**Laboratory Services Series—A Ten-Year
Building-Maintenance Cost History**

H. F. Keesee

MASTER

OAK RIDGE NATIONAL LABORATORY

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PLANT AND EQUIPMENT DIVISION
LABORATORY SERVICES SERIES — A TEN-YEAR
BUILDING-MAINTENANCE COST HISTORY

H. F. Keesee

SEPTEMBER 1976

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LABORATORY SERVICES SERIES -- A TEN-YEAR
BUILDING-MAINTENANCE COST HISTORY

H. F. Keesee

ABSTRACT

Maintaining a multifacility national laboratory in a safe, reliable condition is a complex management responsibility in terms of budgets, costs, and proper utilization of personnel and material resources. Increasing wage rates and material costs, combined with decreased budgets and aging facilities, create unusual challenges to maintenance managers. This report contains a ten-year history of building-maintenance costs, a brief description of the maintenance program, analyses of personnel requirements, cost increase indexes, unit costs, cost controls, procedures, and a brief discussion of alterations and improvements.

INTRODUCTION

Clinton Laboratories (forerunner of Oak Ridge National Laboratory) was established in 1943 as a two-year pilot plant. In the early days, each division occupied a separate facility and was responsible for the operation and maintenance of that facility. Maintenance competed with program requirements for funds. With the advent of multioccupancy facilities, a building-maintenance responsibility was established within the Plant and Equipment (P&E) Division (then the Engineering and Mechanical Division), and a small budget was established for this purpose.

The Laboratory has continued to grow and age, thus increasing maintenance requirements, while manpower and funds to satisfy these requirements have continued to decline. Escalating costs plus recovery from the "depression" years may be giving the impression of runaway costs in the building-maintenance function.

The information contained in this report is presented to make the reader aware of the complexities, magnitude, and costs of maintaining a multifacility research complex in a safe, reliable state.

EVOLUTION OF THE BUILDING-MAINTENANCE ACCOUNT

A systematic approach to the management of the maintenance of facilities or services did not exist in the early days. Each operating or research division was responsible for funding the maintenance work required for their facilities. If a research-oriented manager chose to ignore a leaking roof, a leaking faucet, or a burned-out light bulb and use his

funds for research work, he was free to do so, since his facility was the only one affected.

With multioccupancy facilities, such as the Central Research and Administration Complex, Area 4500, the buildings and their services became common to more than one group. In these situations, no one group felt responsible for services shared with others; hence the maintenance responsibility was established.

GROWTH OF THE BUILDING-MAINTENANCE ACCOUNT

Early records, long since lost, indicated that the building-maintenance function was probably established in 1950, or earlier, with a budget of about \$50,000 per year. Some persons who were involved seem to think that the account was established earlier than 1950 and was used to fund some minor painting in sensitive public areas and patching of a few roof leaks in shared areas of the Laboratory. A record of the scope of the maintenance activity prior to FY-1965 does not exist. The 3063 building-maintenance account had been merged with another account, probably in 1962 or 1963, and was not reestablished until November 1965, with an apparent budget of about \$900,000 per year. Since that date, we have reasonably complete information, if only in summary form.

The existence of gross deficiencies in the facilities at ORNL had been apparent for some time. Many roofs had deteriorated beyond a state where repair was reasonable, and replacement was necessary. Building service equipment had deteriorated to a point where complete overhaul or replacement was required before preventive maintenance programs could be instituted. Releases of radioactive material to the environs of the Laboratory were common because of plugged or failed filters; on the other hand, filters were being replaced unnecessarily because of the absence of a coordinated program for maintenance of exhaust systems (damper adjustments, fan respeeding, flow measurements, etc.). Hood-exhaust blowers were undersized or underspeeded, resulting in insufficient air flow to control hood contents. Numerous cases were found where cracked and ruptured mortar joints permitted entry of rain into the building walls, and the freeze-thaw cycles literally destroyed large sections of these walls. Windows were falling out, and doors were falling off their jambs. Chilled-water coils were freezing; steam-heating coils were leaking; floor drains were plugged; lavatories leaked steady streams of water; flush valves would not work; roofs leaked; glass was broken; lights were burned out; floor tiles were loose, etc., etc., ad infinitum! Heat exchangers had plugged tubes and patches upon patches. Heating equipment froze, and condensate lines were plugged with scale. Insulation was nonexistent in many cases, and there were few spare maintenance parts. Vital services could not be isolated for maintenance or repair because there was no alternate. "Finger-engineered" modifications of building utilities were considered inadequate and were not in keeping with codes or standards. Painting was practically nonexistent and still is marginal for an important, internationally recognized, research facility.

Important maintenance work was accomplished only on a fill-in basis until a failure occurred that resulted in a shutdown of the facility or program and repairs were effected on a crash basis.

Vast sums of money were expended to correct these deficiencies and to install alternate sources of vital utilities.

Much of the cost identity of this work cannot be established. Existing records indicate that at least \$1,000,000 was expended through FY-1970 to correct some of these deficiencies.

SCOPE OF THE MAINTENANCE FUNCTION

Maintenance of a research complex such as ORNL is no "small-potatoes" operation. A sampling of the scope of ORNL is listed below. Only those items paid for by account 3063 are included (no research equipment).

1. 190 buildings¹
2. approximately 1,500,000 ft² of roofing
3. approximately 2,500,000 ft² of floor area
4. 350 pumps
5. 28 emergency generators
6. 420 heaters of various descriptions
7. 32 vacuum pumps (house vacuum only)
8. 225 auxiliary emergency lighting units (battery powered)
9. 50 air compressors
10. 75 spare motors
11. 100 building cranes
12. 21 elevators
13. 36,000 light fixtures (30,000 fluorescent, 6000 incandescent)
14. 925 fume hoods (756 filtered)
15. 532 safety shower units
16. 61 eyewash units
17. 168 steam-reducing stations
18. 12,000 tons of air conditioning

-
1. A building has a roof and walls and is usually occupied continuously or intermittently (does not include cooling towers, storage sheds, etc.).

19. 127 service sinks (janitor's)
20. 507 bathroom lavatories
21. 468 commodes (or water closets)
22. 185 sanitary showers
23. 25,000 corded equipment items
24. 25,000 electrical receptacles
25. 10,000,000 ft² of paintable surface
26. 239 rest rooms and change rooms
27. 262 urinals
28. 10,000 pieces of building service equipment in programmed preventive maintenance

In addition, the complex includes miles of piping, electric wiring, and drain lines and thousands of doors. We don't really know how many windows, doors, locksets, stair treads, handrails, breaker panels, motor starters, and the like exist at ORNL. There are several thousands of each, and the task of cataloging them would be monumental.

A sampling of some of the material purchased from Stores in CY-1975 may help in conveying the magnitude of the maintenance task. A few of the more common items are tabulated below. These are Stores issues only, except paint and roof coating, and do not include material purchased on requisitions (the figures are approximate).

1. 6700 gal of paint and waterproofing
2. 6300 gal of roof coating
3. 19,300 light bulbs and tubes
4. 1100 vee belts
5. 4900 gal of gasoline and diesel fuel (used in exercising emergency generators)
6. 250 cylinders (of various sizes) of refrigerant
7. 1000 tubes of caulking
8. 1400 gal of lubricating oil
9. 1430 gal of cooling-tower corrosion inhibitor
10. 1540 gal of cooling-tower biocide

COST IDENTITY MECHANISMS

In an account of this magnitude, a mechanism for identifying costs and sources is a necessity. An index common to most ORNL facilities is floor area. Comparison of costs by unit of floor area is the only reasonable index available in monitoring maintenance cost trends.

Several EDP-printed reports are published monthly by the accounting functions in the Computer Technology Center.

The Operating Cost Report, UCN-1610A (Exhibit 1), provides total costs and man-month information. This report is the only cost and labor report published in summary form and is necessary in the management of any account.

The Labor Cost Report, UCN 618 (Exhibit 2), contains the details of labor distribution in terms of cost. This report is valuable in the determination of labor cost sources. It contains a cost summary of account payroll, charges in, charges out, and total labor for the account and any subaccounts. It is the only reliable source of costs for departmental labor and fringe-benefit costs.

The ORNL Work Order Summary, Report No. 1338 (Exhibit 3), is valuable in summarizing by categories of cost. It contains labor, overhead, and material costs for the current month, for fiscal years to date, and total to date. Also included is the estimate for the current fiscal year, the total estimate, and estimated balance.

The Work Order Report, Report No. 1440 (Exhibit 4), contains the complete detail of work order costs. Hours of labor by payroll code are given for the current month, fiscal year to date, and total to date. In addition, material item cost and details are presented for the current month, with the totals given only for fiscal years to date and total to date.

While of limited value in extracting management-type information, the Work Order Report is the only source of complete work order detail in one document. It is used primarily by field engineers and work center supervisors in job control.

The Detail Labor Charges, Report No. 1748 (Exhibit 5), contains the labor hour detail for the entire account. It is the only document where such information is available in one report and is the source of information used in determining the makeup of the work force charged to the account.

The information contained in the above-mentioned reports has been extracted and is contained in various forms in the tables and charts in later sections.

WORK ORDER SYSTEM

Work performed on the building-maintenance account is in accordance with the procedures of ORNL and the P&E Division.

The basic procedure is ORNL Standard Practice Procedure No. 38B (not appended to this report), which establishes the various types of work

orders in use at ORNL. Plant and Equipment Division Procedure D.1.6 (Exhibit 6), an adjunct to the ORNL Procedure, establishes authority and responsibility within the P&E Division for approval of work and other expenditures against work orders and accounts in P&E.

The Work Order, UCN-2879A (Exhibit 7), is the basic work order in use, as specified in SPP-38B, and is the basis for all other forms of work authorizations.

The Blanket Work Order Request, UCN-1685 (Exhibit 8), may be used to authorize the expenditure of funds, including up to 80 man-hours of labor, for small segments of standing work, when supported by a properly approved basic work order.

The Job Plan, UCN-4665 (Exhibit 9), may be used to authorize expenditure of funds as provided in P&E Procedure D.1.6, when properly completed and signed in accordance with procedures.

The Programmed Maintenance Card, Exhibit 10, constitutes authority to perform the work specified in the text of the card. These cards are computer printed in accordance with information contained in the P&E computerized preventive maintenance program. They are supported by standing blanket work orders.

DEFINITION OF MAINTENANCE WORK

Maintenance work is the work necessary to keep buildings and all their services operating in a safe, reliable condition and to protect the government's capital investment. All other work can be defined as either an alteration, an improvement, or a service to others.

Another way of stating this definition is that the facilities should be maintained in such condition that, if a change of facility occupancy or use occurs, any work associated with that change is not maintenance; and maintenance work is only the work required to maintain the building and installed services in such condition that they are available when needed by the later occupant.

The following maintenance categories have evolved at ORNL over a period of years and are called subnumbers in our cost-collection parlance:

Subnumber 01, Exterior Maintenance, collects the cost of maintaining the exterior features of a building's envelop except roofing. Exterior maintenance includes exterior doors and their hardware, windows and their hardware, handrails, entry steps, canopies, signs, rain gutters, siding, cleaning, mortar joint repairs, caulking, relaying of brick or block, and the application of waterproofing compounds.

Subnumber 02, Roofing Maintenance, collects the cost of maintaining all roofing at ORNL. Roofing maintenance includes inspections, minor repairs, and any rejuvenations (resaturating). Flashings, counterflashing, and maintenance of parapets are included, as well as complete reroofing.

Subnumber 03, Interior Maintenance, collects the cost of maintaining the interior features of ORNL buildings that are not included in one of the other subnumbers. Typical services or features identified here are doors and their hardware, compressed-gas systems, building vacuum systems, heating systems not associated with air-conditioning systems, and nonfiltered ventilating systems.

Subnumber 04, Drainage Systems Maintenance, collects the cost of maintaining the drainage systems within ORNL buildings, including process drains, sumps, sump pumps, sanitary sewers, and radioactive-waste systems.

Subnumber 05, Heating, Ventilating, and Air-Conditioning (HVAC) Maintenance, collects the costs of maintaining all HVAC systems at ORNL. Included are air filter maintenance, controls calibration and adjustment, lubrication, drives, cooling towers, air-cooled and evaporative condensers, preheat coils, reheat coils, perimeter heat coils, window and thru-wall units, antifreeze, motors, blowers, pumps, and power circuits associated with HVAC systems.

Subnumber 06, Exhaust Systems Maintenance,² collects the costs of maintaining exhaust systems that handle radiochemical and/or hazardous chemical fumes. Exhaust systems maintenance includes periodic hood-face velocity measurements, mechanical maintenance (drives and bearings), repair of sash mechanisms, replacement of glass, replacement of HEPA filters, maintenance of gages and alarms, and calibration of controls and alarms.

Subnumber 07, Steam Systems Maintenance, collects the cost of maintaining the steam systems in buildings at ORNL, including pressure-reducing valves, safety valves, traps, strainers, isolation valves, and insulation repair.

2. Central systems serving primarily cell-ventilation operations (e.g., HFIR, TRU, TUFCD, 3019, and the central facilities in the Isotopes Area) are not included in the building-maintenance account.

