DOCKET NO: A-93-02
V-B-24

TECHNICAL SUPPORT DOCUMENT FOR

SECTION 194.43: PASSIVE INSTITUTIONAL CONTROLS - IMPLEMENTATION COST ESTIMATE

U. S. ENVIRONMENTAL PROTECTION AGENCY
Office of Radiation and Indoor Air
Center for the Waste Isolation Pilot Plant
401 M. Street, S. W.
Washington, DC 20460

MAY, 1998

Technical Support for this document was provided by TechLaw, Inc. and its subcontractors under EPA Contract 68D50174.

TABLE OF CONTENTS

Appendices

EXECUTIVE SUMMARY

This technical support document was prepared to develop an independent cost estimate, in 1997 dollars, for the implementation of three elements of the Waste Isolation Pilot Project (WIPP) Passive Institutional Controls (PICs). These element were: construction of a berm which outlines the perimeter of the subsurface storage area, construction of large stone kiosks / markers, and archival of printed information worldwide.

The total volumes calculated for each berm material type were as follows: 1) soil / riprap 129,688 cubic yards (cy); 2) riprap 189,128 cy; 3) caliche 252,892 cy; 4) salt 443,473 cy; and 5) excavated soil 439,747 cy, with the total cost of the 1,325,240 cy berm construction was estimated to be $40,043,031. The total cost of 48 kiosks / markers construction with metal anchors was estimated to be $15,313,723; however, if these same 48 kiosks / markers were constructed with stone interlock the total estimated cost would rise to $28,252,813. Depending on how the documents are bound (saddlestitched or perfect bound) the cost estimate ranges from $80,500 to $90,750, respectively. Shipping of the documents was estimated to be $15,000.

The grand total of the cost estimates were $68,401,595 (1997 dollars). A summary of these data is provided in the following table.

Based on approximately 50 years of construction data collected by the R.S. Means company for both a thirty US city average, and Albuquerque, New Mexico it is anticipated that construction costs will increase by approximately three to four fold during the next century. The following figure presents these historic construction cost data. These data suggest that the construction costs of the PICs in the year 2100 may range from $205,000,000 to $275,000,000.

PASSIVE INSTITUTIONAL CONTROLS - IMPLEMENTATION COST ESTIMATE

1.0 INTRODUCTION

The Department of Energy (DOE) has submitted a Title 40 Code of Federal Regulations (CFR) Part 191 Compliance Certification Application (CCA) for the Waste Isolation Pilot Plant (WIPP), which is located near Carlsbad, New Mexico, to the Environmental Protection Agency (EPA) for review. As part of the CCA DOE has proposed passive institutional controls (PICs) which would serve to warn future generations of the dangers imposed by the transuranic wastes which are to be entombed at the WIPP site. These PICs are intended to convey information for a period of approximately 10,000 years and include such items as: large man-made structures (berms), large stone kiosks / markers, and archival of printed information.

1.1 SCOPE

This technical support document was prepared to develop an independent cost estimate, in 1997 dollars, for the implementation of three elements of the WIPP PICs. These element were: construction of a berm which outlines the perimeter of the subsurface storage area, construction of large stone kiosks / markers, and archival of printed information worldwide.

2.0 DATA COLLECTION

2.1 BERMS

Berm geometry information was provided in Chapter 7, Figure 7-15, page 7-75 of the CCA, as well as CCA Appendix PIC, Figure VIII-2, page 72. These data provided cross-sectional and plan views of the berm, and construction material requirements.

Construction costs related to the berm were derived from the R. S. Means Heavy Construction Cost Data, 11th Annual Edition, 1997. This construction cost estimating guide has been used throughout the construction industry since 1942 and has been established as an industry standard.

