 inactive Hanford reactors (105/109 Buildings). Additional structures may be designated as "key" facilities on a case by case basis. [Ibid., Section 8.1.2]

TPA Subsection 8.1 describes the relationship between decommissioning phases, processes, and key planning documents, as summarized in the following Table:

Decommissioning Process Relationships.

Phase	Facility Processes	Key Planning Documents
Transition	Stabilization Deactivation Surveillance Maintenance Decontamination	Project Management Plan
		Facility Transition End Point Criteria Document
		Preclosure Work Plan
		Surveillance and Maintenance Plan
Surveillance and Maintenance	Surveillance Maintenance (Deactivation and Decontamination as necessary to reduce S&M expenses)	Surveillance and Maintenance Plan
Disposition	Decontamination Dismantlement Entombment Closure Site Restoration	Decision Document (Action Memo, CERCLA Record of Decision, or RCRA Closure Plan)
		Project Design Report

Source, USDOE et al. 1998, Section 8.1.3.

Appendix A of the TPA provides definitions for each decommissioning phase:
Facility Transition Phase: A period of time during which activities necessary to place the subject facility in a safe, stable, and environmentally sound condition, suitable for an extended period of surveillance and maintenance (S&M) pending final disposition are completed. Facility transition starts with termination of operations, includes the establishment of an S&M program, and ends with the achievement of facility-specific end point criteria.
These actions could include the collective conversion of the facility for potential other uses or permanent shutdown; by the removal of fuel, draining and/or de-energizing of systems, removal of accessible stored radioactive and hazardous materials and other deactivation actions to place the facility in a safe and stable condition for the surveillance and maintenance program. This phase usually involves stabilization and deactivation processes and may also include some decontamination activities necessary to effectively result in reduced S&M cost for the facility. [Note: Facility transition documentation describing end point criteria for regulated units and hazardous substances that will remain in the facility following transition will be approved by the regulators.]

Facility Surveillance and Maintenance Phase: A period in the life of a facility following completion of the transition phase until such time as the facility is dispositioned for other use, or facility disposition has commenced. The S&M program provides direction, management, and performance assessments to be carried out in accordance with an approved S&M plan. The S&M phase ensures that facilities are maintained in a safe and environmentally sound manner until a final disposition occurs. In addition, the level of effort will be established in the S&M Plan to minimize the costs of final disposition (i.e. as low as economically achievable) whether the facility is planned by DOE-HQ to be released for alternate use or for dismantlement and site restoration, and/or entombment under the facility disposition phase.

Facility Disposition Phase: Final period in the life of a facility. This phase occurs when no future use is identified as part of the DOE-HQ facility assessment process and priority is given to proceed with disposition. This phase primarily involves processes to achieve a final end state for the facility (e.g., entombment, and/or dismantlement and site restoration), including closure of any TSDs [waste treatment, storage, or disposal sites]. Facility dispositions may be integrated with cleanup of past-practice units covered under CRECLA Remedial Action or RCRA Corrective Measure Authority.

A Hanford facility enters the Transition phase once DOE makes a formal determination that the facility is surplus and is to be remediated. Subsection 8.5 of the TPA describes requirements to move a facility into the Surveillance and Maintenance phase. As indicated in the table above, required documentation includes a Project Management Plan, a Preclosure Work Plan, a Facility Transition End Point Criteria Document, and a Surveillance and Maintenance Plan. The End Point Criteria are developed to establish acceptable final conditions of systems and spaces at the end of the transition phase. For a facility to exit the Transition phase, achievement of End Point Criteria must be verified. The lead regulatory agency must also approve the DOE Surveillance and Maintenance (S&M) plan. The S&M plan is expected to ensure that a facility is maintained cost effectively in a safe, stable condition that represents no significant risk to human health and the environment until final disposition can be completed. [Ibid., Section 8.5.4] With regard to the Special Review of policies at Oak Ridge described above, an effective surveillance and maintenance program represents the opposite of an "abandon in place" approach.