- Subnumber 08, Water Systems Maintenance, collects the cost of maintaining the water distribution systems within buildings at ORNL. Water systems maintenance includes maintenance of backflow-preventer valves, isolation valves, booster pumps, water heaters, heat exchangers, storage tanks, water stills, safety shower inspection, eyewash fountains, drinking fountains, and insulation repair.
- Subnumber 09, Electrical Systems Maintenance, collects the cost of maintaining electric power systems in buildings at ORNL. Electrical systems maintenance includes transformers, distribution panels, breakers, fuses, all branch circuits, motor controls, and receptacles.
- Subnumber 10, Auxiliary Electrical Systems Maintenance, collects the cost of maintaining auxiliary electric systems in buildings at ORNL. This work includes maintenance of emergency generators, engines, drives, transfer switches, and battery-powered emergency lighting. The cost of fuel and labor for periodic exercising is also included.
- Subnumber 11, Interior Painting, collects the cost of all interior maintenance repainting at ORNL on the basis of need or normal schedules. Normally, repainting on nonmaintenance requests is charged to the requester.
- Subnumber 12, Exterior Painting, collects the cost of maintenance painting on the exterior of buildings at ORNL on the basis of need or normal schedules.
- Subnumber 13, Corded Equipment Inspections, collects the cost of inspection of portable corded equipment and electrical receptacles at ORNL. The first charges to this subnumber were made in February 1970.
- Subnumber 14, Elevators, Cranes, and Hoists, collects the cost of maintaining hoisting equipment at ORNL and includes the cost of repair, replacement, or adjustments of motors, brakes, cables, hooks, and controls of cranes and elevators. Reropeing (cables), as required, is also charged to this subnumber.
- Subnumber 15, Floor Maintenance, collects the cost of maintaining floors of buildings at ORNL. Floor maintenance includes floor tile, cove base, patching of damaged concrete, carpeting (when approved), and poured-in-place floors.
- Subnumber 16, Relamping, collects the cost of relamping buildings at ORNL. Relamping includes tubes, bulbs, ballasts, starters, and fixture cleaning. These costs were collected separately beginning in November 1967.

Subnumber 96, Rest Room Maintenance, collects the cost of maintaining rest rooms and change facilities in buildings at ORNL. The work includes unplugging fixtures, repair or replacement of fixtures, valves, flush valves, nonskid tape in sanitary showers, and maintenance of stalls and doors.

Subnumber 95, Miscellaneous Maintenance, collects maintenance costs not classified elsewhere.

The information contained in the various sections of this report was prepared in the context of these definitions.

CONSUMER INDEX

Everyone has experienced rapidly increasing costs in the past several years, and ORNL is no exception. Information supplied by ORNL budgeting officials was used to construct a consumer index curve, Exhibit 11, covering the period from FY-1967 through FY-1975. Table 1 was constructed from the information contained in the curve (FY-1966 = 100). The figures in Table 1 were used to adjust experienced cost in later sections of this report.

Table 1. ORNL Consumer Index

Fiscal Year	Consumer Index	Fiscal year	Consumer Index
1966	100	1971	126
1967	102	1972	131
1968	107	1973	141
1969	114	1974	160
1970	120	1975	184

WAGE INCREASE INDEX

It is a firmly established fact that labor costs are increasing. Information contained in the various cost reports was used to construct a wage index for the average hourly person engaged in the maintenance function at ORNL. Table 2 was constructed by dividing the annual P&E hourly labor cost by the number of man-years of P&E hourly labor associated with that cost, line 1 divided by line 2, resulting in a dollars per man-year figure, line 3. The annual increase in dollars per man-year, line 4, and the increase from FY-1966 may be determined as in line 5. The index is easily determined by dividing successive dollars per man-year by the FY-1966 figure.

An interesting exercise consisted in comparing the wage increase index to the ORNL consumer index. This is done in lines 6 and 7, and the resultant comparison is shown in line 8. It is interesting to note that

Table 2. Wage Increase Index Determination, ORNL Journeymen Mechanics

	FY-1966	FY-1967	FY-1968	FY-1969	FY-1970	FY-1971	FY-1972	FY-1973	FY-1974	FY-1975
1. P & E Hourly Labor Cost, Dollars	541,590	642,450	697,730	668,060	655,790	692,450	694,490	767,380	795,130	1,152,850
2. Man-Years of P & E Hourly Labor	80.3	88.6	95.0	85.2	78.6	75.9	72.2	74.5	73.7	97.1
3. Dollars Per Man-Year	6,750	7,250	7,340	7,840	8,340	9,120	9,620	10,300	10,790	11,870
4. Annual Increase, Dollars Per Man-Year	--	500	90	500	500	780	500	680	490	1,080
5. Increase Since FY-1966, Dollars Per Man-Year	--	500	590	1,090	1,590	2,370	2,870	3,550	4,040	5,120
6. Wage Increase Index (FY-1966 = 1.00)	--	1.07	1.09	1.16	1.26	1.35	1.43	1.53	1.60	1.76
7. ORNL Consumer Index	--	1.02	1.07	1.14	1.20	1.26	1.31	1.41	1.60	1.84
8. Difference, WII - ORNL CI		+0.05	+0.02	+0.02	+0.06	+0.09	+0.12	+0.12	0	-0.08

the wage increase index continually outdistanced the consumer index until FY-1974, when the two were equal. Finally, in FY-1975, the wage increase index fell behind the consumer index by 0.08 point. This may be attributed to rapidly increasing material costs experienced in FY-1975.

The indexes contained in Table 2 are presented graphically in Fig. 1. The very steep slopes of both curves are readily apparent and vividly portray the deep reduction in buying power.

It is interesting to note the increase in labor rates in the past several years, especially for hourly employees. Table 3 contains the negotiated wage rates vs date of increase for a journeyman mechanic (e.g., carpenters, pipefitters, and electricians). The same information is presented in graphic form in Fig. 2. Calculations indicate that the Code 32 wage rate rose 84.6% during the period shown in the table. The current company-union contract contains wage renegotiation clauses for June 22, 1976, and June 22, 1977.

Table 3. Hourly Wage Rates, ORNL Journeymen Maintenance Mechanics

Effective Date	Rate, \$ per hr	Increase, \$ per hr	Percent Increase
4-15-65	3.45		
10-15-66	3.55	0.10	3
4-15-68	3.82	0.27	8
4-15-69	3.97	0.15	4
6-22-70	4.37	0.40	10
8-22-71	4.50	0.13	3
1-22-72	4.62	0.12	3
6-22-72	4.90	0.28	6
6-22-73	5.23	0.33	7
6-22-74	5.79	0.56	11
6-22-75	6.37	0.58	10

ACCOUNT TOTAL COSTS

Account 3063 absorbs a variety of charges from numerous sources, including the direct salaries of the monthly supervisors and department staff, weekly salaried support personnel, retained fringe benefits of all hourly personnel, the salaries of the 4500-complex building manager's group, various minor charges from Inspection Engineering, janitors, Waste Treatment groups, etc. In addition, the wages of all hourly personnel and material in direct support of the building maintenance function are included.

Table 4 presents a ten-year cost history of charges to account 3063. The format essentially follows that of the Operating Cost Report, Exhibit 7, with minor changes to clarify and further separate charges,

Fig. 1. Wage increase and consumer index vs fiscal years.

Fig. 2. Hourly wage rate, ORNL journeyman mechanic.

Table 4. Costs by Elements of Cost, Account 3063

	FY-1966	FY-1967	FY-1968	FY-1969	FY-1970	FY-1971	FY-1972	FY-1973	FY-1974	FY-1975	10-Year Total	% of Sub- Total	% of Total
Department Labor	141,260	118,320	194,890	133,530	171,620	200,890	226,030	251,920	260,650	319,900	2,069,010	63.93	13.45
Fringe Benefits	67,240	80,840	100,580	114,360	108,430	138,500	119,320	125,410	142,530	169,430	1,167,140	36.07	7.59
Subtotal:	208,500	199,160	295,470	248,390	280,050	339,390	345,350	377,330	403,180	489,330	3,236,150	100.00	21.04
Labor*													
Plant & Equipment	645,450	642,450	697,730	658,360	655,790	692,450	694,490	767,380	795,130	1,187,550	7,446,570	97.31	48.43
I & C	4,450	2,520	3,390	1,340	2,860	6,590	5,780	8,340	6,860	5,790	48,420	0.63	0.31
Inspection Engineering	380	1,290	0	60	210	40	50	320	270	1,770	4,390	0.06	0.03
General Engineering	26,380	33,370	24,760	7,070	3,420	3,350	6,460	4,170	5,340	34,000	148,320	1.94	0.96
ORGDP	60	520	200	10	300	140	360	0	0	0	1,590	0.02	0.01
Others	-230	0	10	-10	10	10	0	0	10	3,200	3,000	0.04	0.02
Subtotal:	676,580	680,150	726,090	677,330	662,590	702,580	707,140	780,210	807,610	1,232,310	7,652,290	100.00	49.76
Material													
Maintenance Material	412,420	600,610	356,000	301,540	240,870	230,540	267,630	233,960	276,000	447,380	3,366,950	84.94	21.89
Subcontracts	0	0	31,020	37,320	29,710	1,440	0	0	18,660	75,220	193,870	4.89	1.27
Outside Procurement [†]	0	100	0	-530	-1,050	0	10,240	13,050	17,210	60,980	100,000	2.52	0.65
Stores Material [†]	17,170	40,370	43,310	35,930	20,550	28,290	28,290	16,890	25,290	35,840	292,270	7.37	1.90
Travel	0	60	610	1,530	10	0	260	200	0	950	3,620	0.09	0.02
Other	0	0	0	110	10	0	630	670	2,000	3,890	7,310	0.19	0.04
Subtotal:	429,590	641,140	430,940	376,400	290,100	260,610	307,050	264,770	339,160	624,260	3,964,020	100.00	25.77
3063-1 Cost	0	0	54,690	56,550	54,980	60,130	55,410	51,340	58,230	111,300	512,630	--	3.33
Misc. Costs and Adjustments	-1,590	380	400	-10	1,990	-10	600	670	6,480	2,800	11,710	--	0.10
Total Account Costs:	<u>1,313,080</u>	<u>1,520,830</u>	<u>1,507,590</u>	<u>1,418,380</u>	<u>1,289,710</u>	<u>1,362,700</u>	<u>1,415,550</u>	<u>1,474,320</u>	<u>1,614,660</u>	<u>2,460,000</u>	<u>15,376,820</u>	--	100.00

* Includes general and administrative overhead (G&A) and burden where applicable.

[†] Material for departmental use.

such as department labor, fringe benefits, subcontracts, maintenance material, and departmental material.

The decline in total costs from FY-1967 to FY-1970 and a slight annual increase through FY-1974 may be noted, with an additional increase in FY-1975. A portion of the FY-1975 increase may be attributed to added emphasis on energy conservation work and reactivation of the Experimental Gas-Cooled Reactor (EGCR) facility, which is discussed in a later section of this report.

Figure 3 shows the totals of Table 4, with a smoothed average for the account. In addition, the information contained in the ORNL consumer index, Exhibit 6, has been used to adjust the smoothed average curve to indicate cost performance in terms of FY-1966 dollars.

Figure 4 shows the experienced costs adjusted for the consumer index. This plot clearly indicates that we have never equaled FY-1967 in terms of 1966 dollars.

Another interesting exercise is the comparison (Fig. 5) of later-year costs if FY-1966 costs were escalated in accordance with the consumer index. Obviously, the escalated cost is nearly equal to FY-1975 experienced cost.

Table 5 contains the same information as contained in Table 4, but the information is presented as percentages of the total with a ten-year average included. It may be noted that departmental labor and retained fringe benefits have averaged only 21% of the total over the ten-year period. Hourly labor constitutes approximately 50% of the total, while maintenance materials were approximately 22%. The balance went for departmental material, subcontracts, and shop cleaning.

SOURCE OF LABOR

Account 3063 absorbs labor charges from a variety of sources. Table 6 lists the principal source accounts. Those accounts enumerated are in the P&E Division with the exception of account 3060, which is Engineering. Minor labor costs come from a few accounts other than P&E, such as Inspection Engineering and the Instrumentation and Controls (I&C) Division. These accounts are included in the miscellaneous classification. In addition, the 3063 payroll, 3063 charges to other accounts, percent of payroll charged out, charges from non-3063 accounts, charge-ins as a percent of the total, and fringe benefits as a percent of the total are given. This information has been collected for the last eight years only on a routine basis, and no attempt has been made to construct it for FY-1966 and FY-1967. The total of Table 6 is presented graphically in Fig. 6. This is the total labor charged to the account.

Figure 7 presents the 3063 payroll and the percent of payroll charged out. The results of the "depression" years are readily apparent.

Fig. 3. Account 3063 cost totals vs fiscal years.

Fig. 4. Experienced cost adjusted for consumer index.

Fig. 5. FY-1966 costs escalated at consumer index rate.

Table 5. Elements of Cost, Percent of Total

	66	67	68	69	70	71	72	73	74	75	10-Yr. Avg.
Department Labor	10.8	7.8	12.9	12.9	13.3	14.7	15.7	17.1	16.1	13.0	13.4
Fringe Benefits	<u>5.1</u>	<u>5.3</u>	<u>6.7</u>	<u>8.1</u>	<u>8.4</u>	<u>10.2</u>	<u>8.4</u>	<u>8.5</u>	<u>8.8</u>	<u>6.9</u>	<u>7.6</u>
Subtotal:	15.9	13.1	19.6	21.0	21.7	24.9	24.4	25.6	25.0	19.9	21.0
Labor*											
Plant & Equipment	49.2	42.2	46.3	47.1	50.8	50.8	49.1	52.0	49.2	48.3	48.5
I & C	-	-	-	-	-	-	0.4	-	-	0.2	-
Inspection Eng.	-	-	0	-	-	-	-	-	-	-	-
General Eng.	2.0	2.2	1.6	-	-	-	-	-	-	1.4	-
ORGDP	-	-	-	-	-	-	-	-	0	0	-
Others	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>0.1</u>	<u>-</u>
Subtotal:	51.5	47.7	48.2	47.7	51.4	51.6	50.0	52.9	50.0	50.0	50.1
Material											
Maintenance Material	31.4	39.5	20.0	21.3	18.7	16.9	18.9	15.9	18.3	18.2	21.9
Subcontracts	0	0	2.5	2.7	2.3	-	0	0	1.2	3.0	-
Outside Procurement [†]	0	-	-	-	-	-	-	-	1.0	2.5	-
Stores Material [†]	1.3	2.6	2.4	2.5	1.6	2.1	2.0	1.1	1.6	1.5	-
Travel	0	-	-	-	-	-	-	-	0	-	-
Other	<u>0</u>	<u>0</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>0.2</u>	<u>-</u>
Subtotal:	32.7	42.2	25.0	26.5	22.5	19.1	21.7	18.1	21.0	25.4	25.4
3063-1 Costs	-	-	3.6	4.7	4.3	4.4	3.9	3.5	3.6	4.5	4.1
Miscellaneous	0	0	-	-	-	-	-	-	0.4	0.2	-

* Includes G&A and burden where applicable.