2.2 KIOSKS / MARKERS

Kiosk / marker specifications were provided in Chapter 7, Figures 7-12 and 7-13, pages 7-69 and 7-71 of the CCA, as well as CCA Appendix PIC, Figures V-1, V-2, and V-4, pages 48, 49 and 51. These data provided marker specifications, dimensions, engraved message contents and plan views. Specifically, 16 kiosks / markers would be placed at spacing of approximately 600 feet along the perimeter of the berm, and 32 kiosks / markers would be placed at spacing of approximately 2600 feet along the perimeter of the WIPP Site Boundary, for a total of 48 kiosks / markers.

Cold Spring Granite Company of Cold Spring, Minnesota and Keystone Granite Company of Elberton, Georgia were contacted to provide technical information and cost estimates for the construction of the kiosks / markers. Construction costs related to the installation of the markers were derived from the R. S. Means Heavy Construction Cost Data, 11th Annual Edition, 1997. This construction cost estimating guide has been used throughout the construction industry since 1942 and has been established as an industry standard.

2.3 ARCHIVAL OF PRINTED INFORMATION

2.3.1 Printing and Binding

A.B. Hirschfeld Press of Denver, Colorado was contacted to establish costs associated with the printing and binding of the WIPP PIC related documentation. Specifications for paper and ink as set forth in the PIC Design Report Revision 0, Section XIV, Offsite Archival Storage, which references the paper requirements of National Archives and Records Administration (NARA) Bulletin Number 95-7 were provided to A. B. Hirschfeld Press.

These specifications included the following:

- ♦ Text and cover of alkaline paper;

- ♦ Carbon black ink with a pH greater than 5.5;
- ♦ 100 document sets (Title 40 CFR Part 191 Compliance Certification Application, pg. 7-79);
- ♦ 50 volumes per set (assumption made for estimating purposes);
- ♦ 100 pages per volume (assumption made for estimating purposes);
- ♦ Camera-ready copy provided to printer; and
- ♦ FOB Denver.

2.3.2 Archives

USA

On February 28, 1997, a meeting was held with Joel Barker, Director of the Rocky Mountain Region National Archives (Archives), and select staff members of the Regional Archives and Records Center which is located at the Denver Federal Center.

The Regional Archives and Records Center provided assistance in obtaining telephone numbers for National Archives in other countries and identified Ms. Nancy Bartlett of the Society of American Archivists (SAA) at the University of Michigan as a source of additional information. Although Ms. Bartlett of the SAA could not be contacted since she was out of the country for several weeks, Mr. Bill Wallock, SAA, provided a Web Site address (HTTP:// www.lib.uidaho.edu / special-collections / other. repositories. html) which he thought might be helpful in obtaining international archive telephone numbers. A search of the Web Site revealed that there was only limited information obtainable at that address. The National Archives in Canada, the United Kingdom, and Australia were successfully contacted. In an effort to obtain information on archiving information in Mexico, Ms. Marsh Wilis, Program Director of the Americas Development Group was contacted. Ms. Wilis resides on the Board of Directors of the Mexico Cultural Center and North American Trade Dispute Resolution Center, and was the former President of the Colorado Advisory Council on Mexico, and presently represents the State of Veracruz, Mexico on international development.

3.0 DATA PRESENTATION

3.1 BERMS

The berm cross section was divided into five material types: 1) soil / riprap exterior armor which would be vegetated; 2) riprap armor for the caliche underlayment; 3) caliche cap for the salt core; 4) salt core; and 5) excavated existing soil which would provide a keyway for the construction of the berm (Appendix A). The total volumes calculated for each material type are as follows: 1) soil / riprap 129,688 cubic yards (cy); 2) riprap 189,128 cy; 3) caliche 252,892 cy; 4) salt 443,473 cy; and 5) excavated soil 439.747 cy (Appendix A).

