

BENEFICIAL RE-USE OF DECOMMISSIONED FORMER
NUCLEAR FACILITIES

RECEIVED

JUN 20 1997

OSTI

L.E. Boing
Argonne National Laboratory
Technology Development Division
9700 South Cass Avenue
Argonne, IL 60439

The submitted manuscript has been authored by a contractor of the U.S. Government under contract No. W-31-109-ENG-38. Accordingly, the U.S. Government retains a nonexclusive, royalty-free license to publish or reproduce the published form of this contribution, or allow others to do so, for U.S. Government purposes.

June 1997

To be presented at the "Decommissioning, Decontamination and Reutilization of Government and Commercial Facilities" meeting to be held in Knoxville, TN, September 7-12, 1997.

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

BENEFICIAL RE-USE OF DECOMMISSIONED FORMER NUCLEAR FACILITIES

L.E. Boing
Argonne National Laboratory
Technology Development Division
9700 South Cass Avenue
Argonne, Illinois 60439
Tel: (630) 252-6729

ABSTRACT

With the decision to decommission a nuclear facility, it is necessary to evaluate whether to fully demolish a facility or to re-use the facility in some capacity. This evaluation is often primarily driven by both the past mission of the site and the facility and the site's perceived future mission. In the case where the facility to be decommissioned is located within a large research or industrial complex and represents a significant resource to the site's future mission, it may be a perfect candidate to be re-used in some fashion. However, if the site is a rather remote older facility with little chance of being modified to today's standards for its re-use, the chances for its re-use will be substantially reduced.

In this presentation, some specific cases of former nuclear facilities being decommissioned and re-used will be reviewed and some factors required to be considered in making this decision will be reviewed.

At the ANL-East site, three former nuclear-facilities have been fully re-utilized and another has been partially re-utilized. At the former Experimental Boiling Water Reactor (EBWR) facility, after decommissioning was completed and the facility was released, the structure was turned over to the on-site Waste Management Operations for modification into a packaged TRU waste storage facility. At another on-site facility, nine research laboratories formerly housing over 60 plutonium gloveboxes have been re-utilized for non-radiological research including an electron-microscopy laboratory. The former Plutonium Fabrication Facility (Bldg. 350) has been re-used for the DOE New Brunswick Laboratory. The CP-5 Research Reactor recently released a small domed out-building formerly used for facility emergency ventilation (during reactor operations) for re-

use as a road salt storage facility for use by the Plant Facilities and Services Group.

Numerous other sites have re-used former nuclear facilities for a variety of purposes:

- a former research reactor building is now being used as a experimental waste reduction facility,
- a former plutonium fuels fabrication facility is being re-utilized as a laser R&D laboratory,
- a former boiling water reactor containment building is now being used for computer tomography R&D,
- several former fuel processing buildings at a major fuel processing complex have been re-utilized for other R&D, plant support services, or for waste storage/decontamination,
- a former fuel fabrication plant now being utilized after decommissioning as a gaming establishment,
- former commercial reactor plants are now being utilized as:
 - municipal vehicle maintenance service centers,
 - repowered using natural gas as the heat source,

- a former fuel reprocessing facility has decontaminated and decommissioned a set of hot cells to allow for the eventual re-utilization of the cells for vitrification of liquid HLW stored in the same facility.

Factors to be considered in making a decision regarding the re-use of a facility after decommissioning must be made on a case-by-case basis. Among the factors to be evaluated are:

- likely degree of structural degradation in doing the D&D,
- cost savings to be realized and are they economically justifiable,
- age of the structure and its current condition,
- plans for long-term site use,
- compliance with relevant codes for today's re-use versus yesterdays construction and operational standards,
- costs of performing any modifications to make the facility usable after D&D is completed,
- acceptable residual activation or contamination levels for the re-use mission.

The re-use of facilities after decommissioning is not only feasible, but has been done in numerous instances and using an evaluation process that considered many of the factors described above.

I. INTRODUCTION/SCOPE OF THE PROBLEM

The DOE complex has currently identified over 7,000 surplus radioactively contaminated facilities that may require eventual decommissioning. Many of these facilities are either former defense program facilities or were involved in non-defense or commercial DOE nuclear programs supporting the development of the nuclear power industry in the US.

The commercial nuclear industry is also quickly approaching a time when there will be multiple commercial Nuclear Power Plants (NPP's) being either shutdown or in some cases requesting license extensions. This is the case both here in the US, as well as in the UK, Canada, Germany, France, and other countries. Those of us familiar with the research reactor community are also aware of the same trend in this area. This is even

pronounced in many developing or smaller countries of the world with the 40th anniversary of the Atoms for Peace program quickly approaching. Many of the first research reactors from this program are preparing to either shut down or be replaced with new reactors for use in national research programs.