[†] Material for departmental use.

Table 6. Source Account Charges to 3063 (Dollars), Labor Costs Only

	FY-1968	FY-1969	FY-1970	FY-1971	FY-1972	FY-1973	FY-1974	FY-1975	8-Yr. Total	% of Total
3003 Field Engineering	52,950	50,900	64,200	106,220	85,610	74,320	43,110	73,640	550,950	5.7
3016 Fabrication	63,230	72,500	63,340	23,950	28,800	37,020	26,310	79,370	394,520	4.0
3060 Engineering	13,420	3,940	1,890	3,370	3,410	2,440	3,510	21,900	53,880	0.5
3062 Maintenance - Grounds	6,340	4,530	4,170	900	3,980	5,550	7,780	17,000	50,250	0.5
3063 Building Maintenance (hourly only)	195,370	200,680	202,090	190,180	216,010	253,800	335,020	492,640	2,085,790	21.5
3077 Electrical, A/C, and Heating Services	374,510	361,190	330,940	373,210	332,830	353,230	371,540	547,700	3,045,150	31.3
3078 Research Services - East	19,340	22,000	26,000	20,940	15,360	24,540	9,170	7,330	144,680	1.5
3079 Research Services - West	25,450	19,000	15,920	13,380	16,580	14,810	7,010	6,250	118,400	1.2
3080 Research Services - South	9,520	17,400	9,810	12,600	15,000	19,040	3,190	11,380	97,940	1.0
3081 Field Services	16,420	25,200	11,980	55,470	57,130	55,460	62,450	74,710	358,820	3.7
3063 Departmental Labor	195,270	154,330	144,120	183,880	199,830	221,780	216,960	273,000	1,553,370	16.1
3063 Fringe Benefits	95,730	114,860	107,530	135,510	118,370	124,700	138,780	163,920	999,400	10.3
Miscellaneous Charges and Adjustments	-4,200	122,670	14,600	-25,490	11,320	16,320	48,160	50,400	269,580	2.7
Account Totals:	<u>1,063,350</u>	<u>1,169,200</u>	<u>996,590</u>	<u>1,094,120</u>	<u>1,104,230</u>	<u>1,203,010</u>	<u>1,272,990</u>	<u>1,819,240</u>	<u>9,722,730</u>	
3063 Payroll	748,790	772,010	724,840	896,200	853,900	937,540	1,068,430	1,366,860	7,368,210	
3063 Charged Out	308,120	313,370	277,980	393,720	325,940	342,910	382,480	465,040	2,814,560	
% of Payroll Charged Out	41.1	41.2	38.4	43.9	38.2	36.6	35.8	34.0	38.2	
Charges In	622,680	584,320	550,110	596,300	576,300	614,000	587,040	917,420	5,048,810	
Charge Ins, % of Total	58.6	50.0	55.2	54.6	52.2	51.0	46.1	50.4	51.9	
Fringe Benefits, % of Payroll	12.8	14.9	14.8	15.1	13.9	13.3	13.0	12.0	13.6

Fig. 6. Labor charges to account 3063.

Fig. 7. Payroll for account 3063.

Figure 8 represents the labor charged by 3063 to other research and operating accounts. The depression-years pattern is also apparent in this figure, indicating that all segments of the Laboratory were affected by budget problems in the financially troubled past.

Figure 9 represents labor charges to 3063 from other accounts. The depression pattern is repeated.

Table 7 contains the same information as contained in Table 6, but the information is presented as percentages.

Table 8 contains the composition of manpower by payroll classification and source account to 3063. This is an average of January 1973 through June 1975. Requirements of less than 0.1 man-year are not enumerated. The total of this historical data is 120 man-years. The spread covers the hourly spectrum except for the janitorial force, Stores personnel, and the Cafeteria and Steam Plant employees. Each group's contribution to the total has been calculated and is given as a percent of the total. It is apparent that no one group dominates the account. The largest hourly group is the electricians (14% of the total). Laborers are second (11.3%), while painters and air-conditioning and refrigeration mechanics are in third position (10.3%). Pipefitters are in fourth position (9.1%), and carpenters and millwrights are in fifth position (5.5%).

Data have been accumulated on the makeup of the typical labor force utilized in the building-maintenance function since November 1973 and are presented in Table 9. Although only eight months are available for FY-1973, it is assumed that this information is approximately correct for the entire year. Fiscal years 1974 and 1975 are based upon complete information.

The following list further defines the roles of the classifications shown in Table 9 in the building-maintenance function.

1. Monthly includes the monthly salaried personnel assigned to account 3063 (supervisors, general supervisors, and department head). The 4500-complex building manager, one equivalent P&E area manager, and miscellaneous salaried personnel support from the Instrumentation and Controls and General Engineering Divisions.
2. Weekly includes the departmental clerk, two assistants to the 4500-complex building manager, miscellaneous weekly salaried assistance from the Field Engineering Department, Inspection Engineering, Fire Department personnel, and draftsmen in General Engineering.
3. Insulators are hourly craftsmen who repair, replace (after maintenance), and install new insulating materials on all piping, vessels, and air-conditioning ducts at ORNL. With the current emphasis on energy conservation, this activity becomes more important and will increase in intensity in the future as energy costs increase.

Fig. 8. Account 3063 charges to others.

Fig. 9. Labor charged to account 3063 by others.

Table 7. Source Account Charges to 3063, Percent of Total

	FY-1968	FY-1969	FY-1970	FY-1971	FY-1972	FY-1973	FY-1974	FY-1975	8-Yr. Avg.
3003 Field Engineering	5.0	4.4	6.4	9.7	7.8	6.2	3.4	4.0	5.9
3016 Fabrication	5.9	6.2	6.4	2.2	2.6	3.1	2.1	4.4	4.1
3060 Engineering	1.3	0.3	0.2	0.3	0.3	0.2	0.3	1.2	0.5
3062 Maintenance - Grounds	0.6	0.4	0.4	0.1	0.4	0.5	0.6	0.9	0.5
3063 Building Maintenance (hourly only)	18.4	17.2	20.3	17.4	19.6	21.1	26.3	29.1	20.9
3077 Electrical, A/C, and Heating Services	35.2	30.9	33.2	34.1	30.1	29.4	27.2	30.1	31.5
3078 Research Services - East	1.8	1.9	2.6	1.9	1.4	2.0	0.7	0.4	1.6
3079 Research Services - West	2.4	1.6	1.6	1.2	1.5	1.2	0.6	0.3	1.3
3080 Research Services - South	0.9	1.5	1.0	1.2	1.6	1.6	0.2	0.6	1.1
3081 Field Services	1.5	2.2	1.2	5.1	5.2	4.6	4.9	4.1	3.6
3063 Departmental Labor	18.4	13.2	14.5	16.8	18.1	18.4	17.0	15.0	16.4
3063 Fringe Benefits	9.0	9.8	10.8	12.4	10.7	10.4	10.9	9.0	10.4
Miscellaneous Charges and Adjustments	-0.4	10.4	1.4	-2.4	0.7	1.3	3.8	2.9	2.2
3063 Payroll, % of Total	70.4	66.0	72.7	81.9	77.3	77.9	83.9	75.1	75.6
Payroll Charged Out	41.1	41.2	38.4	43.9	38.2	36.6	35.8	34.0	38.6
Charges In	58.6	50.0	55.2	54.6	52.2	51.0	46.1	50.4	52.3
Fringe Benefits, % of Payroll	12.8	14.9	14.8	15.1	13.9	13.3	13.0	12.0	13.8

Table 8. Man-Years of Labor Charged to 3063 by Payroll Classifications

	3003	3011	3016	3017	3019	3060	3062	3063*	3075	3077	3078 3079 3080	3081	Shop Clean Up	Approx. Totals	Percent of Total
Monthly	2.4	0	0	0.9	0	0.3	0	12.6	<0.1	0	0	0	x	16.2	13.5
Weekly	0.7	x	<0.1	x	x	0.6	x	1.0	<0.1	0.7	0	0	x	3.0	2.5
Insulators	x	x	x	x	x	x	x	1.7	x	x	x	x	x	1.7	1.4
Machinists	x	x	0.5	x	x	x	x	x	x	x	x	x	x	0.5	0.4
Sheet Metal Workers	x	x	2.0	x	x	x	x	x	x	x	<0.1	x	x	2.0	1.6
Welders	x	x	0.2	x	x	x	x	0.5	x	x	0.1	0.1	x	0.9	0.7
Truck Drivers	x	x	x	x	0.2	x	<0.1	1.0	x	x	<0.1	0.2	x	1.5	1.2
Instrument Mechanics	x	x	x	x	x	x	x	x	0.6	x	x	x	x	0.6	0.5
Electricians	x	x	x	x	0.2	x	x	1.2	x	14.3	1.2	x	x	16.9	14.0
Substation Operators	x	x	x	x	x	x	x	x	x	4.3	x	x	x	4.3	3.1
Pipefitters	x	x	0.1	x	0.3	x	x	7.8	x	2.3	0.5	x	x	11.0	9.1
Millwrights	x	x	0.1	x	x	x	x	3.2	x	2.9	0.5	x	x	6.7	5.5
Boilermakers	x	x	0.2	x	x	x	x	x	x	x	x	x	x	0.2	0.2
Painters	x	x	x	x	x	x	x	12.4	x	x	x	x	x	12.4	10.3
Riggers	x	x	<0.1	x	x	x	x	x	x	x	<0.1	0.7	x	0.8	0.6
Laborers	x	x	x	x	x	x	0.9	3.7	x	1.4	0.1	0.2	7.3	13.6	11.3
Carpenters	x	x	x	x	x	x	x	5.7	x	0.6 [†]	0.3	x	x	6.6	5.5
Power Equip. Operators	x	x	x	x	x	x	0.1	x	x	x	<0.1	0.2	x	0.3	0.2
Automotive Mechanics	x	0.6	x	x	x	x	x	x	x	x	x	x	x	0.6	5.0
Leadburners	x	x	0.1	x	x	x	x	x	x	x	x	x	x	0.1	---
A/C & Refrig. Mechs.	x	x	x	x	x	x	x	x	x	12.4	x	x	x	12.4	10.3
Utility Mechanics	x	x	x	x	x	x	x	7.7	x	x	x	x	x	7.7	6.4
Totals:	3.1	0.6	3.2	0.9	0.7	0.9	1.0	58.9	0.7	38.9	2.9	1.4	7.3	120.0	†

* Includes fringe benefits.

† Assigned to 3077 from 3063 effective July 1973.

‡ Exceeds 100% due to rounding.

x -- Denotes that these classifications do not charge from these accounts.

Table 9. Typical Labor Force Charged to Building Maintenance, Man-Years

Payroll Classification	FY-1973	FY-1974	FY-1975
Monthly	16.6	15.9	19.3
Weekly	4.2	3.6	5.9
Insulators	1.2	1.2	2.6
Machinists	0.4	0.4	2.9
Sheet Metal Workers	2.6	1.5	2.3
Welders	1.4	0.7	1.0
Truck Drivers	1.2	1.0	1.1
Instrument Technicians	0.7	0.5	0.5
Electricians	18.0	15.0	18.8
Substation Operators	4.0	4.3	4.5
Pipefitters	12.1	9.7	11.5
Millwrights	6.2	5.9	8.7
Boilermakers	0.2	0.1	0.3
Painters	6.2	11.9	17.1
Riggers	0.8	0.6	1.0
Laborers	12.6	12.2	15.5
Carpenters	6.0	5.5	7.0
Power Equipment Operators	0.2	0.2	0.3
Automotive Mechanics	0.6	0.6	0.5
Leadburners	-	0.1	0.1
A/C & Refrigeration Mechanics	10.7	10.6	15.4
Utility Mechanics	7.8	7.0	8.1
Others	-	-	2.0
Totals:	113.7	108.5	146.4

4. Machinists machine replacement parts, such as pump and fan shafts, and other repair items for equipment used in providing various types of building services. This need usually arises when the equipment is so old that repair parts are no longer commercially available or when there is insufficient time to procure repair parts due to the urgency of the use of the equipment.
5. Sheet metal workers repair and replace air-conditioning and exhaust ducts that are fabricated from sheet metal, roofing flashings and counterflashings, and corner and edge flashings on metal buildings; install duct dampers; and maintain roof gutters and downspouts.
6. Welders are required for welding pipe and structural steel shapes in the course of repairing, replacing, or installing services and in maintenance of building structures.
7. Truck drivers are necessary to assist in the movement of men, materials, tools, and equipment around the Laboratory as required in the performance of maintenance work. In addition, this account supports a taxi service that was instituted to move hourly maintenance personnel.
8. Instrument technicians maintain the maintenance paging system, the radios used by 3063 personnel, and portions of the service system controls that are not maintained by electricians (air-conditioning and exhaust system controls).
9. Electricians perform all relamping services; maintain motor control centers, breaker panels, disconnect switches, motors, wiring, etc.; perform annual corded equipment inspections; lubricate electric motors; install emergency lighting; exercise the emergency power generators throughout the Laboratory; and perform numerous other maintenance functions.
10. Substation operators operate building electrical services and air-conditioning systems (start-stop), monitor systems operations, read meters, and perform a general hourly landlord observation function, off-shift, as assurance that all support systems are performing satisfactorily (e.g., air-conditioning systems, power distribution, exhaust and water systems, compressed gases, etc.).
11. Pipefitters maintain the many miles of pressurized piping in the attics, basements, service chases, etc., throughout the Laboratory. They perform maintenance on the thousands (we don't know how many) of valves, miles of drain lines, sewers, sumps, rest rooms, backflow-preventer devices, heating coils not associated with air conditioning, pressure-reducing stations, safety valves, heat exchangers, water heaters, unit space heaters, drains, and in-line pumps. Pipefitters also perform safety shower inspections and many other building services.