The Surveillance and Maintenance Phase represents an interim condition until DOE makes a decision to initiate the Disposition phase, or disposition actions are required by the lead regulatory agency. Required documentation for the Disposition phase includes a decision document, which defines final end states upon the completion of disposition; and a Project Design Report, which describes activities during the Disposition phase. Disposition may cover a range of activities, including but not limited to decontamination, dismantlement, entombment, closure, and/or site restoration.

As indicated above, TPA Section 8.0 covers designated "key" facilities. Facilities other than those designated "key" for the purposes of TPA Section 8.0 are not regulated under that section, but as the TPA notes, Section 8.0 reflects national DOE guidance. Other facilities are subject to general DOE/EM guidelines, which specify the phases of Transition, Surveillance and Maintenance, and Disposition. [Ibid., Figure 8-1]

Surveillance and Maintenance Considerations with the B Reactor

The B Reactor, one of the inactive production reactors along the Columbia River, is one of the "key" facilities designated by the TPA. For other inactive reactors, remedial action plans are to place each reactor in "interim safe storage." Under this condition, auxiliary structures are decontaminated, demolished, and removed. Each reactor building is decommissioned, areas outside the reactor core are decontaminated, and access to the building is restricted. The reactor cores are left in place so radioactive components may decay for upwards of 75 years, after which time the reactor cores will be dismantled and removed to an on-site radioactive waste storage facility.

With the B Reactor, the first Hanford production reactor to operate during the Manhattan Project, some consideration has been given to preserving the reactor and its confinement building as a museum. DOE/RL has recently reassessed the idea of a B Reactor Museum, calling the concept "commendable," but not an appropriate use of federal funds for Hanford remediation [Lee 2002]. However, an earlier planning document did consider preserving B Reactor in museum status as one remediation option, and considered surveillance and maintenance implications in its evaluation of alternatives.

That document was the Engineering Evaluation/Cost Analysis (EE/CA) for the B Reactor, issued in June 2001 for public comment as part of the CERCLA remediation process [USDOE/RL 2001]. The EE/CA evaluated three alternatives: No Action; Surveillance and Maintenance, and Hazard Mitigation for Public Access. Under the No Action alternative, required by law to be evaluated, the reactor facility would not be decontaminated, and ongoing surveillance and maintenance activities would be discontinued. The goal of the Surveillance and Maintenance alternative would be to maintain the facility in a "minimum safe condition" for ten years. The Hazard Mitigation for Public Access alternative would include routine surveillance and maintenance, and additional remedial action to allow public access to the building as a museum. The EE/CA identified this latter remediation option as the Preferred Alternative.

In considering alternatives, the EE/CA noted that, "The 105-B Facility is an aging structure that has exceeded its original intended design life." [Ibid., p. 4-5]

"The reactor building continues to age and deteriorate. Without intervention, the threat of potential release of hazardous substances increases, and it becomes more difficult to confine

these hazardous substances from the environment. The S&M activities required to confine the hazardous substances over the long term would be expected to increase the risk of potential exposure to personnel as additional activities become necessary to prevent the spread of contamination." [Ibid., p. 2-9]

In its evaluation of the No Action alternative, the EE/CA identified this as the "No Cost" option, but found that:
"Because the facility would not be decontaminated, and no action would be taken to prevent the facility from deteriorating, there would be an increased threat and likelihood that a release would occur, potentially exposing the workers, public, or the environment to hazardous substances." [Ibid., p. 4-2]

In its analysis of alternatives, the EE/CA assumed that the overall protection of human health and environment was the primary objective of the removal action. However,
"Alternative One [No Action] would not eliminate, reduce, or control risks to human health and the environment. Therefore, Alternative One would not provide overall protection of human health and the environment and would not achieve the removal action objectives. Because implementation of this alternative would not meet the threshold criterion of protectiveness, it cannot be considered a viable alternative. On this basis, the No Action alternative was not carried through for further evaluation." [Ibid., pp. 5-1, 5-2]