With all of the above facts in mind, what really does happen to a reactor or other nuclear facilities after decommissioning? What are the options for potential re-use of these facilities?

In some cases, the entire facility is immediately decommissioned and the facility demolished with no plans for any further R&D program at the site. In other cases, a replacement facility is constructed. Some institutes may elect to place a facility into a "safe storage" condition to allow for radioactive decay, etc. prior to decommissioning. In some cases, larger DOE sites have identified future missions which can impact the decommissioning and reuse options.

In the following sections I would like to review several case studies both at the ANL-East Site and numerous other sites where former reactor facilities and/or nuclear facilities have been decommissioned and beneficially re-used. Certain factors required to be evaluated for some facilities prior to their selection for re-use may influence or even eliminate the ability to re-use certain decommissioned facilities.

Factors/Considerations Affecting Re-use

Certain institutional site use plans and other facility specific conditions resulting from decommissioning can impact beneficial re-use of space/buildings. The following factors are among those to be considered when evaluating re-use of decommissioned facilities.

- Age of Structure and Current Condition

Obviously, a newer structure is typically easier to find a beneficial re-use for as compared to an older, more aged structure. Although short-term use may be possible, longer term use of such a structure may not be cost effective or wise due to structural degradation.

A relatively new structure which has been used frequently up to shutdown and has not been left vacant for a prolonged period is a more likely candidate for re-use after decommissioning.

- Long-Term Site Use/Mission

Some DOE sites may have no site mission after their current inventory of surplus facilities are decommissioned. The future plans for the site land use may be to turn the site over for unrestricted re-use. In some instances a short-term re-use may be feasible even in this particular situation, possibly for equipment storage, temporary offices, waste storage, etc., but in other cases this may not be feasible.

In some instances, certain DOE sites have found beneficial re-use for decommissioned facilities in their continuing site R&D missions. Certain commercial NPP may elect to replace the nuclear heat source with a conventional fossil-fueled heat source and the site re-used in the long-term for continued electrical generation.

Facilities which are decommissioned and located in areas close to the site fence may not be possible candidates for re-use. This is a result of incorporating more conservative land use and site real estate management policies into the decision-making process than was previously done. The image of the facility or site even being in close proximity to homes and the public in general may be a greater concern than in the past. On the other hand, stakeholders may support the use of some of these facilities to the greatest extent possible to minimize construction of "very short-term use" new facilities to support the clean-up of an area or site.

- Presence of Residual Activation or Contamination

In some cases, certain facilities may have areas which are inaccessible and have residual contamination or activation levels in them. In the course of performing the decommissioning work these areas may be made inaccessible. These areas may or may not pose a hazard to the next user, depending on the final planned use of the facility. Depending on the levels of activation or contamination, certain restrictions may be placed on the options for re-use of the decommissioned facility. Accessibility of the residual radioactivity is only one aspect of this consideration for re-use. The other aspect is whether or not any potential for radiation exposure to the follow-on users is acceptable or not acceptable. If it is acceptable, it should be justifiable through a formal evaluation process.

- Resulting Structural Degradation from Decommissioning

Decommissioning can be a very messy operation. Especially when removing areas of permanent structural concrete or after "chasing leaks" of radioactivity into underlying foundations and after removing areas of high contamination. An assessment will need to be performed of the financial resources needed in order to restore those areas for beneficial occupancy which have structural degradation from the decommissioning. In the early days of decommissioning, entombment was used at some of the earlier reactors as a means of quickly and easily dealing with decommissioning. This approach has fallen from favor and is now not considered an acceptable option. In a similar context, the resulting structural degradation or damage done in the decommissioning of the facility may make parts of the structure (if not all of the structure) an uneconomical candidate for re-use.

- Compliance with Structural Codes

Older facilities may need to be evaluated if they are able to be modified in a cost-effective manner to comply with any relevant "beneficial occupancy" codes. Since these structures are likely to be fairly old (>20 years), they will most likely not be able to comply with many of the current Life Safety Code requirements which would preclude some re-use opportunities.

- Resulting Cost Savings

In some instances, combinations of factors will result in an insignificant cost savings to re-use the facility after decommissioning. However, at many smaller DOE sites, extensive re-use of former nuclear facilities and other nuclear facility out-buildings are economical, mostly with only minor conversion costs to office space or general use space. When investigated, the various supporting amenities (cranes, robustness of structure, etc.) do quickly provide opportunities for cost savings. This is a common practice at many research institutes which are amenable to re-use of areas for new research missions.