11. Millwrights maintain fans, blowers, air compressors, pumps, power transmission devices (such as vee belts), gearboxes, and couplings; align equipment; perform maintenance inspections; exchange air filters (dust filters and HEPA exhaust filters); and perform a comprehensive planned lubrication program and other miscellaneous functions.
12. Boilermakers perform a portion of the maintenance work on the water heaters and other service pressure vessels throughout the Laboratory, including repair or replacement of tubes and tube bundles in the steam-operated vessels. They fabricate smaller pressure vessels used in the Laboratory for noncritical service, where the size does not warrant commercial procurement.
13. Painters, of course, perform all painting at the Laboratory, both programmed and nonprogrammed. They perform other maintenance work, such as maintenance of signs on building exteriors; sandblasting, or other cleaning associated with maintenance painting; and application of waterproofing on the exterior of masonry buildings.
14. Riggers (iron workers) are involved in moving heavy equipment, materials, and supplies used in the maintenance function; in the use of boatswain's chairs; hanging of swinging scaffolds; installation of safe anchorages; rigging for high work; fabrication and installation of handrails and other guarding devices for buildings, service accesses, ladders, and platforms; and they perform numerous other services required in the maintenance function at ORNL.
15. Laborers serve as "strong backs" in essentially all areas of maintenance. They carry, hand, take out materials and debris, dig ditches and holes, mix mortar, handle concrete block and brick, do heavy work associated with roofing maintenance, sweep floors, bail water, run dewatering pumps, shovel dirt, serve as safety sentinels around dangerous work, and clean up P&E shops. Numerous tasks of infinite variety are assigned to laborers where there is no clear-cut evidence that the work should be assigned to skilled craftsmen.
16. Carpenters repair wood buildings and maintain most features of the insides of buildings, such as doors, locksets, door closers, glass, floor tile, acoustical tile, ceiling tile, and most features associated with the building envelop, such as windows, doors, stair treads, etc. Carpenters are assigned the task of maintaining nonskid tape in the sanitary showers throughout ORNL.
17. Power equipment operators operate mobile cranes in the process of moving supplies and equipment, lifting or lowering pallets of material, and hoisting boatswain's to high reaches for the purpose of painting or other maintenance work.

18. Automotive mechanics perform routine preventive checks and repair work on the emergency electric generator engines throughout the Laboratory, such as checking engine coolant and battery specific gravity, checking and replacing lubricating oil and antifreeze, and taking samples of engine oil for examination. Emergency generator engine rebuilding or overhaul may be done by the automotive mechanics.

Maintenance of departmental motor vehicles is charged to the automotive maintenance accounts.
19. Leadburners repair lead flashings, lead drains, and other very minor maintenance functions on a limited basis.
20. Air-conditioning and refrigeration mechanics maintain all air-conditioning and refrigeration equipment at ORNL. They perform repair and replacement of refrigerant compressors, refrigerant coils, and steam and hot water coils, when associated with air-conditioning equipment. They also repair, replace, adjust, and calibrate a wide variety of thermostats, humidistats, and pressure controls (pneumatic and electric); repair leaks in refrigerant systems; evacuate and recharge systems; change oil in refrigerant compressors; repair or replace condensers, evaporators, and integral window units; treat cooling towers; replace filters; maintain all manner of control valves; adjust zone controls; and perform various other duties.
21. Utility mechanics comprise a catch-all classification encompassing the so-called "trowel trades," roofing, etc. They lay brick and block; finish concrete; and set tiles of various sorts; repair damaged mortar and brick; acid-clean brick; and etch concrete. They also perform the maintenance on all built-up roofing at ORNL; repair plaster; repair concrete floors and steps; patch damaged walls, plug holes left when services are relocated or removed; and are an important part of the building preservation program.
22. Others include the occasional inspector from Inspection Engineering, the occasional janitor who mops up after a line break or repair job, an occasional Fire Department employee who stands by when some important feature of the fire protection system is out of service for maintenance, and other miscellaneous support personnel that are periodically required.

Table 10 indicates the number of hourly employees assigned to the building-maintenance account, by quarters, since FY-1968. Each year has been averaged to smooth the fluctuations. Please note that this represents the employees assigned to account 3063 and not the total charged to the account. Some of these employees were charged out to research and operating accounts, while other employees were charged in from other accounts.

Table 10. Hourly Personnel Assigned to Account 3063,
by Fiscal-Year Quarters

Quarter	FY-68	FY-69	FY-70	FY-71	FY-72	FY-73	FY-74	FY-75
First	77	80	80	82	68	72	72	88
Second	85	77	79	81	67	68	70	89
Third	79	76	82	72	68	64	75	88
Fourth	80	75	82	69	69	64	82	89
Average	80	77	81	76	68	67	75	88

Figure 10 illustrates the information contained in Table 10. The effects of reductions in force and attrition are clearly visible. Calendar year 1973 was the lowest in the eight-year period. An eight-year minimum of 64 was recorded in the third and fourth quarters of 1973. Thirty additional hourly employees, listed below, have been added to account 3063 since the second quarter of 1973 through 1975:

2 insulators	12 painters
1 electrician	3 laborers
1 pipefitter	4 carpenters
3 millwrights	4 utility mechanics

Table 11 contains a tabulation of man-years of labor charged to account 3063 for department labor and fringe benefits, P&E labor, and all other support labor. This information clearly indicates the general decline in the use of hourly labor in the maintenance of buildings at ORNL since the peak year of FY-1968 until FY-1975. It is also interesting to note that, for five consecutive years, the total man-years charged was under the ten-year average (FY-1970 through FY-1974) and in FY-1974 was within one man-year of being the lowest in the ten-year period.

Figure 11 illustrates the P&E hourly effort, and Fig. 12 contains the departmental labor, fringe benefits, and other support labor. Figure 11 indicates declines in four consecutive years, with a rather stable two-year period followed by the FY-1975 increases due, for the most part, to the addition of painters, roofers, and apprentices. Figure 12 indicates a rather stable situation for departmental employees and the total fringe benefits, but an increase, due to added employees, in FY-1975.

MAINTENANCE COSTS

As defined earlier in this report (definition of maintenance work), maintenance is the work required to maintain an asset in a safe, reliable state and to protect the capital investment. With that definition in mind, the information contained in the monthly EDP reports has been extracted to construct the following tables and figures. The data are as accurate as can reasonably be achieved with a reasonable expenditure of effort. Much additional effort would be required to produce exact

Fig. 10. Hourly personnel assigned to account 3063.

Fig. 11. Man-years of P & E hourly labor charged to account 3063.

Fig. 12. Man-years of department labor, fringe benefits, and other support labor charged to account 3063.

Table 1_. Man-Year Analysis, Account 3063

	FY-66	FY-67	FY-68	FY-69	FY-70	FY-71	FY-72	FY-73	FY-74	FY-75	10-Yr. Avg.
Dept. Labor & Fringe Benefits	24.5	21.5	30.7	29.9	25.2	29.5	29.2	30.2	29.4	34.0	28.4
Man-Years, P & E Labor	80.3	88.6	102.7	95.4	86.9	84.8	80.3	81.6	81.2	111.3	89.3
Man-Years, Other Support Labor	<u>1.8</u>	<u>2.3</u>	<u>2.0</u>	<u>0.6</u>	<u>0.6</u>	<u>0.9</u>	<u>0.9</u>	<u>1.0</u>	<u>0.8</u>	<u>2.3</u>	<u>1.3</u>
Total Man-Years:	<u>106.6</u>	<u>112.4</u>	<u>135.4</u>	<u>125.9</u>	<u>112.7</u>	<u>115.2</u>	<u>110.4</u>	<u>112.8</u>	<u>111.4</u>	<u>147.6</u>	<u>119.0</u>

figures, and that effort does not appear warranted at this time. In addition, the present work-order system would require revision to permit computer sorting of the maintenance costs from other costs.

In accordance with the cost categories established in the definitions earlier, Table 12 has been constructed. Each fiscal year has been totaled, and those totals are compared with FY-1966. In addition, the totals have been adjusted for the consumer index, and those figures are compared with FY-1966.

Figure 13 contains the fiscal-year totals, and Fig. 14 reflects the difference between fiscal-year totals and FY-1966. Figure 15 contains the annual costs and adjusted cost for the consumer index.

Figure 16 represents the cost added due to the consumer index for each fiscal year based upon annual experienced costs.

Figures 17 through 34 are plots of each of the maintenance categories contained in Table 12.

Figure 17 shows that exterior maintenance was at its minimum in FY-1968, with general increases until FY-1975. Increasing deterioration of masonry surfaces due to weathering has required increased emphasis on repairs and preservation of building surfaces to prevent further damage.

Figure 18 shows that roof maintenance costs were at the maximum in FY-1966, when it was necessary to reroof several facilities. The roofs had deteriorated beyond a repairable condition and were replaced. Added emphasis on early detection and repair of defects produced a gradual decline in costs until FY-1971. At that time, it became apparent that, if enormous reroofing costs were to be avoided, much additional emphasis on preventive work was needed. Over the ensuing three years (FY-72, -73, and -74), a roof preservation program was initiated. Fiscal year 1975 costs were approximately the same as those for FY-1974 and are expected to remain stable for the next few years as the preservation program functions to maintain and preserve the roofs.

Figure 19, which is for interior maintenance, generally shows the same pattern as for other areas. The Laboratory continues to grow and age, and additional attention is required to maintain it properly.

Figure 20, which covers the maintenance of drainage systems, shows that these cost have generally remained stable over the years until FY-1974 and FY-1975, when problems developed with process waste lines in the 4500 complex that required considerable effort to correct.

Figure 21, which covers heating, ventilating, and air-conditioning maintenance, indicates an increasing trend, up and down, until FY-1974, when the apprentice program was reestablished and, of even greater significance, the energy conservation mandates were reviewed. The adjustments from previously accepted normal temperature settings created

Table 12. Maintenance Costs by Categories

	FY-1966	FY-1967	FY-1968	FY-1969	FY-1970	FY-1971	FY-1972	FY-1973	FY-1974	FY-1975	Total	Average
01 Exterior Maintenance	38,360	16,390	12,940	23,920	21,960	25,200	35,670	35,710	41,230	74,820	326,270	32,630
02 Roof Maintenance	86,080	77,050	45,310	41,160	35,800	33,610	43,950	61,410	76,150	77,060	577,590	57,760
03 Interior Maintenance	76,170	63,190	68,360	38,550	52,680	58,210	51,230	84,080	72,410	117,620	682,500	68,250
04 Drainage Maintenance	19,320	20,930	20,240	18,310	18,440	11,810	13,050	16,250	19,260	41,380	198,990	19,900
05 HVAC Maintenance	233,280	267,430	259,690	288,850	256,560	300,000	291,250	267,290	282,180	393,630	2,840,080	284,010
06 Exhaust Systems Maintenance	95,140	85,120	70,420	60,020	55,480	57,690	51,190	57,020	62,340	81,320	675,740	67,570
07 Steam Systems Maintenance	29,440	18,010	22,690	12,760	18,590	12,220	18,550	18,350	16,880	24,990	192,390	19,240
08 Water Systems Maintenance	21,370	22,800	22,280	23,870	23,130	31,990	30,950	29,000	28,400	35,130	268,920	26,890
09 Electrical Maintenance	71,510	72,080	45,050	19,580	9,560	29,020	17,120	18,450	13,810	12,640	308,870	30,890
10 Auxiliary Electric Maintenance	18,650	13,050	16,550	16,850	15,510	26,300	19,310	24,610	28,990	30,800	210,650	21,060
11 Interior Painting	NA*	NA*	33,410	21,280	22,290	10,860	15,800	21,340	82,360	141,860	349,200	34,920
12 Exterior Painting	NA*	NA*	14,510	7,980	9,920	11,410	23,710	29,370	41,140	81,060	219,100	27,390
13 Cord Inspection	--	--	--	--	--	16,030	7,720	22,840	15,310	23,400	85,300	17,060
14 Elevators and Cranes	14,340	11,230	10,170	13,760	12,110	13,340	13,010	16,300	17,270	20,570	142,000	14,200
15 Floor Maintenance	NA*	NA*	6,220	4,580	13,630	5,630	21,820	24,770	17,140	28,020	121,810	15,230
16 Relamping	NA*	NA*	37,240	55,610	45,990	45,720	33,750	50,700	41,450	45,730	356,190	44,520
96 Rest Room Maintenance	NA*	NA*	4,120	4,530	7,810	9,310	10,210	13,900	15,700	14,420	80,000	10,000
95 Other Maintenance	138,000	143,120	56,510	17,410	13,380	18,010	14,630	16,920	11,950	20,010	449,970	45,000
Total:	841,660	810,940	745,620	669,020	632,840	716,360	712,920	808,310	884,010	1,264,470		
Difference from 1966	--	-30,720	-95,980	-172,640	-208,820	-125,300	-128,740	-33,350	+42,350	+422,810		
Totals Adjusted for CI	--	795,040	696,900	586,860	527,370	568,540	544,210	573,270	552,510	687,210		
Difference from 1966	--	-46,620	-144,760	-254,800	-314,290	-273,120	-297,450	-268,390	-289,150	-154,450		

*Established in FY-1968. These costs were collected in other categories in prior years.