In an effort to simulate the actual construction of the berm, construction activities were divided into 17 distinct efforts:

1)	Clear and grub the berm footprint, over-excavation area and five miles of access roads;	$251,983
2)	Grub stumps and remove the same areas as listed above;	$112,840
3)	Topsoil stripping and stockpiling same areas as above;	$634,091
4)	Hauling of salt core material;	$3,048,433
5)	Backfilling of salt core material;	$850,581
6)	Compaction of salt core material;	$254,553
7)	Hauling of screened caliche material;	$9,205,269
8)	Backfilling caliche material;	$485,047
9)	Compaction of caliche material;	$145,160
10)	Hauling of riprap material;	$5,219,932
11)	Placing riprap material;	$7,425,756
12)	Backfilling riprap material;	$102,110
13)	Backfilling excavated soil material;	$142,954
14)	Compaction of excavated soil;	$42,781
15)	Hauling soil / riprap armor;	$3,579,389
16)	Placement of soil / riprap armor; and	$8,319,597
17)	Seeding berm, overexcavated areas, and access road.	$222,555
Total cost of berm construction		$40,043,031

Cost data related to the construction of the berm is presented in Appendix B.

3.2 KIOSKS / MARKERS

In an effort to simulate the actual construction of the kiosks / markers, fabrication and construction activities were divided into six distinct efforts:

1)	Quarrying and finishing of components for five piece marker using metal anchor technology including delivery of 48 markers to Albuquerque, New Mexico;	$12,939,102
1A)	Quarrying and finishing of components for five piece marker using no metal with rock interlock technology including delivery of 48 markers to Albuquerque, New Mexico;	$25,878,192
2)	Sandblast engraving of messages ;	$1,741,555
3)	Transport to the WIPP Site from Albuquerque;	$300,000
3)	Excavation of marker foundations;	$24,806
4)	Backfill and compact marker foundations;	$10,429
5)	Kiosk / marker handling and installation on site;	$245,088
6)	Kiosk / marker unloading and transport on site;	$52,142
Total cost of kiosk / marker construction with metal anchors		$15,313,723
Total cost of kiosk / marker construction with stone interlock.		$28,252,813

3.3 ARCHIVAL OF PRINTED INFORMATION

3.3.1 Printing and Binding

Depending on how the documents are bound (saddlestitched or perfect bound) the cost estimate ranges from $80,500 to $90,750, respectively. Appendix D provides a cost estimate for printing and binding.

3.3.2 Archives

USA

The US National Archives confirmed that they would accept the WIPP documents which would be stored in an environmentally controlled area to increase the life expectancy of the documents. Once documents are accepted by the Archives, the Archives has legal custody of the documents. All costs associated with storage, use, and preservation of the documents are borne by the Archives and are not passed on to the originator of the documents.

The Archives provided a copy of the National Archives and Records Administration

(NARA) Bulletin Number 95-7 which specifies the type of paper to be used for the creation of Federal records (Appendix E). The bulletin concurs with the paper specifications for the WIPP document as set forth in the CCA.

United Kingdom

The national archives for the UK are maintained by the Public Record Office (PRO). The Government Services Department of the PRO indicated that they do not normally accept documents from other nations. The Chief Executive of the PRO will entertain a written request for inclusion of the WIPP document in the archives. Such a request should be directed to:

Mrs. Farah Tyacke, Chief Executive
Public Record Office
Ruskin Avenue
Kew
Surrey
TW9 4DU
Tel. 44 181 392 5200

Canada

The National Archives of Canada do not normally accept documents from other nations. A written request will be taken under consideration. The request should be directed to:

Mr. Eldon Frost
Director, Manuscript Division
National Archives of Canada
395 Wellington Street
Ottawa, Ontario
K1A 0N3
Tel. 613-993-7254

Australia

The Australian Archives will accept only documents which pertain to the Commonwealth. Ms. Dagmar Parer of the Australian Archives indicated that there may be other institutions such as universities and libraries which may accept the WIPP document. Ms. Parer offered her assistance in identifying such repositories and may be contacted at:

Australian Archives
National Office
Mining Industry House
216 Northbourne Avenue
Braddon ACT 2612
Tel: 61 6 209 3633