- Interim Re-use Due to Final Processing at a Plant Location

Certain sites may elect to re-use some parts of certain facilities for an interim re-use. This is especially true if modifications to an existing facility already located in a very remote area or confined area is required to finalize the decommissioning of the facility. Some limited decommissioning may be done to retrofit the decommissioned area for support to the ultimate decommissioning of all the facility or plant. This is true of an area that may be modified to allow for processing of certain waste types remaining on-site that require

treatment prior to disposal, i.e., high-level liquid waste or possibly scrap metals generated in decommissioning which may be melted for re-use in waste containers.¹

The following are some specific instances where former nuclear facilities were re-used after decommissioning.

Piqua Nuclear Power Facility

The Piqua Nuclear Power Facility (PNPF) at Piqua, OH contained a 45.5 MW(t) organically cooled and moderated reactor built and operated between 1963 and 1966. The city of Piqua operated and maintained the facility and the Atomic Energy Commission (AEC) owned the facility. In 1969 the PNPF was decommissioned and the reactor vessel complex including cavity liner and the space between the vessels was backfilled with dry quartz sand. At last report the city had been re-using the remainder of the facility as a motor pool maintenance/storage area.²

UNC Naval Products Facility

UNC Naval Products formerly operated a facility in Montville, CT on 240 acres of land for the manufacture of nuclear propulsion units for the DOE and the U.S. Navy. The entire facility consisted of about 430,000 square feet. The facilities were decontaminated and decommissioned in the period of 1991-1993. In a very unique re-use of a former nuclear facility, the land was purchased by the Mohegan Tribe and it now houses the Mohegan Sun Casino. The tribe has managed to use all but four of the original buildings for its operations.³

Santa Susana Field Laboratory (SSFL) - Energy Technology Engineering Center (ETEC)

Over the last 40 years or so, numerous research reactors have been designed, built, and operated at the SSFL-ETEC facilities. Many of these have been decommissioned over the last 15 years, released from their state of California operating licenses, and now many are being beneficially re-used. Here is a sampling of some of these:⁴

- Former Sodium Reactor Experiment (SRE) Containment building is being used for storage of high-dollar equipment items.
- Former Nuclear Materials Development Facility (NMDF) is being used for laser research and development program after being successfully

decontaminated and decommissioned from its earlier life as a plutonium fuels facility.

- Former DeSoto Avenue Fuel Fabrication Facility is now being used for the manufacturing of rocket-engine components.

Idaho National Engineering and Environmental Laboratory (INEEL)

At the INEEL site, several early reactor safety program facilities have been re-used for several new missions. These include:

- The SPERT-1 Reactor building was decommissioned in 1964, all equipment removed by 1969 and the building re-used to house the Power Burst Facility (PBF) plant protective system equipment.⁵
- Similarly the SPERT-III Reactor building was decommissioned in 1980 and all reactor components removed. It now houses the Waste Experimental Reduction Facility (WERF).⁶

Others

References 7 & 8 detail several other instances where former nuclear facilities have been decontaminated and decommissioned and are being re-used.

References 9 & 10 detail several early power demonstration reactors that replaced the nuclear heat source with a conventional fossil fueled heat source after decommissioning the nuclear side of the plant. The Fort St. Vrain nuclear plant and Pathfinder nuclear plant have both undergone this process.

The following are several case studies of facility re-use at the ANL-East site after decommissioning.

EBWR Facility

The EBWR decommissioning was completed in 1996 and the facility is undergoing conversion/modification into a waste storage facility. Packaged TRU waste drums will be stored on the four levels of the facility and in the former reactor cavity and fuel pool pending off-site shipment for disposal at a DOE facility.¹⁰

Minor facility modifications will include crane upgrades and structural upgrades and the new facility will be operational in 1997. This reuse is estimated to result in a cost savings of \$2 million US dollars.

CP-5 Reactor Facility

The CP-5 reactor facility is currently undergoing decommissioning at the ANL-East site. At the CP-5 Facility there are two former reactor support structures which have been turned over to Facility Operations for their use in routine operational functions.

The first of these is the former Vaporsphere structure (Bldg. 330 M), which was used as part of the emergency ventilation system at the facility. With a minimal amount of fence moving and clean-up, the structure was able to be free released and turned over to the Grounds Department for use as a Road Salt Storage facility. A "drive through" opening was made into the dome and the facility was operational. It was estimated that this resulted in a cost savings of about \$200 K to the DOE as compared to constructing a new storage facility.