Fig. 13. Maintenance costs by fiscal years, account 3063.

Fig. 14. Difference in maintenance cost from FY-1966.

Fig. 15. Annual maintenance cost and cost adjusted for consumer index.

Fig. 16. Cost added due to increase in consumer index.

Fig. 17. Exterior maintenance costs.

Fig. 18. Roof maintenance costs.

Fig. 19. Interior maintenance costs.

Fig. 20. Drainage systems maintenance costs.

Fig. 21. Heating, ventilating, and air-conditioning maintenance costs.

Fig. 22. Exhaust systems maintenance costs.

Fig. 23. Steam systems maintenance costs.

Fig. 24. Water systems maintenance costs.

Fig. 25. Electrical systems maintenance costs.

Fig. 26. Auxiliary electrical systems maintenance costs.

Fig. 27. Interior painting costs.

Fig. 28. Exterior painting costs.

Fig. 29. Corded equipment inspection costs.

Fig. 30. Elevator and crane maintenance costs.

Fig. 31. Floor maintenance costs.

Fig. 32. Relamping costs.

Fig. 33. Rest room maintenance costs.

Fig. 34. Miscellaneous maintenance costs.

vast numbers of problems that required additional mechanics to manipulate building zone controls and to make minor alterations in order to meet the mandates. Normally, this work would have been collected as a modification cost; but in this instance the items were too numerous and minor to sort out.

Figure 22, for exhaust systems maintenance, reflects a continual decline in costs through FY-1972, when the maintenance requirement stabilized, with continued cost-of-living increases thereafter.

Figure 23, for steam systems maintenance, reflects the general decrease in costs through FY-1971, with cost-of-living increases thereafter.

Figure 24 shows that water-system maintenance costs have remained stable, with only slight increases due to the cost of living.

Figure 25, for electrical systems maintenance, shows a very significant decline in FY-1968. This was due to removal of relamping from this category and the separate collection of relamping costs. The cost of maintaining the Laboratory's building electrical systems has continued to decline.

Figure 26 shows that auxiliary electric-systems maintenance costs have remained rather stable throughout the period, even in view of added units and continued aging.

Figure 27, for interior painting, clearly indicates the plight of the painting program at ORNL over the years. Costs prior to FY-1968 are not available. Since FY-1968, painters were always among the first to receive reductions in force until the painter crew was, in effect, eliminated. As indicated in this figure, the entire effort applied to interior painting was less than one man-year in FY-1971. Increased demands for painting to improve aesthetics in important areas of the Laboratory required the addition of personnel in FY-1974 and FY-1975. Progress is now being realized, and maintenance planning personnel are developing an interior maintenance painting plan for submission late in calendar year 1976.

Figure 28, for exterior painting, shows approximately the same pattern as for interior painting. It became apparent that additional emphasis on exterior painting was necessary to prevent damage to the building structures; therefore, the small quantities of painting resources available were assigned to exterior maintenance on a priority basis in order to lessen the rate of exterior deterioration. With increasing budgets, additional emphasis is now being placed on this important feature of building preservation.

Figure 29 shows the cost of conducting the electrical cord inspection program at ORNL. This cost collection point was established in FY-1971. Costs have continued to increase since that time and are expected to continue as the Laboratory continues to stress the importance of safety inspections.

Figure 30 shows the cost of maintaining the Laboratory's elevators and cranes. Costs have remained relatively stable over the years, with only cost-of-living increases.

Figure 31 shows the cost of maintaining the flooring systems. Costs of floor maintenance were identified as a particular concern in FY-1968 due to the age of most of the buildings at ORNL, which still had much of the original flooring systems. Costs have increased steadily since that time and are expected to increase in the future (Building 4500-N still contains much of the original floor tile).

Figure 32 shows the cost of the relamping activity at ORNL. The cost of relamping was identified as a concern early in the cost-collection activity but was not established as a cost-collect element until FY-1968. The costs of relamping followed the general pattern of decline until the energy conservation mandates were received. Approximately 8000 fluorescent light tubes were removed from service, and that cost was charged to relamping. Since lighting levels were reduced, additional emphasis is necessary inasmuch as burnouts or flickering tubes can no longer be tolerated.

How much does it cost to maintain a rest room? The answer is, "more than one would estimate." Figure 33 shows the cost of maintaining the rest rooms and change rooms at the Laboratory. The trend is up. Leaking pipes, dripping faucets, plugged commodes, dry floor drains, rusting partitions, etc., contribute to a continuing maintenance problem that appears to be increasing.

Finally, Fig. 34 shows the cost of a catchall group. If the activity cannot be identified as belonging to one of the previous groups, it goes here. In some of the previous groups, the costs prior to FY-1968 were collected here. As refinements in cost collection were made, these costs were reduced rapidly and have remained at a low level since those dates. Some additional refinement in these costs is possible, but the value of such refinement is questionable.

Table 13 contains a ten-year cost history by buildings, the ten-year totals, and the average for the period. Columns have been totaled by fiscal years. Only specifically identified buildings are included in this tabulation. This is interesting information but is of little value except for trend monitoring; therefore, Table 14 was constructed, which contains the building-maintenance cost in cents per square foot per fiscal year, with the ten-year average per building. The building floor area and the average unit cost for the period is given. In addition, the averages for each fiscal year are given. In this manner, changes in facility size are readily considered in examining annual costs.

Figure 35 plots the unit-cost data by fiscal year. The minimum was apparently reached in FY-1969. Costs have continued to rise since then, even though the period from FY-1970 through FY-1973 is considered the depression years. The lower line in this figure shows the experienced

Table 13. Total Maintenance Cost by Facility

Bldg.	FY-1966	FY-1967	FY-1968	FY-1969	FY-1970	FY-1971	FY-1972	FY-1973	FY-1974	FY-1975	10-Year Total	10-Year Average
1000	9,030	6,350	10,020	6,550	7,170	7,560	9,090	7,570	7,870	15,400	86,610	8,660
1504	--	--	--	--	--	--	--	--	240	2,460	2,700	1,350
2000	12,670	8,910	35,490	8,590	10,970	9,600	15,190	25,630	17,640	18,510	163,200	16,320
2001	15,990	11,460	12,050	15,160	10,420	12,320	18,290	20,080	19,260	32,880	168,910	16,890
2008	10,050	2,100	1,260	2,870	2,170	5,810	1,880	2,930	3,100	1,430	33,600	3,360
2010	7,280	6,310	8,320	5,850	10,000	6,020	9,950	8,400	16,520	14,490	93,140	9,310
2011	2,110	1,120	2,800	3,110	2,040	2,430	1,370	1,940	4,780	3,340	25,040	2,500
2013	17,260	4,480	3,550	3,130	3,560	6,090	3,930	4,920	2,640	14,430	63,990	6,400
2016	--	--	830	800	510	730	1,670	1,160	1,110	1,910	8,720	1,090
2018	2,080	12,150	5,560	1,290	1,570	1,180	1,120	1,600	1,040	1,920	29,510	2,950
2024	--	--	1,200	650	650	1,620	3,800	2,500	4,900	5,550	20,870	2,610
2026	10,460	7,690	8,580	7,800	9,970	7,130	9,330	10,060	14,390	15,530	100,940	10,090
2069	2,900	2,510	830	1,510	1,460	1,000	1,540	3,170	1,410	2,890	19,220	1,920
2500	2,880	1,090	2,340	4,020	2,340	3,820	3,580	3,280	5,860	4,820	34,030	3,400
2506	11,780	1,270	2,550	1,280	1,780	1,760	1,540	4,120	3,010	3,970	33,060	3,310
2516	6,600	1,000	2,420	720	1,010	1,480	1,270	1,250	1,340	6,380	23,470	2,350
2518	11,080	12,360	5,900	3,660	2,870	2,700	5,820	3,360	7,000	10,490	65,240	6,520
2519	4,390	6,820	2,810	3,320	3,560	3,370	3,160	5,040	3,750	7,000	43,220	4,320
2525	4,520	16,360	8,760	6,150	6,080	7,150	9,340	11,560	12,330	16,760	99,010	9,900
2531	2,410	1,990	2,850	2,040	3,060	4,220	3,140	5,280	2,690	3,770	31,450	3,140
3001	6,800	11,800	10,810	7,050	4,960	8,220	6,570	12,030	24,050	10,630	102,920	10,290
3003	820	2,530	1,400	900	1,000	3,510	6,380	2,080	3,340	2,900	24,860	2,490
3005	10,220	4,670	3,790	1,860	2,550	2,270	2,050	3,500	4,410	2,930	38,250	3,820
3010	8,040	6,050	5,910	3,730	3,270	4,980	7,010	3,370	4,150	5,630	52,140	5,210
3012	3,840	1,990	1,840	2,510	1,520	1,280	3,220	1,330	2,140	16,450	36,120	3,610
3017	4,090	4,480	1,100	750	610	3,910	5,440	4,320	6,710	4,110	35,520	3,550
3019	14,610	13,690	14,920	10,690	15,780	21,810	13,700	13,140	19,910	13,310	151,560	15,160
3024	1,680	2,410	780	2,390	2,320	3,730	2,480	2,400	2,490	13,850	34,530	3,450
3025	15,310	23,140	11,470	12,990	18,490	13,000	11,010	11,140	28,030	14,380	158,960	15,900
3026	5,770	35,740	9,520	6,440	5,960	7,670	5,350	8,160	7,160	11,410	103,180	10,320
3028	2,960	1,960	2,410	3,000	2,820	2,410	1,890	2,130	1,960	3,630	25,170	2,520
3029	960	2,710	1,470	1,730	2,340	1,640	1,420	1,750	3,200	4,060	21,280	2,130
3037	3,100	2,150	2,190	6,500	5,020	1,800	2,280	3,460	4,080	8,660	39,240	3,920
3038	4,560	3,570	3,430	5,220	3,510	2,200	3,070	3,900	4,120	9,640	43,220	4,320
3042	25,520	18,380	16,720	14,170	11,170	10,030	9,280	11,790	10,600	17,770	145,430	14,540
3044	4,230	4,800	2,820	2,890	3,020	3,800	4,410	3,140	4,140	4,970	38,220	3,820
3047	9,430	15,180	12,520	7,180	9,530	11,220	16,090	10,000	9,780	11,930	112,860	11,290

Table 13 (continued)

Bldg.	FY-1966	FY-1967	FY-1968	FY-1969	FY-1970	FY-1971	FY-1972	FY-1973	FY-1974	FY-1975	10-Year Total	10-Year Average
3104	400	530	2,320	3,230	1,470	360	510	800	970	1,800	13,290	1,330
3500	13,010	21,580	14,860	14,430	26,430	20,620	14,990	14,530	28,690	22,160	191,630	19,160
3502	2,080	1,460	560	1,430	2,400	770	1,620	1,640	490	2,230	14,680	1,470
3503	3,540	3,140	2,770	2,730	2,880	3,310	2,020	2,750	1,480	10,670	35,290	3,530
3504	2,360	7,790	3,130	3,030	4,630	3,780	3,160	3,620	3,600	3,330	37,430	3,740
3508	6,480	6,930	6,390	8,010	10,610	6,420	6,830	5,000	6,790	6,650	70,110	7,010
3517	13,350	6,900	10,450	8,840	7,210	8,880	7,300	10,600	5,930	11,530	90,990	9,100
3525	18,070	14,270	8,450	6,920	17,290	9,800	9,860	8,630	12,450	16,930	122,670	12,270
3550	37,790	9,350	3,360	2,940	2,110	3,240	4,150	4,700	4,960	6,260	78,860	7,890
4500N&S*	298,980	263,880	--	--	--	--	--	--	--	--	562,860	56,290
4500N	--	--	181,790	155,960	109,610	92,880	125,770	116,160	149,060	204,530	1,135,760	141,970
4500S	--	--	72,350	89,560	85,410	86,260	73,850	103,000	103,920	118,690	733,040	91,630
4501	24,760	20,650	18,370	20,580	13,490	18,370	18,100	26,280	20,760	49,050	230,410	23,040
4505	12,640	17,670	10,640	8,620	10,940	11,160	7,820	9,130	17,520	21,620	127,760	12,780
4507	7,230	0	1,880	1,060	1,240	2,940	1,530	1,460	7,850	5,890	31,090	3,110
4508	55,230	46,720	44,750	43,740	44,580	44,320	40,610	54,850	44,050	62,550	511,400	5,110
4509	Costs prorated to buildings served.											
5000	1,280	4,050	1,650	1,300	1,020	1,790	2,760	1,330	1,100	840	17,120	1,710
5500	13,900	12,960	13,330	14,040	13,020	16,020	17,240	14,990	21,530	25,330	162,360	16,240
5505	--	14,520	7,270	8,570	6,690	8,170	5,450	6,570	7,780	10,840	75,860	8,430
6000	14,690	15,190	16,970	14,230	15,270	17,010	16,140	23,330	23,870	29,630	186,330	18,630
6010	--	--	1,120	3,940	7,000	10,980	8,250	9,740	13,500	12,660	67,190	8,400
6025	--	--	1,420	3,190	4,610	6,180	6,950	7,240	4,590	7,830	41,920	5,240
7001	2,650	2,280	4,860	5,710	5,090	2,630	4,570	8,630	6,040	13,020	55,480	5,550
7002	3,900	8,740	10,660	3,630	2,380	3,250	5,060	5,790	4,390	11,780	59,580	5,960
7003	700	940	1,860	840	2,340	1,580	1,210	2,230	1,420	4,410	17,530	1,750
7005	2,390	1,310	1,800	1,100	4,170	3,410	1,380	1,540	1,720	6,240	25,060	2,510
7007	1,110	1,860	1,580	1,140	820	900	650	1,910	1,190	990	12,150	1,220
7009	2,160	1,820	5,210	2,440	2,980	3,190	3,250	4,870	1,010	4,320	31,250	3,120
7012	5,750	2,730	6,350	11,640	8,310	5,500	5,540	5,750	8,010	9,440	69,020	6,900
7500	6,190	20,880	1,960	3,060	3,200	8,340	4,340	2,950	3,360	1,710	54,990	5,500
7503	8,030	9,770	5,340	4,310	3,770	4,000	1,350	2,660	7,740	4,180	51,150	5,120
7601	--	--	--	--	--	--	--	--	--	1,030	1,030	1,030
7602	--	--	--	--	--	--	--	--	--	270	270	270
7603	--	--	--	--	--	--	--	--	--	2,030	2,030	2,030
7605	--	--	--	--	--	--	--	--	--	320	320	320

