With the one hour per shift adjustment, the rate of this procedure is

1 unit/4 hr x 7/8 adj = 0.219 units/hr

To find the cost of labor, equipment, and materials per unit, the hourly rate is divided into the hourly costs. This yields $68.49, $4.57, and $3.84 per unit for labor, equipment, and materials respectively. The total comes to $76.90 per electronic equipment unit.

A.4.3.2 Spray Cleaner

According to the source at the Institute of Fire Restoration, a more thorough job of cleaning than with vacuuming can be done by using an electronics spray cleaner. Such sprays are applied from an aerosol can and leave no residue. When used with cotton swabs, this is an effective cleaning technique.

This source estimated that it would take one worker twelve hours to clean one unit of electronic equipment with this method. This implies a rate of

1 unit/12 hrs x 7/8 adj = 0.073 units/hr

with the one hour per shift adjustment.

If labor costs $15.00 per hour, the labor cost per unit is

($15.00/hr) ÷ (0.073 units/hr) = $205.48/unit

Assuming that the minor equipment required for this operation costs about $1.00, the cost per unit is

($1.00/hr) ÷ (0.073 units/hr) = $13.70/unit

Again using five percent of the total cost to estimate the materials cost, we get $0.89 per hour. This implies the use of about one-sixth of the can of spray cleaner per hour. The material cost per unit is

($0.89/hr) ÷ (0.073 units/hr) = $12.19/unit

Adding the three cost categories gives the total cost per electronic equipment unit of $231.37.

A.4.3.3 Remove and Replace

Information on the electronic equipment in the average home, including the cost of the various items, is available in a publication titled "Consumer Electronics U.S. Sales" published by the Electronics Industries Association, Consumer Electronics Group. This source is used to develop the inventory of electronic equipment items contained in a unit of this category (see the discussion in Appendix E). In addition, this source provides information useful in estimating the replacement cost of electronic equipment.

The first step in calculating the replacement cost of electronic equipment is to determine most commonly owned items of electronic equipment (see Table A.4.3.3.1). The items-per-unit column is based on the reported percent of households with the specified item. The average cost of the item comes from the cited publication and is calculated by dividing the total dollar value of sales by the number of items sold in 1985. Multiplying the average price by the items per unit gives the estimated average dollar value per unit of that item. Summing these amounts gives an estimate of the cost to replace the electronic equipment (not including installation labor).

Because the dollar amounts in Table A.4.3.3.1 are in 1985 prices, it is necessary to convert them to 1982 prices to be compatible with other dollar amounts in this volume. Using the GNP implicit price deflator, the 1982 dollar amount is

$$\$850 \times (100/111.5) = \$762$$

TABLE A.4.3.3.1. Calculation of the Replacement Cost of Electronic Equipment

		1985 $	
Item	Items per Unit	Avg. Price	Cost per Unit
Color TV	0.92	327	301
B&W TV	0.60	82	49
VCR	0.37	351	130
Home cmptr	0.16	500	80
Audio sys	0.88	282	226
Tel ans mach	0.13	74	10
Crdls phone	0.15	70	11
Reg phone	0.98(est)	31	30
Radio	0.98	13	13
Total			850

Source: Electronics Industries Association.

Note that this electronic equipment cost falls in the material, not the equipment category. This is because equipment refers to the tools used over and over to complete the operation, while materials refers to items needing regular replacement as the operation proceeds from structure to structure.

It is estimated that to remove the contaminated electronic equipment it will take one worker two hours. To install the new equipment the estimated crew of one will take four hours. The total time is, therefore, six hours. The rate, with adjustment, is

$$1 \text{ unit}/(2 \text{ hr} \times 8/7 \text{ adj} + 4 \text{ hr}) = 0.159 \text{ units/hr}$$

While the removal and installation of electronic equipment parallels the removal and installation of soft-surface furnishings, it is felt that a somewhat greater skill level is required with electronic equipment. For this reason, the hourly labor cost is estimated at $15.00 per hour. Equipment includes minor tools with an estimated cost of $2.00 per hour.

Dividing the hourly labor and equipment costs by the production rate gives the costs on a per unit basis. Labor is $94.34; equipment is $12.57; and materials is $762. The total of these amounts comes to $868.92 per unit.