As noted above, under the Surveillance and Maintenance alternative, the goal would be to maintain the facility in a minimum safe condition. Activities would be balanced to reduce hazards to workers while also reducing the potential for releases of contaminants. Major repairs such as reroofing and shoring structural components would be necessary. These repairs would be required to ensure facility integrity, which is necessary to contain contaminants within the structure. It is anticipated that a new roof would be required for the reactor once during the first 10 years of remedial action. Roofs typically have a 20 year service life and based on the present age of the building, 3 to 5 years would be the maximum remaining life of roof cover. Other major repairs would be performed as needed. [Ibid., p. 4-3]

The EE/CA noted that in general, as facilities age and deteriorate, surveillance and maintenance must become more aggressive over time, and worker safety is a critical factor.

"Without an increasingly aggressive S&M program, the threats associated with unplanned releases within the structure as well as to the environment and injury to workers would increase. Conversely, an aggressive S&M program would require workers to enter the facility more often, and workers may be required to perform more invasive procedures to maintain the facility, which would increase the potential for exposure to workers." [Ibid., p. 4-3]

Under the Surveillance and Maintenance Alternative, some contamination would remain in place, and the B Reactor facility would not be available for public access or historical interpretation. Estimated costs for this alternative over 10 years were $1.66 million, including estimated costs of $540,000 for roof replacement alone. [Ibid., p. 4-10]

Alternative Three, Hazard Mitigation for Public Access, would include the same activities as Surveillance and Maintenance, along with additional remedial actions to allow public access to portions of the B Reactor facility as a museum. Total estimated costs for this option would be $3 million over 10 years.

The EE/CA recommended this option as the Preferred Alternative:
"Alternative Three would afford the best balance between providing protection of human health and environment, meeting removal action objectives, achieving cost effectiveness, and providing an end state that supports and is consistent with DOE's intent to preserve the facility for historical interpretation. Alternative Three allows interim use of the 105-B Facility for this purpose while a decision is made regarding its final configuration." [Ibid., p. 6-1]

As noted at above, DOE/RL is currently reassessing the approach of preserving B Reactor as a museum. Nonetheless, the Engineering Evaluation/Cost Analysis for this "key" facility contains ample evidence that RL recognizes the importance of routine surveillance and maintenance activities, and the rejection of an alternative that would represent an "abandon in place" strategy.

Surveillance and Maintenance Considerations with Building 313

Another Hanford document describes surveillance and maintenance considerations in the disposition of Building 313, in the Hanford 300 Area. This building is one that is not designated a "key" facility by Section 8 of the TPA.

This document is the Isolation Plan for the southern portion of Building 313, issued in February 1997 [Bechtel Hanford 1997]. At the time, the northern portion of 313 was leased to a company for non-DOE commercial activities; the southern portion was inactive.

Building 313 is designated the Metal Fabrication Building. During the time that production reactors were operating at Hanford, this building was used in the fabrication of uranium reactor fuel. In 1995, the southern portion of 313 was partially characterized for radioactive and chemical hazards. The Isolation Plan was designed to resolve problems that might make future demolition of the building and disposal of the remaining rubble "difficult from a regulatory perspective [Ibid., p. ES-1]." The strategy of the Isolation Plan was to reduce or eliminate immediate risks from hazards in 313-South to allow approximately 3 to 7 years to elapse without the need to enter the building again, for surveillance and maintenance, characterization, or pre-demolition preparations [Ibid., p. 1]. Facility transition plans for 313-South were to initiate decontamination and decommissioning at a later date, and eventually to demolish the facility when funds were available.

The condition of the 313-South roof was recognized as a special challenge for isolation:

"Many areas of the roof have structural failures (openings) in the asphalt of the roof membrane, felt membrane, insulation board, felt vapor seal, and asphalt for insulation board and vapor seal. These failures allowed water from rain and melting snow to leak through the openings, causing weakening of the roof panel sections. This leakage has caused concrete failure; some concrete has fallen exposing the rebar, which is now severely corroded. Other roof openings have been made by purposefully cutting through the concrete and rebar. This causes additional concerns with regards to roof structural and weather integrity."