Table 13 (continued)

Bldg.	FY-1966	FY-1967	FY-1968	FY-1969	FY-1970	FY-1971	FY-1972	FY-1973	FY-1974	FY-1975	10-Year Total	10-Year Average
7700	2,370	2,160	2,430	2,370	2,160	2,160	4,580	3,870	4,020	1,780	27,900	2,790
7709	1,220	1,190	1,390	980	620	870	4,490	840	580	1,400	83,580	8,360
7710	4,530	4,190	6,890	1,450	2,560	5,030	2,720	4,160	10,900	3,100	45,530	4,550
7900	10,530	10,280	11,640	11,140	11,990	20,110	12,560	17,660	12,240	18,200	136,350	13,640
7910	2,520	1,960	2,800	3,810	2,790	2,500	3,780	3,680	3,660	3,280	30,780	3,080
7920	11,540	13,130	7,140	11,750	9,040	10,200	13,190	12,190	8,570	15,160	111,910	11,190
7930	--	--	8,770	15,170	15,060	12,580	11,620	19,450	14,400	16,100	113,150	14,140
Totals:	<u>851,810</u>	<u>810,450</u>	<u>725,730</u>	<u>665,300</u>	<u>640,580</u>	<u>649,520</u>	<u>684,180</u>	<u>746,020</u>	<u>841,300</u>	<u>1,091,140</u>	<u>7,777,670</u>	<u>1,028,951</u>

*Collected as one facility through FY-1967.

Table 13 (continued)

Bldg.	FY-1966	FY-1967	FY-1968	FY-1969	FY-1970	FY-1971	FY-1972	FY-1973	FY-1974	FY-1975	10-Year Total	10-Year Average
7700	2,370	2,160	2,430	2,370	2,160	2,160	4,580	3,870	4,620	1,780	27,900	2,790
7709	1,220	1,190	1,390	980	620	870	4,490	840	580	1,400	83,580	8,360
7710	4,530	4,190	6,890	1,450	2,560	5,030	2,720	4,160	10,900	3,100	45,530	4,550
7900	10,530	10,280	11,640	11,140	11,990	20,110	12,560	17,660	12,240	18,200	136,350	13,640
7910	2,520	1,960	2,800	3,810	2,790	2,500	3,780	3,680	3,660	3,280	30,780	3,080
7920	11,540	13,130	7,140	11,750	9,040	10,200	13,190	12,190	8,570	15,160	111,910	11,190
7930	--	--	8,770	15,170	15,060	12,580	11,620	19,450	14,400	16,100	113,150	14,140
Totals:	<u>851,810</u>	<u>810,450</u>	<u>725,730</u>	<u>665,300</u>	<u>640,580</u>	<u>649,520</u>	<u>684,180</u>	<u>746,020</u>	<u>841,300</u>	<u>1,091,140</u>	<u>7,777,670</u>	<u>1,028,951</u>

*Collected as one facility through FY-1967.

Table 14. Building-Maintenance Unit Costs, Cents Per Square Foot Per Year, by Facility

Bldg.	FY-66	FY-67	FY-68	FY-69	FY-70	FY-71	FY-72	FY-73	FY-74	FY-75	Average	Floor Area	Notes
1000	20.7	14.6	23.0	15.0	16.5	17.3	20.9	17.4	18.1	35.3	19.9	43,580	
1504	--	--	--	--	--	--	--	--	4.8	49.2	27.0	5,000	Occupied FY-1974.
2000	54.2	38.1	151.8	36.7	46.9	41.1	65.0	109.6	75.5	79.2	69.8	23,380	
2001	74.9	50.5	53.1	66.8	45.9	54.3	80.6	88.5	84.9	126.6	72.6	25,960	3,280 sq ft added FY-1975.
2008	243.9	51.0	30.6	69.7	52.7	141.0	45.6	71.1	75.2	34.7	81.6	4,120	
2010	75.6	48.5	64.0	45.0	76.9	46.3	76.5	64.6	127.0	111.4	73.6	13,010	3,380 sq ft added FY-1967.
2011	40.9	21.7	54.3	60.3	39.5	47.1	26.6	37.6	92.6	64.7	48.5	5,160	
2013	156.2	40.5	32.1	28.3	32.2	55.1	35.6	44.5	23.9	130.6	57.9	11,050	
2016	--	--	34.6	33.3	21.2	30.4	69.6	48.3	46.2	79.6	45.4	2,400	
2018	31.6	184.6	84.5	19.6	23.9	17.9	17.0	24.3	15.8	29.2	44.8	6,580	
2024	--	--	21.5	11.7	11.7	16.6	38.9	25.6	50.2	56.8	29.1	9,770	4,200 sq ft added FY-1971.
2026	59.6	43.8	44.6	40.5	51.8	37.0	48.5	52.3	74.8	80.7	53.4	19,240	1,700 sq ft added FY-1968.
2069	44.7	38.7	12.8	23.3	22.5	15.4	23.7	48.8	21.7	44.5	29.6	6,490	
2500	58.5	22.2	47.6	81.7	77.6	77.6	72.8	66.7	119.1	98.0	69.2	4,920	
2506	112.6	12.1	24.4	12.2	17.0	16.8	14.7	39.4	28.8	37.9	31.6	10,460	
2516	125.0	18.9	45.8	13.6	19.1	28.0	24.0	23.7	25.4	120.8	44.4	5,280	
2518	80.8	90.1	43.0	26.7	20.9	19.7	12.4	24.5	51.0	76.0	47.6	13,720	
2519	26.5	41.2	17.0	16.5	17.7	16.7	15.7	25.0	18.6	34.7	23.0	20,160	3,600 sq ft added FY-1969.
2525	21.5	77.9	41.7	29.3	29.0	28.2	36.8	45.6	48.6	66.1	42.5	25,350	4,350 sq ft added FY-1971.
2531	33.0	27.3	39.0	27.9	41.9	57.8	43.0	77.3	36.8	51.6	43.1	7,300	
3001	19.3	33.5	30.6	20.0	14.1	23.3	18.6	34.1	68.2	30.1	29.2	35,270	
3003	16.3	50.2	27.8	17.9	19.8	69.6	126.6	41.3	66.3	57.5	49.3	5,040	
3005	244.5	111.7	90.7	44.5	61.0	54.3	49.0	83.7	105.5	70.0	91.5	4,180	
3010	154.6	116.3	113.7	71.7	62.9	95.8	134.8	64.8	79.8	108.3	100.3	5,200	
3012	46.4	24.0	22.2	30.3	18.4	15.5	38.9	16.1	25.9	86.5	52.4	8,280	
3017	78.7	86.2	21.1	14.4	11.7	36.2	50.4	40.0	62.1	38.1	43.9	10,800	5,600 sq ft added FY-1971.
3019	41.9	39.3	42.3	30.7	45.3	62.5	39.3	37.7	57.1	38.2	43.5	34,870	
3024	13.5	19.4	6.3	19.3	18.7	30.0	20.0	19.3	20.0	111.6	27.8	12,410	
3025	60.6	91.6	45.4	51.4	73.2	51.5	43.6	44.1	97.2	49.8	60.8	28,850	3,600 sq ft added FY-1974.
3026	24.9	154.2	41.1	27.8	25.7	33.1	23.1	35.2	30.9	49.2	44.5	23,180	
3028	58.7	38.9	47.8	59.5	55.9	47.8	37.5	42.3	38.9	72.0	49.9	5,040	
3029	40.0	112.9	61.2	72.1	97.5	68.3	59.2	72.9	133.3	169.2	88.7	2,400	
3037	40.0	27.7	28.3	83.9	64.8	23.2	29.4	44.6	52.6	111.7	50.6	7,750	
3038	61.0	47.8	45.9	69.9	47.0	29.4	41.1	52.2	55.2	129.0	57.8	7,470	
3042	82.4	59.3	54.0	45.7	36.0	32.4	30.0	38.1	34.2	57.4	47.0	30,980	
3044	72.9	82.8	48.6	49.8	52.1	65.5	76.0	54.1	71.4	85.7	65.9	5,800	
3047	40.4	65.0	53.6	30.7	40.8	48.0	68.9	82.8	41.9	51.1	52.3	23,350	
3104	5.7	13.3	33.2	46.3	21.1	12.3	7.3	11.5	13.9	25.8	19.0	6,980	

Table 14 (continued)

Bldg.	FY-66	FY-67	FY-68	FY-69	FY-70	FY-71	FY-72	FY-73	FY-74	FY-75	Ave-age	Floor Area	Notes
3500	19.7	32.7	22.5	21.9	41.0	31.2	22.7	22.0	34.5	33.6	29.1	66,000	
3502	19.3	8.1	3.1	7.9	13.3	4.3	9.0	9.1	2.7	12.4	8.9	18,000	7,200 sq ft added FY-1967.
3503	34.7	30.8	27.2	26.8	28.2	32.5	19.8	27.0	14.5	104.6	34.6	10,200	
3504	49.2	162.3	65.2	63.1	96.5	78.8	65.8	75.4	75.0	59.4	80.1	4,800	
3508	85.5	91.4	84.2	105.7	140.0	84.7	90.1	66.0	89.6	87.7	92.5	7,580	
3517	133.5	69.0	104.5	88.4	72.1	88.8	73.0	106.0	59.3	115.3	91.0	10,000	
3525	62.3	49.2	29.1	23.9	59.6	33.8	34.0	29.8	42.9	58.4	42.3	29,000	
3550	270.5	66.9	24.0	21.0	15.1	23.2	29.7	33.6	35.5	44.8	56.4	13,970	
4500N&S*	37.8	33.3	--	--	--	--	--	--	--	--	35.6	791,970	
4500N	--	--	40.3	34.5	24.3	20.5	27.9	25.7	33.0	45.3	31.4	451,460	
4500S	--	--	21.2	26.3	25.1	25.3	21.7	30.2	30.5	34.9	26.9	340,510	
4501	31.0	25.3	23.0	25.7	16.9	23.0	22.6	32.9	26.0	61.3	28.8	80,000	
4505	31.6	44.1	26.6	21.5	27.3	27.9	19.5	27.8	43.8	54.0	31.9	40,040	
4507	151.3	0	39.3	22.2	25.9	61.5	32.0	30.5	164.4	123.2	65.0	4,780	
4508	23.0	19.5	18.6	18.2	18.6	18.5	16.9	22.8	18.4	25.1	20.1	240,000	
4509	Costs prorated to facilities served.												
5000	22.6	71.7	29.2	23.0	18.0	31.7	48.8	23.5	19.5	14.9	30.3	5,650	
5500	30.9	28.8	29.6	31.2	28.9	35.6	38.3	33.3	47.8	55.3	36.1	45,000	
5505	--	66.5	33.2	39.1	30.5	37.5	24.9	30.0	35.5	49.5	38.5	21,900	
6000	33.6	34.8	38.9	32.6	34.9	38.5	36.9	53.4	54.6	67.8	42.6	43,700	
6010	--	--	6.7	23.6	42.0	65.5	49.5	58.4	72.7	68.2	48.4	18,570	1,900 sq ft added FY-1974.
6025	--	--	23.7	51.7	76.8	103.6	115.8	120.7	76.5	71.8	80.0	10,900	4,900 sq ft added FY-1975.
7001	10.1	8.6	18.4	21.7	19.3	10.0	17.4	32.8	22.9	45.4	21.1	26,340	
7002	17.4	38.9	47.5	16.2	10.6	14.5	22.5	25.8	19.6	52.5	26.5	22,440	
7003	14.1	19.0	37.6	17.0	47.3	31.9	24.4	45.0	28.7	85.1	35.4	4,950	
7005	53.2	29.2	40.1	24.5	92.9	75.9	30.7	34.3	38.3	139.0	55.3	4,490	
7007	31.7	53.1	45.1	32.6	23.4	25.7	18.6	54.6	34.0	28.3	34.7	3,500	
7009	31.1	26.2	75.0	35.1	42.9	45.9	46.8	70.1	14.5	62.2	45.0	6,950	
7012	22.1	10.5	24.4	44.8	32.0	21.1	21.3	22.1	30.8	36.3	26.5	26,000	
7500	64.5	217.5	20.4	31.9	33.3	86.9	45.2	30.7	35.0	17.8	58.3	9,600	
7503	61.1	74.3	40.6	32.8	28.7	30.4	10.3	20.2	58.9	31.8	38.9	13,140	
7601	--	--	--	--	--	--	--	--	--	**	**	**	
7602	--	--	--	--	--	--	--	--	--	9.3	9.5	11,040	
7603	--	--	--	--	--	--	--	--	--	*	*	*	
7605	--	--	--	--	--	--	--	--	--	1.6	1.6	20,160	
7700	**	**	**	**	**	**	**	**	**	**	**	**	

Table 14 (continued)

Bldg.	FY-66	FY-67	FY-68	FY-69	FY-70	FY-71	FY-72	FY-73	FY-74	FY-75	Average	Floor Area	Notes
7709	37.2	36.3	42.4	29.9	18.9	26.5	136.9	25.6	17.7	42.7	41.4	3,280	
7710	60.8	56.2	92.5	19.5	34.4	67.5	36.5	55.8	146.3	41.6	61.1	7,450	
7900	18.2	17.7	20.1	19.2	20.7	34.7	21.7	30.4	21.1	31.4	23.5	58,000	
7910	18.8	14.6	20.9	28.4	20.8	18.7	28.2	27.5	27.3	24.5	23.0	13,400	
7920	41.1	46.8	25.5	41.9	32.2	36.4	47.0	43.5	30.6	54.0	39.9	28,050	
7930	--	--	22.8	39.5	39.2	32.7	30.2	50.6	37.5	41.9	36.8	38,420	
Average	59.7	53.5	40.9	35.9	38.0	41.5	42.1	44.0	49.9	62.7	45.2		
ORNL CPI	100	102	107	114	120	126	131	141	160	184			
Adjusted CPI	59.7	52.5	38.2	31.5	31.7	32.9	32.1	31.2	31.2	34.1			

*Not applicable for a combined collection.