A.4.4 Paper Products

Paper products refer to printed, typed, and written documents. Not included are miscellaneous paper products such as packaging materials or paper towels. For most items, the important characteristic is what is written or printed on the paper and not the paper item itself. The contents of a unit of paper products is described in Appendix E.

A.4.4.1 Vacuum "As Is"

In this operation paper surfaces are vacuumed with minimal disruption to the paper. Books are vacuumed in their shelves without removing them. File drawers are opened and the edges of contained papers are vacuumed. Besides reducing the suction power, it may be necessary to use a special nozzle to vacuum loose papers on desks. An inverted, cone-shaped nozzle with a screen or brush covering is a possibility.

In addition, this operation is understood to include spraying the paper with compressed air, either from a can or from a compressor via a hose. According to the primary source of information for this operation, a representative from the Institute of Fire Restoration, using compressed air in this way greatly increases the effectiveness of the procedure.

This source estimated that a crew of two could complete the vacuuming in two hours. With the one hour in eight adjustment, the rate is

1 unit/2 hr x 7/8 adj = 0.438 units/hr

Here we assume that labor, equipment, and material costs are the same as with similar vacuuming operations (see Sections A.3.2.4 and A.4.1.1). Converting the hourly costs to cost per unit we get

Labor: (2 x $11.14/hr) ÷ 0.438 units/hr = $50.87/unit

Equipment: (2 x $1.50/hr) ÷ 0.438 units/hr = $6.85/unit

Material: ($50.87 + $6.85) (.05/.95) = $3.04/unit

The total cost is $60.76 per unit.

A.4.4.2 Vacuum Item by Item

In this operation all the exterior surfaces of books and reports are vacuumed and blown with compressed air, but individual pages are not. Again, the primary source is the representative from the Institute of Fire Restoration. According to him, the same crew and equipment as used in the "vacuum as is" operation could complete the present operation in six hours.

Using the same calculations as in Section A.4.4.1, we find the production rate is 0.145 units per hour. The labor, equipment, and material costs per unit are $153.66, $20.69, and $9.24, respectively. The total of these amounts is $183.59 per unit of paper products.

A.4.4.3 Vacuum Sheet by Sheet

In this operation each page of unbound paper is separately vacuumed and blown with compressed air. In most cases, tightly bound paper items such as books would be vacuumed on the exterior surfaces and would not require vacuuming of each page. The source from the Institute of Fire Restoration estimated that the same crew as in the two previous paper vacuuming operations would need eight hours to complete this intensive vacuuming operation.

Performing the same calculations as in Sections A.4.4.1 and A.4.4.2, the output rate is estimated at 0.109 units per hour. Divided into the hourly costs, this yields the costs per unit: $204.40 for labor, $27.52 for equipment, and $12.29 for materials. The total is $244.21 per unit.

A.4.4.6 Copy and Replace

In this operation, paper items are 1) replaced through purchase of uncontaminated copies, 2) reprinted in the case of computer output, or 3) reproduced on a copier machine with the contaminated original discarded.

Part of the basic unit of paper items includes 15 shelf-feet of books. Using a figure of $3.00 per inch, the replacement cost for these items is $540.

The items to be copied are first boxed or bagged in order to keep track of their origin. The container of papers is then removed from the building and taken to a specially modified copying facility. The most important feature of this facility is that the materials to be copied are separated from the copy machine output by a solid and impermeable barrier. Essentially, the masters are kept in one room, and the copies are produced and kept in another. The major operational difference between this operation and the familiar copying at commercial copy facilities is that two workers per copy machine would be required. One would handle masters, the other would work with the copies and the fresh copy paper.

The estimated time to copy paper materials is four hours. In addition another two hours are necessary for collecting and returning paper items. Assuming nine cents per page and a copying rate per copy machine of about 400 pages per hour, the cost comes to $128. The amount of nine cents per page is based on the assumption of 2.5 cents per page per worker, three cents per page for equipment, and one cent per page for materials.

The rate for this operation is, then,

1 unit/6 hr x 7/8 adj = 0.146 units/hr.