"Should the roof collapse, fixed contamination from inside the facility could eventually become loose contamination from constant exposure to the weather. Furthermore, since the south end is at least nominally attached to the north end (which is still an occupied building), it is possible the north end could sustain damage if the south end roof collapsed. Finally, it is important to keep

the building as intact as possible to facilitate further demolition; demolition of a structurally unsound building can be hazardous and costly." [Ibid., p. 10]

The proposed solution to stabilize the roof included removing loose gravel, dust, and dirt by vacuuming the roof material directly into a low-specific activity waste container. All ventilation equipment was to be removed from the roof and disposed, with fire-retardant plywood or sheetmetal covers to be placed over openings. The roof surface and ventilation enclosures would then be treated with an appropriate sealant. These actions were designed to:

- Eliminate the possibility of airborne contamination from contaminated dust and dirt;
- Reduce the weight stress on the roof;
- Seal the roof from the outside environs and prevent contaminated airborne particulate from escaping the interior of the building.

[Ibid., p. 11]

The costs to refurbish the roof were estimated at $295,000, the most expensive single action in the Isolation Plan [Ibid., p. 22]. Work to implement the plan was expected to start in April 1998, sealing the roof would be completed June 1998, with project closure expected September 1998 [Ibid., p. 27]

Since the Isolation Plan for Building 313-South was devised, plans have changed for remediation in the Hanford 300 Area. Under the Hanford 2012 Plan, most buildings in that area, including 313 (North and South) were expected to be decontaminated and demolished by 2012. The date for demolition of Building 313 has since slipped to 2018, but it may be restored to 2012 under recent plans to accelerate remediation at Hanford [USDOE/RL 2002b, p. 13].

Under those circumstances, current plans are not to refurbish the roof for 313-South. Instead, the facility is to be placed in a "minimal surveillance" mode. [Benecke 2002] The expectation is that the facility will be demolished and removed before it becomes critical to refurbish the roof.

This revision in plans seems justified, as long as Building 313 is demolished relatively promptly. However, if demolition is delayed, then there may be a need to reevaluate building conditions: As time proceeds, deterioration of the roof may accelerate, with the detrimental conditions predicted in the 313-South Isolation Plan. Thus, although the Isolation Plan clearly recognizes the drawbacks of an "abandon in place" approach, the situation with Building 313 points up a more subtle challenge. Building managers may face a need to balance conflicting considerations with facilities expected to be demolished in the near term: The longer demolition is delayed, the more a facility may deteriorate, with the consequences that decontamination and demolition may become more difficult and more expensive. Thus, challenges to maintaining schedules (and associated funding) for remediation activities can also represent challenges to implementing surveillance and maintenance activities.

Facility Stabilization Project

Challenges are also illustrated by the Facility Stabilization Project at Hanford. The goal of this project is to move Hanford facilities from conditions where maintenance is costly to states that are safe and cost effective pending final disposition. This is in keeping with a broader goal within DOE of "reducing the mortgage," that is, reducing the amount of funds committed to maintaining structures and equipment: If facilities can be demolished, or partially

decontaminated by removing the most hazardous materials, then the continuing costs of maintaining facilities can be reduced.

Information on the Facility Stabilization Project has been provided at public workshops on the RL Budget. The public presentation for the Fiscal Year (FY) 2001 budget reported that, "Numerous issues and legacies exist with these old facilities which present hazards and risks to the employees and public." Such issues include facilities deteriorating with age, residual inventories of radioactive and hazardous materials, surveillance and maintenance costs that may be excessive with time, and final facility decommissioning dates that may be decades away. [USDOE/RL 1999]

The presentation for the Fiscal Year 2002 budget reported that the Project included 101 facilities and 216 individual waste sites to be managed in safe conditions until deactivation. Progress in the project has been reported in the public budget presentations. But as one might expect, budgets have limits and funding limits have impacts on the scope of the program.