**Not in cost collection program.

Fig. 35. Building-maintenance unit costs.

costs adjusted for the consumer index. This indicates that, when compared with FY-1966 costs, the present rates are substantially lower than for any year preceding FY-1969.

It has been recognized that unit cost decreases as facility size increases. The data contained in Table 13 have been used to construct Fig. 36. This is an approximation of declining unit cost with increasing building size. No claim is made as to the statistical accuracy of this information. Several points were averaged on the low end of the horizontal axis, while few are available on the high end. In addition, many facilities in the 20,000- to 30,000-ft² range are laboratories, as opposed to smaller office and service facilities.

The declining cost vs increasing size is predictable inasmuch as the cost of maintaining a utility distribution station for a large facility is only slightly more expensive than for smaller facilities. The cost of repairing a dripping faucet in a small facility is equal to the cost of repairing a faucet in a large facility; albeit, there may be more of them.

Also, as may be predicted, the curve will flatten eventually. One facility of approximately 450,000 ft² has averaged 31.4 cents per square foot over an eight-year period; another facility of 240,000 ft² has averaged 20.1 cents per square foot in the same period. The absence of several facilities in this size range makes more positive assertions unwise, but this appears to be the trend.

Thus, it appears feasible that facilities be constructed as large as possible, consistent with effective utilization of space, in order that maintenance costs are minimized.

It should be noted also that a square floor plan (in relation to building perimeter) provides the maximum floor area, which would further reduce unit costs.

PROGRAMMED MAINTENANCE

The P&E Division developed a computerized preventive maintenance scheduling system early in the 1960s that is known as the Programmed Maintenance Program. The system is used to perform the scheduling of preventive maintenance work on building services and equipment.

The cost of the program has been a lingering question through the years. In FY-1974, a cost-collection system was devised and put into effect, with the first data becoming available in October 1973. Records indicate that the programmed maintenance activity accounted for approximately 13.8% of the total maintenance cost in FY-1974 and 15.2% in FY-1975. This information is rather useless, since the extent of computerized scheduling and planning can be varied over a wide range. For example, it could range anywhere between 0 and 100%. The effect of the use of a computerized scheduling system on total maintenance costs would be much

Fig. 36. Unit maintenance cost vs facility size.

more meaningful information, assuming that the preventive, or other, work was performed on schedule. It could be assumed that, if maintenance were performed properly on the optimum schedule, breakdowns and other failures could be minimized, thus minimizing costs. Budget problems have not permitted this situation to be observed.

ALTERATIONS AND IMPROVEMENTS

For the purpose of these discussions, alterations may be defined as work associated with changes to a facility to accommodate changing facility use. For example, a partition alteration could provide suites of offices, create office space from a service area, or create a laboratory from a suite of offices. In other words, an alteration is the creation of a new space from some previous space. It may also be defined as the alteration of a utility or service to serve newly altered facilities.

Improvements, on the other hand, may be defined as causing an existing service, utility, or facility to be more useful by increasing capacity, extending coverage, or making changes to reduce operating and maintenance costs.

Generally, the P&E Division does not fund alterations; however, exceptions are (1) needed alterations in P&E facilities may be supported if funds are available and (2) alterations in public areas of other Laboratory facilities under proper conditions.

The costs of improving the facilities at the Laboratory are, as a rule, not chargeable to the building-maintenance account; but there are some exceptions. Since the costs of maintenance are charged to the building-maintenance account, minor improvements are funded as funds are available if that work results in reduced maintenance. Indeed, in this manner, significant reductions in maintenance costs have been realized in the several years the account has been in existence. A recent example of improvement work is the installation of energy conservation features, primarily in P&E Division facilities. (Note: The existence of recently installed conservation features permitted continued operation of the 7000-area facilities when the natural gas supply was severely curtailed in December 1974.)

Inadequacies in original design and construction have hindered maintenance efforts for many years. Where minor deficiencies affect maintenance costs, safety, or reliability, they are corrected as funds are available.

From the foregoing statements, it may be deduced that these are variable costs, which is true to a very large degree. There has not been a year when some alteration or improvement costs were not incurred, because, even in the depression years, the Laboratory remained somewhat fluid with changing use of facilities associated with the transition from a hardware type of research to more or less of a software type. This change required the modification of facilities; and, as a result of those modifications, some alterations of utilities and services were

necessary. In addition, past finger-engineered installation of services and utilities had not always been in keeping with recognized codes and standards (e.g., ASME Unfired Pressure Vessel Code, National Plumbing Code, and National Electric Code).

In recent years, the use of UCC-ND Engineering Standards was directed by Laboratory management. This, in effect, has caused large portions of the Laboratory's utility and service systems inside buildings to be reviewed. This is not to say that the existing services are not in accordance with those standards but merely raises the question.

Computer-printed cost reports dating back to FY-1965 have been reviewed. Lists of alteration and improvement work have been compiled and are presented in Appendix II. The jobs are specifically identified, but blanket (or small) jobs have not been included because of the monumental task of such a compilation. Note the increased attention to the Occupational Safety and Health Act (OSHA) involved safety work in FY-1972 and FY-1973 and to energy conservation work beginning in FY-1973. It is stressed that these lists do not constitute a complete listing of this work.

In addition, as a part of the cost monitoring activities, all identifiable alteration and improvement work has been collected on a routine basis since FY-1968. Table 15 contains those costs by fiscal years and in categories in keeping with maintenance-cost identities. Totals by fiscal years are given, and these totals contain the cost of specific jobs previously listed. By subtracting the specific lists from the fiscal-year totals, a figure is obtained that may be assumed to be the blanket-order type, or minor work, discussed previously.

This information is presented in Fig. 37. The steady decline in these costs through FY-1973 may be attributed to completion of improvement work and continuing budget reductions. The FY-1974 and FY-1975 increases may be attributed to OSHA-induced safety requirements and, to a greater degree, the energy conservation work required to meet the ERDA mandates. In addition, the cost of reactivating the EGCR facilities for the Liquid-Metal Fast Breeder Reactor (LMFBR) Fuel Reprocessing Facility was charged to this account.

MATERIAL COSTS

It is difficult to analyze material costs with any degree of confidence. This is an important factor in preparing budgets and, as may be noted in these exercises, can introduce significant variables in a cost plan.

In view of the vast numbers of items consumed, it is impractical to attempt to analyze specific items over a long period of time. In addition, the availability of a particular material, or the cost of that material, tends to result in substitutions. Thus, it appears more

Table 15. Alterations and Improvements, Account 3063

	FY-1968	FY-1969	FY-1970	FY-1971	FY-1972	FY-1973	FY-1974	FY-1975
01 Exterior	3,080	6,960	2,450	40	3,280	2,770	5,060	43,430 ^b
02 Roofs	1,580	2,940	2,120	920	3,470	3,090	4,630	25,290
03 Interior	6,820	1,580	16,520	8,540	11,100	3,260	33,210	64,680 ^b
04 Drainage	6,660	670	3,900	20	100	50	1,700	100
05 HVAC	55,240	33,840	11,800	16,470	8,690	18,440	2,300	18,760 ^b
06 Exhaust	4,890	16,000	10,230	0	380	100	140	660
07 Steam	4,230	10,810	17,940	15,340	19,670	4,230	3,240	6,690
08 Water	2,550	3,410	4,490	800	7,860	1,350	1,040	4,090
09 Electrical	22,480	17,980	1,580	2,610	3,760	4,690	1,660	2,030
10 Auxiliary Electrical	0	4,810	0	10	0	540	1,220	0
12 Exterior Painting ^a	0	9,590	2,550	0	0	220	0	0
14 Elevators and Cranes	0	80	1,820	1,780	440	0	80	630
96 Rest Rooms	6,000	0	220	160	1,140	5,550	1,570	8,170
95 Miscellaneous	<u>55,160</u>	<u>40,870</u>	<u>11,620</u>	<u>10,260</u>	<u>40</u>	<u>200</u>	<u>160</u>	<u>92,740^c</u>
	168,690	149,540	87,240	56,950	59,930	44,490	56,010	266,270
Less Specific Job List Totals:	125,070	66,760	65,220	29,990	40,030	40,070	35,300	212,760
Assumed Minor Work:	43,620	82,780	22,020	26,940	19,900	4,430	20,710	54,610

^aPainted for aesthetics only.^bContains \$124,420 for energy conservation improvements.^cContains \$76,200 for reactivation of EGCR facility.

Fig. 37. Alteration and improvement costs.

appropriate to compare material costs with more easily obtainable parameters. This comparison is shown in Table 16. Here, the parameters are hourly labor costs, material costs, and man-years of labor.

One might examine the ratio of material to labor. Figure 38 is a plot of this analysis. In this case, the ratio was high in the early years of our history, with a very rapid decline. The high values in FY-1966 and FY-1967 were due, in part, to year-end purchases of maintenance materials as a result of surplus budgets. Those materials were consumed in later years, with corresponding reductions in maintenance costs. The ratio continued to decline until the FY-1971 to FY-1973 period, when material costs essentially skyrocketed.

Another way of examining material costs is as a percentage of the total direct maintenance cost. This is done in Fig. 39; the pattern repeats as in Fig. 38.

One final exercise is to compare the cost of material per man-year of labor. This comparison is shown in Fig. 40; and, again, the pattern repeats.

One can only conclude that predictions concerning future material costs on maintenance budgets may be something less than accurate.

FACILITY GROWTH

Financial conditions in recent years might lead us to believe that the Laboratory was stagnant in terms of physical growth, which is not true. In the period of CY-1966 through CY-1976, approximately 165,000 ft² of space was added — approximately 100,000 ft² with the acquisition of the former EGCR facilities and approximately 65,000 ft² in new construction. Two currently approved projects — the Heavy Ion Laboratory and the Environmental Sciences Laboratory — will be included in the near future, and the Energy Systems Research Laboratory is in the planning stage.

The 65,000 ft² of new construction is derived from numerous small additions to facilities and will not be enumerated here. Figure 41 is a plot of the growth since FY-1966. Admittedly, this is not phenomenal growth; but it does illustrate the fact that the Laboratory is not dormant. Each one of these additions to the Laboratory's space inventory places additional maintenance requirements on already limited resources.

Appendix II is a list of buildings in the building-maintenance cost-collection system, with approximate floor areas.

CONCLUSIONS

Building-maintenance costs have declined from a high in FY-1967 to a low in the period from FY-1970 to FY-1973. The reasons for this decline are varied from elimination of conditions resulting in high maintenance costs to forced reductions in budgets. The cost of doing business has

Table 16. Material Cost Analysis

	FY-1966	FY-1967	FY-1968	FY-1969	FY-1970	FY-1971	FY-1972	FY-1973	FY-1974	FY-1975
Hourly Labor ^a	541,690	642,450	697,730	668,060	655,790	692,450	694,490	767,380	795,130	1,152,850
Maintenance Material Costs	412,420	600,610	356,000	301,540	240,870	230,540	267,630	233,960	294,340	483,780
Man-Years of Hourly Labor	80.3	88.6	95.0	85.2	78.6	75.8	72.2	74.5	73.7	97.1
Ratio Material/Labor	.761	.935	.510	.451	.367	.333	.335	.305	.371	.420
Material as a Percent of Total	43.2	48.3	33.8	31.2	26.9	25.0	27.8	23.4	27.0	29.6
Material Per Man-Year	5,140	6,780	3,750	3,540	3,060	3,040	3,710	3,140	3,990	4,980

^aDoes not include shop cleanup or EGCR reactivation costs.

Fig. 38. Ratio of material costs to hourly labor costs.

Fig. 39. Material cost as a percent of total maintenance costs.

Fig. 40. Material cost per man-year of labor.

Fig. 41. Growth of floor area at ORNL.

increased by a factor of approximately 1.84 over the FY-1966 figure. The wage-increase index constructed for a journeyman mechanic approximates the consumer index supplied by budget officials.

