

# Appendix B

## Library of Congress'

### Operating Cost Estimates for

#### Full-Scale Mass Deacidification Facility

##### November 1987

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This appendix contains the estimates of operating costs for a full-scale mass deacidification facility prepared by the Library of Congress and submitted to OTA as of November 1987. All estimates are preliminary and subject to refinement based on results of tests at the Texas Alkyls pilot plant. The appendix consists of three parts:

1. The basis for costs describing assumptions used to develop operating cost estimates.
2. Cost tables and discussion showing operating cost estimates at different production rates in terms of total treatment costs, per-book costs, and detailed costs for a facility treating 1 million books per year. These detailed costs are further explained in a series of notes.
3. Standard operating costs that are not applicable to the proposed facility.

#### ***Basis for Costs***

Preliminary annual operating costs for the Ft. Detrick Book Deacidification Facility are based on two to four T/V Chambers operating on a 72-hour treatment cycle or less for 24 hours per day, 7 days per week, and 350 days per year.

A checklist to aid in determining the Annual Operating Costs was prepared by modifying a similar table in *Perry's Chemical Engineers' Handbook* (Perry, Chilton, Kirkpatrick, 4th ed., McGraw-Hill, 1963). This checklist was prepared in two parts: Part 2 - table B-1 includes all those items assumed applicable to a government-owned installation at Ft. Detrick, and Part 3 lists those items not applicable.

Part 2- tables B-2 and B-3 show for the Ft. Detrick Facility a summary of the annual operation costs in dollars per year and in dollars per book, respectively, for four annual production rates.

The cost of book handling at the Library and book transportation to and from the plant are not included as part of plant operating costs because these tasks would have to take place independent of the process used. Previous estimates placed this figure at approximately \$0.70 per book.

Contractor supervision and operation of facility is assumed.

Operating data, soon to be obtained from the Texas Alkyls Small Scale Test Deacidification Facility in Deer Park, Texas, will be used to refine the cycle times and the number and the capacity of T/V Chambers. With these data and from the design of the Ft. Detrick Facility the costs estimated in table B-1 will be updated.

#### ***Cost Tables and Discussion***

Table B-2 shows the major annual operating costs for four production rates.

Table B-3 converts the dollar costs in table B-2 to dollars per book treated.

Table B-1 is for an annual capacity of 1 million books, and shows a breakdown of costs for each group of costs shown in table B-3.

#### ***Items Not Applicable to the Ft. Detrick Facility***

1. Plant Costs
  - Company contribution of profit sharing or thrift plan
2. Plant Overhead
  - Purchasing
  - Personnel and industrial relations
  - Automotive and rail switching
  - Plant hospital and dispensary
  - Cafeteria and club rooms
  - Taxes on properties and operating licenses
  - Insurance - property
  - Depreciation
3. Distribution Costs
  - Containers and packages
  - Freight
  - Operation of terminals and warehouses
  - Wages and salaries plus fringe benefits
  - Operating materials and utilities
  - Rental or depreciation