In their budget presentations, RL officials have reported a "compliance gap," representing the difference between the funds necessary to meet all TPA milestones for a given year, and the actual funds in the budget approved by DOE/Headquarters. In the presentation for the Fiscal Year 2001 budget, RL identified a gap of about $37 million between "critical needs" for facility stabilization, and the proposed DOE budget for the program [USDOE/RL 1999].

The presentation for the Fiscal Year 2002 budget identified specific projects that could not be funded: For example, roof replacements for the PUREX and B Plants were unfunded through each of Fiscal Years 2000, 2001, and 2002 [USDOE/RL 2000]. In more recent developments, however, work on both these roof replacements is in progress, and is expected to be completed by November 2002 [USDOE/RL 2002a].

In summary, the Facility Stabilization Project provides another tangible example that DOE/RL recognizes the hazards associated with deteriorating buildings, and has active programs for surveillance and maintenance in facilities. Budget limitations can represent challenges, however. On the one hand, actions to stabilize and repair facilities can reduce maintenance costs over the long run. As just one example, DOE/RL estimated for the Plutonium Finishing Plant that spending $200 million through 2006 to decontaminate and dismantle the plant would save $1.2 billion in long term surveillance and maintenance costs [Stang 1998].

At the same time, budgets are finite, and funding limitations may have the effort of postponing individual facility stabilization projects. Details for the Hanford FY 2003 budget are still being developed, but expected funding is considered sufficient to eliminate the "compliance gap" for the year [USDOE/RL 2002c].

Accelerated Cleanup at Hanford

DOE/RL has recently released a draft plan for accelerated cleanup at Hanford [USDOE/RL 2002b]. This plan covers remediation activities across the site, but it also contains a short discussion of Hanford Site Infrastructure, including the following remarks:

"Although it has served well for over 50 years, much of this aging infrastructure is at or near the end of its useful life and will not support ongoing site cleanup activities without additional

investment. These additional investments, along with fixed operational costs, divert funds that could be used to accelerate cleanup activities."

"We will manage the infrastructure to extend its useful life only to the extent required for on-going operations. We will allow systems to run to failure whenever such an approach does not endanger personnel or the environment." [Ibid., p. 46]

The last sentence above does imply an "abandon in place" policy, but with significant limits: under conditions where personnel or the environment are not endangered. Such conditions seem consistent with the "Opportunities for Improvement" identified by the Special Review at Oak Ridge (see above), that if it was necessary to use an abandon in place approach, then the approach should be limited to low-hazard facilities.

It will be necessary to adequately analyze situations where systems are allowed to "run to failure." However, the preceding sections have provided ample evidence that Hanford managers are well aware of the drawbacks of "abandon in place." These include the following observations:

- At the time of the 1993 GAO report, DOE had already begun to analyze conditions of inactive Hanford facilities.

- In 1996, amendments to the Tri-Party Agreement established procedures for disposition of "key" Hanford facilities, including provisions for surveillance and maintenance of inactive facilities.

- Review of remediation planning documents for B Reactor, a "key" facility, and Building 313, which is not considered a "key" facility, indicated in both cases an understanding of the detrimental effects of building deterioration.

- In addition, we note that the Hanford "Lessons Learned" web site includes a summary of the lessons learned from the evaluation at Oak Ridge, including the negative consequences of "abandon in place." [USDOE/RL 1998]

At the same time, the material above also indicates that challenges to maintaining inactive facilities at Hanford remain, although they are more subtle than abandon in place. Allocating funds to surveillance and maintenance will prove cost effective over the long term in many cases. However, limits in budgets may also cause limits in surveillance and maintenance activities. Moreover, managers may face a need to balance conflicting considerations with facilities expected to be demolished in the near term. As long as demolition proceeds on schedule, then it may be cost-effective to avoid immediate maintenance requirements. But as a facility remains in place, ages, and deteriorates, surveillance and maintenance may become necessary before demolition. Lastly, the commitment in the draft Performance Management Plan to allow systems to "run to failure" will require analysis and management attention to ensure that this approach meets the goal of avoiding danger to personnel or the environment.

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