Mexico

Various organizations were contacted in an effort to establish the proper repository for the WIPP information. The most appropriate site may be with the National Commission for Science and Technology (CONACYT - Mr. Ruben Barocio Ramirez, Engineer, e-mail - cnaap@supernet.com.mx) which is located in Mexico, City. Other options include:

- The National Archive, Ms. Sylvia Lara Cobos, Lic.; however, this facility did not express great interest;

- The Secretariat of Ecology, Environment, Natural Resources, Mining and Fisheries (SEMARNIP), most permits for mineral exploration are processed by this agency;

- National University , located in Mexico City, Dr. Caspar MacGregor Cruz;

- Technology Institute, located in Monterey, Mexico;

- The National Statistics and Geographic Institute (INEGI);

- National Commission of Nuclear Security and Safeguards
  (Commission Nacional de Seguridad Nuclear y Salvaguardas),
  Engineer (Ing.) Miguel Medina Vaillard, Director General
  Dr. Barragan 779, 5o. Piso, Col. Narvarte
  03020 Mexico, D.F.
  Tel: 011-52-5-590-5182; 590-4181
  Fax: 011-52-5-590-6103

- Light and Energy Distribution and Commercialization Company
  (Distribucion y Comercializacion Compania Mexicana de Luz y Fuerza del Centro)

Engineer (Ing.) Juan Eibenschutz Hartman, Subdirector
Tel: 011-52-5-629-7174; 140-029
Auxiliary Contacts: Sra. Marta Cacho; Sria Srta. Beatriz Olvera

- PEMEX Industrial Security Systems
  (Sistemas de Seguridad Industrial PEMEX)
  Engineer (Ing.) Rafael Fernandez de la Garza, Director Corporativo
  Av. Marina Nacional 329
  Torre Ejecutiva, Piso 35
  1131, Mexico, D.F.
  Tel: 011-52-5-254-4419; 011-52-5-726-1366
  Fax: 011-52-5-545-8090
  Auxiliary Contacts: Srta. Sandra Franco, Secretaria

4.0 DATA INTERPRETATION

4.1 BERMS

The cost estimates presented in Section 3.1 of this document were based on standard construction materials and techniques. A salt core berm which is armored with caliche is not a typical construction effort and as such the cost estimates may vary from actual construction costs. It appears that there may be difficulty in compacting the salt core without the addition of water; however, the salt core is water soluble. Additionally, the compaction of the caliche armor material would also require the addition of water. It seems that if a geotextile were placed over the salt core prior to the placement of the caliche armor this method of construction would both protect the salt core from invasion of water added to the caliche during placement, and allow an adequate amount of water to be added to the caliche which would aid in cementation.

Surface water drainage conduits through the berm were not included in this cost estimate and it is believed that their construction will require great care and possibly increase the berm construction cost by 10% to 20%. Given the 100 year construction method / material testing period set forth in the CCA present construction difficulties would most likely be resolved prior to final construction.

4.2 KIOSKS / MARKERS

According to Mr. Dan Stauty of Cold Spring Granite Company, Cold Spring, Minnesota, and Mr. George Oglesby of Keystone Granite Co. Elberton, Georgia, the trend in the granite quarrying and fabrication industry is towards smaller applications such as granite veneers, granite tiles, and granite facing stones. Because of this trend only a few quarrying operations have the capability of quarrying and fabricating large granite structures. Although the capability to construct large granite monuments is likely to be limited in the future, the supplies of granite are expected to be sufficient. The life span of a typical quarry was reported to be up to 1,000 years.

With current fabrication capabilities it would be difficult to construct granite kiosks as described in the CCA and CCA Appendix PIC. Both of the sources contacted indicated that a two piece granite monument constructed as specified in the CCA and CCA Appendix PIC while feasible to quarry, could not be engraved and handled using conventional techniques. The size of these markers, if constructed to proposed dimensions and configuration would result in a monument weight of approximately 100 to 120 tons. The longest single granite component that could be quarried, handled and engraved would be approximately 12 feet in length. The information provided by those quarries contacted indicated that under present fabrication capabilities the kiosks / markers would be constructed from up to five pieces of granite and yield the CCA specified dimensions (Appendix C). Additionally the joints between the granite components would be fixed using internal stainless steel anchors. This would allow the proper

amount of monument flexibility for wind and other environmental forces. According to Mr. Dan Stauty of Cold Spring Granite, the construction of a metal free monument would be possible but the cost for the engineering design of interlocking components would approximately double the cost of each kiosk / marker.