The second of these is the former CP-5 Operations Storage Building (Building 329) which was used for large equipment storage from reactor operations. This building was upgraded to comply with the requirements for storing packaged hazardous waste awaiting shipment to a hazardous waste disposal site. The space is now being used by Waste Management Operations. This action resulted in a cost savings to the DOE since there was no need to build a new facility.¹¹

Building 212 D-Wing Gloveboxes

Nine laboratories involved in research work for various DOE energy research programs had been in use since 1960 up through the late 1980's. The studies focused on optimizing nuclear fuel composition and basic studies of transuranic metals. The laboratories and gloveboxes were declared surplus and prepared for decommissioning. In the period 1993 - 1996 the decommissioning was fully completed and the boxes packaged for interim storage as TRU waste in the new TRU Waste Storage Facility described earlier. The laboratories were fully free released for unrestricted re-use; approximately 7500 square feet of general laboratory space was released for DOE programmatic re-use in a building undergoing some rather profound changes in the research mission from previous years.¹² This resulted in a cost savings of about \$1.4 million US dollars to the DOE as compared to constructing a new research facility. A minimal amount of refurbishment of the areas was needed. Previous areas released are now being used for a high voltage electron microscope facility.

CONCLUSION

Over the last 25 years, there have been numerous instances of partial and entire facility re-use following decommissioning. In the past, especially at DOE sites, it was a given that facility demolition was the most likely option to be selected in the case of a final decommissioning alternative.

In the last 15 years or so, this option is still best for some facilities; more will be re-used in the future than were in the past. Additionally, other non-DOE sites also have re-used former nuclear facilities and will most likely continue this practice in the future.

The decision in some cases is a rather straight forward one, however in other cases, a careful review and evaluation of the factors influencing the value of re-use of the facility must be performed. Anyone who believes it cannot or has not been done only has to look at the history of the decommissioning of nuclear facilities. It can be done and has been done.

REFERENCES

1. U.S. Department of Energy, Office of Environmental Management, The 1996 Baseline Environmental Management Report, June 1996, DOE/EM-0290.
2. Nuclear Waste News, May 22, 1997, p188.
3. Telecon w/G. Subburamen, Rockwell-Rocketdyne.
4. "Decontamination and Decommissioning of the SPERT-2 and SPERT-3 Reactors at the Idaho National Engineering Laboratory," R.E. Hine, EG&G Idaho Inc., EGG-2074, 1981.
5. "Final Report: Decontamination and Decommissioning of the SPERT-1 Reactor Building at the Idaho National Engineering Laboratory," M.R. Dolenc, EG&G Idaho, EGG-2399, 1986.
6. "Decommissioning of Building C at the Lynchburg Technology Center," R.L. Bennett, B&W Nuclear and Environmental Services Inc., 1994 ANS Winter Meeting, November 1994.
7. "Decommissioning of Building A at the Lynchburg Technology Center," G.S. Hoovler, B&W Nuclear and Environmental Services Inc., 1994 ANS Winter Meeting, November 1994.

8. "Case Study - Pathfinder Decommissioning," John Closs, Northern States Power, presented at the ASME Short Course Program on Environmental Restoration of Nuclear Facilities, May 1992, St. Louis, MO.
9. "Fort St. Vrain Decommissioning - A Successful Conclusion," M.J. Fisher and S.W. Chesnutt, Public Service Company of Colorado, presented at the ANS Topical Meeting on Decommissioning, April 14-17, 1996, Chicago, IL.
10. "Decontamination and Decommissioning of the Experimental Boiling Water Reactor (EBWR): Project Final Report," C.R. Fellhauer, L.E. Boing (ANL) and J. Aldana (NES), ANL/D&D/TM-96/4, September 1996.
11. "Fiscal Year 1993 and 1994 Decontamination and Decommissioning Activities Photobriefing Book for the Argonne National Laboratory - East Site, Technology Development Division, D&D Projects Department," March 1995.
12. "Decontamination and Decommissioning of 61 Plutonium Gloveboxes in D-Wing, Building 212, Argonne National Laboratory - East: Final Project Report," C.L. Cheever and R.W. Rose (ANL), ANL/D&D/TM-96/3, September 1996.
13. "Decontamination and Decommissioning of the West Valley Reprocessing Plant," H.F. Daugherty and R. Keel, West Valley Nuclear Services, DOE/NE/44139-30, November 1986.