**Table B-I.—Breakdown of Annual Operating Costs at 1 Million Books per Year**

Product	Deacidified Books	2.2 Operation engineer. . . . .	45,000
Producer	Contractor to the Library of Congress	2.3 Chemical/computer technician . . . . .	40,000
Location	Ft. Detrick, MD	2.4 Eight operations/technicians/book	
Byproducts	Ethane and water extracted from books	handlers @ \$32,000 . . . . .	256,000
Process	Under vacuum: books dehydrated, diethylzinc reacted with remaining water and acid and dehydrated	2.5 Day shift maintenance person . . . . .	35,000
Operation	Batch cycles	2.6 Outside maintenance support on demand. . . . .	20,000
Annual capacity	500,000 to 2,000,000 books per year	2.7 Total direct labor. . . . .	\$461,000
Fixed investment	See Appendix C: Capital Cost Estimate	2.8 Payroll burden (fringe benefits) for Federal OASI, Workman's Compensation Insurance, contributions to pension, life insurance, thrift plan, vacations, holidays, sick leave, overtime premium .	152,000
Stream days	350 24-hour days	Subtotal: Operating Labor . . . . .	<b>\$613,000</b>
Cost Component	Dollar cost per year	<b>3. Plant Overhead</b>	
1. Plant Costs		3.1 Administration (by plant manager) . . . . .	<b>see 2.1</b>
1.1 Raw Materials		3.2 Indirect labor	
—Standard Test Books . . . . .	\$ 13,000	—Laboratory technician. . . . .	<b>\$ 28,000</b>
1.2 Processing Chemicals		—Secretary/receptionist . . . . .	22,000
Diethylzinc . . . . .	800,000	—Technical service & engineering . . . . .	<b>Note 14</b>
—Treated Water . . . . .	3,000	—Shops and repair facilities . . . . .	<b>Note 15</b>
—Nitrogen . . . . .	30,000	—Shipping and receiving department . . .	<b>Note 16</b>
1.3 Operating Supplies		—Payroll burden of 3.2 Indirect Labor ..	<b>17,000</b>
—Dowtherm J . . . . .	500	3.3 Inspection, safety and fire protection . .	<b>Note 17</b>
—Lubricating oil . . . . .	2,000	3.4 Accounting, clerical and stenographic ..	<b>Note 18</b>
—Kerosene . . . . .	500	3.5 Communications: telephone, mail, teletype, modem . . . . .	<b>3,000</b>
—Refrigerant . . . . .	1,000	3.6 Plant custodial . . . . .	<b>10,000</b>
—Supplies/Sundries . . . . .	3,000	3.7 Plant protection. . . . .	<b>Note 17</b>
1.4 Utilities		3.8 Waste disposal . . . . .	<b>10,000</b>
—Electricity . . . . .	70,000	3.9 Insurance, third party liability. . . . .	<b>20,000</b>
—Cooling Water . . . . .	10,000	Subtotal: Plant Overhead. . . . .	<b>\$110,000</b>
—Instrument Air . . . . .	1,000	<b>4. Administrative Expense</b>	
—Steam . . . . .	3,000	Contractor's fee taken as 15 percent of	
1.5 Maintenance Materials* . . . . .	60,000	2.0 Operating Labor subtotal, \$613,000, plus \$67,000 of 3.2 Indirect Labor . . . . .	<b>\$102,000</b>
Subtotal: Plant Costs . . . . .	<b>\$997,000</b>	Total Annual Operating Cost for 1 Million BPY at Ft. Detrick ... ..	<b>\$.1,822,000</b>

● Replacement parts, repair of equipment, etc.