The total labor cost is based on two people operating the copy machine for four hours and one person collecting and returning paper items during the other two hours. At ten dollars per hour, the total labor cost is $100. The average labor cost per hour is $16.67.

The total equipment cost is equal to the cost of the copy facility plus the cost of a vehicle. The cost of the copy facility is

$0.03/page x 400 pages/hr x 4 hr = $48.00

The cost of the vehicle (see Table A.3.12.5.1) is $5.42 per hour. For 2 hours of use, the cost comes to $10.84. The total equipment cost is $58.84. The cost of materials other than the replacement cost for books, but including paper, gas, and other items is about $20.00 per hour. The total materials cost is $660.

Dividing the hourly costs by the output rate yields the costs per paper product unit: $114.18 for labor, $403.01 for equipment. Adding $660 for materials, the total comes to $1177.19 per unit of paper products.

A.5 VEHICLES

A.5.1 Auto Exteriors

A.5.1.1 Ordinary Spray Wash

A standard spray wash of automobiles is a fairly effective technique for decontaminating the vehicle's exterior. Information for this operation was obtained from car wash businesses in the Richland, Washington area. These data are summarized in Table A.5.1.1.1. Also shown are the representative data.

TABLE A.5.1.1.1. Summary of Data for Ordinary Spray Wash of Automobiles

Source	Rate (autos/hr)	Cost (1982 $/auto) Total	Labor	Equipment	Materials
Columbia Industries	--	3.00	2.40	0.30	0.30
Walker's Hand Car Wash	--	--	(80%)	(10%)	(10%)
L.A. Hand Car Wash	--	6.00	--	--	--
Representative	4	5.00	4.00	0.50	0.50

A.5.1.2 Detailed Wash

This operation involves very thorough cleaning of the automobile's exterior. Also included is application of a protective coating. The information collected from businesses in the Richland, Washington area that perform this service is presented in Table A.5.1.2.1. Also shown are representative data.

TABLE A.5.1.2.1. Summary of Data for Detailed Washing of Automobile Exteriors

Source	Rate (autos/hr)	Cost (1982 $/auto) Total	Labor	Equipment	Materials
Tidy Car	--	100	--	--	--
Terry's Automotive Appearance	--	50	39	5	6
Representative	0.25	75	58.50	7.50	9.00

A.5.1.3 Repainting

For severely contaminated automobiles, it may be necessary to repaint the exterior. This operation includes sanding the surface before painting. The collected and representative cost and rate data are presented in Table A.5.1.3.1.

TABLE A.5.1.3.1. Summary of Data for Repainting Automobile Exteriors

Source	Rate (autos/hr)	Cost (1982 $/auto) Total	Labor	Equipment	Materials
Burkett's Auto Painting and Body Repair	--	300	--	--	--
Cascade Autobody and Paint, Inc.	--	950	600	114	236
Don's Auto Paint and Body	--	1500	900	75	525
Representative	0.083	900	558	72	270

A.5.2 Auto Interiors

A.5.2.1 Vacuum

Table A.5.2.1.1 presents data supplied by various businesses that perform vehicle vacuuming services. In addition, representative cost and rate data are also presented.

TABLE A.5.2.1.1. Summary of Data for Vacuuming of Automobile Interiors

Source	Rate (autos/hr)	Cost (1982 $/auto) Total	Labor	Equipment	Materials
Columbia Industries	--	2.00	1.70	0.20	0.10
Tidy Car	--	10.00	--	--	--
Walker's Hand Car Wash	--	--	85%	10%	5%
Representative	3	6.00	4.10	0.60	0.30

A.5.2.2 Detailed Vacuum and Clean

The data for detailed vacuuming and cleaning of automobile interiors is shown in Table A.5.2.2.1. The crew includes two workers.

TABLE A.5.2.2.1. Summary of Data for Detailed Vacuuming and Cleaning of Automobile Interiors

Source	Rate (auto/hr)	Cost (1982 $/auto) Total	Labor	Equipment	Materials
Tidy Car	--	55.00	--	--	--
Terry's Automotive Appearance	--	40.00	28.00	4.00	8.00
VIP Car Wash	--	35.00	--	--	--
Representative	1	45.00	31.50	4.50	9.00