If the construction of two piece kiosks / markers as described in the CCA and CCA Appendix PIC were a priority, there would likely be additional costs associated with the development and testing of handling technologies that are not currently available in the granite quarrying industry. Without such investment it is unlikely that the industry would develop such capabilities with the current lack of market demand.

The costs for assembly and installation of the kiosks / markers assumes a fairly rapid assembly schedule with foundation excavation occurring on a schedule that would allow uninterrupted kiosk / marker assembly. It would be reasonable to assume that the kiosk / marker components could be delivered and stockpiled on-site until assembly, This would allow an assembly schedule of one kiosk / marker per day with assembly completion in 48 days. If the assembly schedule was delayed, costs could be expected to rise due to standby time for the assembly crew and equipment.

Additionally, the kiosk / marker installation cost estimate assumptions include that the assembly can be completed using standard crane equipment, and all excavation and backfilling of foundations can be completed in one mobilization effort excluding standby time.

4.3 ARCHIVAL OF PRINTED INFORMATION

4.3.1 Printing and Binding

Methods of printing and binding consistent with the requirements of the CCA are presently available and should remain so through the period of interest in the CCA.

4.3.2 Archives

Presently, the only national archive which has agreed to hold the WIPP data is the United States National Archive. National archives in other parts of the world appear to be limited to maintaining data generated within their national boarders. Due to the vagary of national and international political structures and policies determination of the willingness of nations, other than the United States, to house these data is unlikely. Of those nations contacted several suggested that universities and professional societies may be more willing to house the WIPP data. Section 3.3.2 of this document provides information for contacting international archives. These archives were not corresponded with because it was felt that these levels of discussion were best left to the agencies which required storage.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS

The total volumes calculated for each berm material type were as follows: 1) soil / riprap 129,688 cubic yards (cy); 2) riprap 189,128 cy; 3) caliche 252,892 cy; 4) salt 443,473 cy; and 5) excavated soil 439.747 cy, with the total cost of the berm construction estimated to be $40,043,031.
The total cost of 48 kiosks / markers construction with metal anchors was estimated to be $15,313,723; however, if these same 48 kiosks / markers were constructed with stone interlock the total estimated cost would rise to $28,252,813.

Depending on how the documents are bound (saddlestitched or perfect bound) the cost estimate ranges from $80,500 to $90,750, respectively

The grand total of the cost estimates were $68,401,595 (1997 dollars).

5.2 RECOMMENDATIONS

It seems that if a geotextile were placed over the salt core of the berm prior to the placement of the caliche armor this method of construction would both protect the salt core from invasion of water added to the caliche during placement, and allow an adequate amount of water to be added to the caliche to aid in cementation.

Under present fabrication capabilities the kiosks / markers would be constructed from up to five pieces of granite to yield the CCA specified dimensions. Additionally the joints between the granite components would be fixed using internal stainless steel anchors. This would allow the proper amount of monument flexibility for wind and other environmental forces.

Of those nations contacted several suggested that universities and professional societies may be willing to house the WIPP data. Section 3.3.2 of this document provides information for contacting international archives. These archives were not corresponded with because it was felt that these levels of discussion were best left to the agencies which required storage.

APPENDIX A
WIPP BERM VOLUME CALCULATIONS

APPENDIX B
WIPP BERM COST CALCULATIONS

APPENDIX C
PROPOSED MARKER CONSTRUCTION
&
COST CALCULATIONS

APPENDIX D
PRINTING COST ESTIMATE

APPENDIX E
NARA BULLETIN NUMBER 95-7