1.1.1 Raw Materials - The books to be treated are not considered a cost item but Standard Books for quality Control are.  
 2. 1.2 Processing Chemicals: DEZ usage, the major chemical cost, is based on an average 1 1/2 percent DEZ being laid down in an average 1.66 pound book which is equivalent to 72 cents per book for \$17.00 per pound DEZ. Until better operating data is obtained 8 cents was added for small losses and wastage, e.g., equipment and line cleaning, to develop the 60 cents.  
 3. Other Chemicals: How much 1.2 Nitrogen (considered a processing chemical for purging, particularly, the TV Chambers) to be used, is now a guess taken as 250 tons \$120/ton @ \$30,000.  
 4. 1.3 Operating Supplies: Dowtherm J, used as the heat transfer oil, may be needed for periodic replacement. The replacement cost is estimated at about \$500 per year. Lubricating oil for the pumps will probably require changes costing an estimated \$2,000 per year. Kerosene, the sealant for the two Seal Pots, and for clean out of equipment is a minor cost. Supplies/sundries: other lubricating oils, greases, about \$3,000 per year for refrigerant, chemicals for the laboratory and gasket replacement, all usually a minor cost item, will be better known toward the beginning of spring 1966.  
 5. 1.4 Utilities: The amount of electricity, the major utility cost item for power, lighting, refrigeration and air conditioning, will be better known in the spring of 1966 after a few small scale tests and the redesign of the Ft. Detrick deacidification facility. It is estimated now as 1,400,000 kWh @ 5 cents/kWh - \$70,000. Cooling water, instrument air, and steam (for heating comfort) are minor utility cost items.  
 6. 1.5 Maintenance Materials - Taken as a percentage of the chemical processing part of the Ft. Detrick Facility.  
 7.2. Operating Labor - There will be better data from the Small Scale Plant Operations but the labor for Ft. Detrick remains a good but tight estimate until Ft. Detrick is in operation. There will be more clarification for job assignment and responsibilities details. It is assumed that one of the two shift operators will assist in DEZ cart movement and assist in the Quality Assurance Laboratory.  
 8.2.1. A Plant Manager or similarly titled person is needed to be in charge and to interface with Ft. Detrick and Library management. The same person, after the start-up period, should have ample time to manage other operating sites. Thus, a smaller cost than the \$65,000 salary plus benefits could be required.  
 9.2.4. Eight operational technicians/book handlers are determined as two people per shift for 168 hours per week @ 40 hours per person -8.4 people. Assume some of the eight will work overtime to cover for 0.4 person, sick leave, vacation, holidays, jury duty, military service, etc. The two operators per shift was chosen based on the emphasis on safety even though there may not be sufficient activities to occupy two people after start-up and the plant is run routinely.  
 10. All book movements at the facility are planned to be done by the operators.  
 11.2.5. Direct Maintenance Labor - These costs will be better defined after the redesign of the Ft. Detrick facility and the operation of the pilot plant.  
 12.2.8. Payroll Burden on all Labor Charges - this major cost item, lumped as one percentage of labor for all benefits as defined in Reference.  
 13. 3.1 Administration - This is assumed under 2.1 Plant Manager.  
 14. Technical service and engineering will be by contractor and covered under administrative expense.  
 15. Shops and repair facilities are included under maintenance labor.  
 16. Shipping and receiving department to be handled by shift operators.  
 17. Inspection, safety and fire protection and plant protection provided by Ft. Detrick.  
 18.3.4. Accounting provided by contractor and secretary/receptionist does clerical and stenographic.  
 19.3.8. Waste Disposal of 10,000 gallons at \$1.00/gallon - \$10,000.  
 20.4. Administrative Expense: Contact was made with contracting companies in a somewhat similar position to establish the rate of 15 percent and its basis. Also see Notes 14 and 15 preceding.

- 4. Marketing Costs
- 5. Administrative Costs
  - General account, clerical auditing
  - Central engineering and technical
  - Legal and patent
  - Within and outside the facility
  - Payment and collection of royalties
  - Contributions and dues to associations
- Financial
- Debt management
- Maintenance of working capital
- Credit functions
- Communications and traffic management
- Central purchasing activities
- Taxes

**Table B.2.—Annual Operation Costs in Dollars per Year**

Cost components	Capacity in millions of books per year (dollars per year)			
	0.5	1	1.5	2
Plant costs . . . . .	\$ 551,000	\$ 997,000	\$1,450,000	\$1,897,000
Operating labor. . . . .	611,000	611,000	611,000	611,000
Plant overhead . . . . .	110,000	110,000	110,000	110,000
Administrative expense. . . . .	102,000	102,000	102,000	102,000
Total unit treatment cost at Ft. Detrick . . . . .	\$1,374,000	\$1,822,000	\$2,273,000	\$2,720,000

**Table B-3.—Annual Operation Costs in Dollars per Book**

Cost components	Capacity in millions of books per year (dollars per book)			
	0.5	1	1.5	2
<b>Plant costs . . . . .</b>	<b>1.10</b>	<b>1.00</b>	<b>0.96</b>	<b>0.95</b>
<b>Operating labor. . . . .</b>	<b>1.22</b>	<b>0.61</b>	<b>0.41</b>	<b>0.31</b>
<b>Plant overhead . . . . .</b>	<b>0.22</b>	<b>0.11</b>	<b>0.07</b>	<b>0.05</b>
<b>Administrative expense . . . . .</b>	<b>0.20</b>	<b>0.10</b>	<b>0.07</b>	<b>0.05</b>
Total unit treatment cost at Ft. Detrick . . . . .	<b>2.74</b>	<b>1.82</b>	<b>1.51</b>	<b>1.36</b>