The Laboratory continues to grow and age. Wages and material costs continue to increase. Maintenance costs reached a minimum in the period from FY-1970 to FY-1973, with some recovery in FY-1974 and FY-1975. Any reduction in maintenance levels will result in future deterioration of the facilities at the Laboratory.

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Appendix I

PARTIAL LISTS OF ALTERATIONS AND IMPROVEMENTS

PARTIAL LIST OF ALTERATIONS AND IMPROVEMENTS - FY-1965

A06808-11	Reverse Exhaust Fans, Paint Shop	\$ 2,697
A06927-11	Install Manometers, A/C Systems, 4500S	415
A06928-11	Install Filter and Fan Monitoring Equipment, 4508	53
A06993-11	Install Bypass Connections, Backflow Preventer Valves	344
A06995-11	Alter A/C Ducts, 2001	210
A06998-11	Alter Steam Reducing Station and Condensate System, 1000	894
A10201-01	Install Exhaust Fan Alarms, Wing 1, 4500S	27
A10204-01	Repair Room, 2013	1,626
A11002-11	Provide Emergency Power to Sump Pumps, 4500S	30
A11004-11	Modify Condenser Water Piping, A/C Systems, 4500N	2,061
A11006-11	Engineering for Lighting Survey, 3037	310
A11008-11	Correct Air Conditioning Deficiencies, 3047	157
A11025-11	Improve Air Conditioning, Rm. F-4, 4500N	257
A11049-11	Design and Estimate Electric Reheat, Building 7710	471
A11057-11	Alter Discharge Piping from Sump Pump, Building 5500	14
A11061-11	Change Electrical Receptacles to NEMA, 4501, 4505, & 4507	1,658
A11075-11	Alter, Check, and Calibrate PE Switches, 4500N Exhaust Systems	3,349
A11080-11	Relocate Fire Hose Cabinet, Room 121, 4508	211
A11088-11	Construct Change Facility, 4500S Attic	88
A11098-11	Improvements for 3500 Air-Conditioning System	3,724
A11104-11	Study and Estimate Preheat System, 4500N	2,474
A11108-11	Construct Planters, 4500N	447
A11114-30	Provide "As-Built" Wiring Diagrams, 4509 A/C System	496
A11115-01	Install Strainer, Backflow Preventer Valve, 4508	359
A11116-01	Change Electrical Receptacles to NEMA, 5500	1,611
A11132-01	Install Hood Exhaust Alarms, 4500N	5,040
A11133-01	Draw Air Flow Diagrams, 4500 Complex	892
A11134-01	Provide Emergency Power, 4500N Elevator	1,870
A11134-30	Design Emergency Power, 4500N Sump Pumps	430
A11135-01	Install Dust Filters, Paint Shop	264
A11137-01	Install Lighting, 2506 Porch Area	1,678
A11139-01	Synchronize 4508 Emergency Generators	1,904
A11144-01	Install Public Address System Paint Shop to Carpenter Shop	323
A11145-01	Construct Ladder Rack, 2013	648
A11146-01	Upgrade Steam Reducing Station, 4501	4,101
-30		
A11147-01	Alter Sanitary Drain, 7001	637
A11154-30	Permanentize 2069	1,539
31		
A11156-01	Construct Roof Over Monorail, 3026D	885
A11159-01	Install Vacuum Tie-Line, 4500N to 4501	1,160
A11160-01	Install Backflow Preventer Valve, 4500N	1,435
A11162-01	Install Heat and Rest Room, 2516	3,095
A11165-01	Upgrade Exhaust System, 2000 Area	691
A11165-30	Upgrade Exhaust System, 2000 Area	965
A11167-01	Relocate Building Maintenance Facility to 2013	960
A11169-01	Install Outside Push Button Station, 4500N Elevator	22
A11175-01	Install Attic and Exit Lights, 4500N	492
A11176-01	Electrical Alterations, 3025	1,656
A11177-01	Relocate Lavatory Facilities, 3502	572
A11182-01	Modify Building 2516	3,411
A11184-01	Install Backflow Preventer Valve, Chilled Water System, 4509	690
A11190-01	Rest Room Modifications, Building 2013	796
A11192-01	Upgrade Steam Reducing Station, 4508	415
A11194-01	Separate Process and Potable Water, 3550	12
A11197-01	Design Water Treatment Facilities, 4509	871
A11205-01	Install One-line and Control Diagrams, M-G Sets	18
A11206-01	Install Control Diagrams, ORNL Elevators	83
A11216-30	Design and Estimate Fire Door, 7001	13
A11220-01	Install Sump Pump, 4500N	12
A11221-01	Increase Supply Air, 4500N	6
A11222-01	Install Floor Drains, A/C Plenums, 4500S and 4508	6
A11223-01	Install Additional Cooling, Lab G-1, 4500N	6
--	Miscellaneous Alterations and Improvements	<u>16,812</u>

Total of This List:

\$78,394

PARTIAL LIST OF ALTERATIONS AND IMPROVEMENTS - FY-1966

A11006-12	Lighting Improvements, 3037	\$ 190
A11006-56	Lighting Improvements, 3037	5,819
A11090-01	Air Balance Study, 4508 and Operating Study, 4509	1,019
A11098-11	Improve Air-Conditioning System, 3500E	1,445
A11114-30	Provide "As-Built" Drawings, 4509	746
A11116-01	Change Receptacles to NEMA, 5500	565
A11133-01	Provide Air Flow Diagrams, 4500 Complex	22
A11134-02	Provide Emergency Power to Sump Pumps, 4501	1,494
A11139-01	Synchronize Generators, 4508	912
A11146-01	Upgrade Steam Reducing Station, 4501	1,776
A11169-01	Outside Pushbutton Station, 4500N Elevator	200
A11175-01	Install Attic and Exit Lights, 4500N	2,241
A11192-01	Upgrade Steam Reducing Station, 4508	1,879
A11197-01	Install Water Treatment Facilities, 4509	3,895
A11200-01	Update Operating Procedure, A/C Units, 4509	1,053
A11201-01	Install Exhaust Fan Alarm Switches, 4500S	1,283
A11205-01	Provide Emergency Generator, One-Line Diagrams	7,271
A11206-01	Provide Elevator Control Diagrams	169
A11216-30	Design and Estimate Fire Door, 7001	521
A11219-01	Locker Room Modifications, 4500N	977
A11220-01	Install Sump Pumps, 4500N	3,707
A11222-01	Install Floor Drains, A/C Plenums, 4500S and 4508	275
A11223-01	Install Additional Cooling Capacity, Lab G-1, 4500N	205
A11227-30	Design Weather Canopy, Building 2016 (West Portal)	1,006
A11230-01	Change Receptacles to NEMA, 3025	1,664
A11232-01	Install Sump Pumps Alarms, 4500N	3,819
A11233-01	Make Supply Air Flow Diagrams, 4500 Complex	1,760
A11237-01	Convert Receptacles to NEMA, 4505 and 4507	3,528
A11238-01	Convert Receptacles to NEMA, 3503, 3504, and 5000	2,640
A11239-01	Convert Receptacles to NEMA, 7000 Area	4,045
A11240-01	Cut Trough in Floor, 4501	208
A11241-01	Alter Change Room, 3037	3,179
A11244-01	Install Curb, Lab BG-74, 4501	580
A11247-01	Install New Floor Tile, Building 7002	230
A11250-01	Close Windows, South End, 7001	107
A11255-01	Install Corridor Lights, 3550	2,084
A11257-01	Improve Rest Room, Building 3550	3,788
A11263-01	Install Canopy, West Side 2010	1,190
A11267-01	Install Hot Process Water Tie, 4501 and 4505	1,117
A11268-01	Install Emergency Exit Door, 4508	894
A11269-01	Convert Receptacles to NEMA, 2000 and 2024	2,488
A11270-01	Install Floor Tile, 2010	150
A11281-01	Install Canopies, West Portal (2016)	137
A11282-01	Engineering Review, Heating and A/C Controls, 4500N	19
A11283-01	Engineering Review, Heating Coils, 4500N	26
A11285-01	Install Quarry Tile in Kitchen of Cafeteria, 2010	405
A11286-01	Move 300-kw M-G Set from K-25 to 7507	276
A11287-01	Relocate A/C Condensers, 3517	30
A11288-01	Modify A/C System, 3517	21
A11289-01	Prepare Engineering Specifications, Various Projects	2,125
A11292-01	Survey and Estimate, Upgrade Emergency Power, 4500N	17
A11294-01	Convert Receptacles to NEMA, 3012 and 3517	17
A11296-01	Upgrade Sump Pumps, 4508	52
A11300-01	Change Receptacles to NEMA, 3005 and 3042	18
A11317-01	Reroute Steam and Air Lines, 2518	181
A11317-39	Reroute Steam and Air Lines, 2518	127
A11317-56	Reroute Steam and Air Lines, 2518	\$ 7,648
A11318-56	Paint Building 2531 (Waste Evaporator)	1,738
A11322-01	Modify Air-Conditioning Unit, Civil Defense, 4500N	34
A11323-01	Convert Room 245, 4508, to a Rest Room	61
A11323-56	Convert Room 245, 4508, to a Rest Room	627
A11335-01	Complete Air Line Loop, 2519	340
A11335-56	Complete Air Line Loop, 2519	11,335
A60300-95	Emergency Shower Alterations, ORNL Area	1,331
A50239-95	Miscellaneous Alterations	17,879
A71026-39	Interior Improvements, 2069 (Change House)	909
A71026-56	Interior Improvements, 2069 (Change House)	15,629
A71040-01	Alterations, Second Floor, Building 1000	141
A71040-39	Alterations, Second Floor, Building 1000	716
A71040-56	Alterations, Second Floor, Building 1000	41,210

Total of This List: \$175,190

PARTIAL LIST OF ALTERATIONS AND IMPROVEMENTS - FY-1967

Al1098-11	Improvements to Air-Conditioning System, 3500E	\$ 1,035
Al1114-30	Provide "As-Built" Drawings, Electrical System, 4509	193
Al1139-01	Synchronize Generator, 4508	1,886
Al1200-01	Update Operating Procedures, 4500 Complex	169
Al1205-01	Prepare and Install One-Line Diagrams, M-G Plants	9,317
Al1206-01	Prepare Elevator Control Diagrams	33
Al1222-01	Install Floor Drains, A/C Plenums, 4500S and 4508	524
Al1233-30	Prepare Supply Air Flow Diagrams, 4500 Complex	1,336
Al1240-01	Cut Trough in Floor, 4501	346
Al1281-01	Install Canopies, West Portal, 2016	2,618
Al1282-01	Engineering Review, Heating and A/C Controls, 4500 Complex	13
Al1283-01	Engineering Review, Heating Systems, 4500N	1,211
Al1285-01	Install Quarry Tile in Kitchen of Cafeteria, 2010	8,529
Al1286-01	Move Emergency Generator from K-25 to 7507	2,150
Al1288-01	Modify A/C Units, 3517	770
Al1292-01	Engineering Survey, Upgrade Emergency Power, 4500N	4,110
Al1294-01	Convert Receptacles to NEMA, 3012 and 3517	1,647
Al1295-01	Convert Receptacles to NEMA, 3024, 3505, and 3550	1,381
Al1296-01	Upgrade Sump Pumps, 4508	1,663
Al1299-01	Install Gas Storage and Distribution Facilities, Building 2516	1,022
Al1300-01	Convert Receptacles to NEMA, 3005 and 3042	1,375
Al1301-01	Fabricate and Install Degreasing Hood, 2516	1,416
Al1305-01	Construct Storage Shed, North Side, 2567	47
Al1314-01	Construct Ladder Rack, 2516	399
Al1317-01	Reroute Steam and Air Lines, 2518	79
Al1322-01	Modify A/C Units, Civil Defense, 4500N	7
Al1323-01	Convert Room 245, 4508 to a Rest Room	107
Al1323-39	Convert Room 245, 4508 to a Rest Room	153
Al1323-56	Convert Room 245, 4508 to a Rest Room	3,984
Al1335-01	Complete Air Line Loop, 2519	13
Al1336-01	Construct Welding Gas Storage Facility, 2013	1,554
Al1340-01	Engineering Review, Cafeteria Heating and A/C System	65
Al1344-01	Study and Estimate for an Electric Motor Pool	315
Al1347-01	Install Isolation Valve in Condenser Waterline, 3025 A/C	396
Al1357-01	Install Vents on Condensate Lines, 4500N A/C System	1,706
Al1358-01	Paint Identification Symbols Under Safety Showers, ORNL	1,909
Al1359-01	Relocate Steam Reducing Station, 5500	1,978
Al1360-01	Relocate 250 psi-Steam Station to Outside Pit, 3500	148
Al1361-01	Design and Estimate Safety Valve Discharge & M-G Set Exhaust, 4500N	1,171
Al1364-01	Alter Outside Air Intake, 2518	260
Al1365-01	Alter Equipment Room Exhaust, 2518	380
Al1366-01	Separate Potable and Process Water, Bldg. 2001	40
Al1366-30	Separate Potable and Process Water, Bldg. 2001	468
Al1367-01	Separate Potable and Process Water, Bldg. 2008	5
Al1367-30	Separate Potable and Process Water, Bldg. 2008	568
Al1372-01	Provide Blowdown and Make-up Water, 3086 Cooling Tower	710
Al1373-01	Install Ground Detectors, 480-volt Systems	2,342
Al1374-01	Install Hydrogen Line to Glass Shop, 4500N	1,549
Al1375-01	Revise Condensate Piping, Preheat Coils, 4500S	2,082
Al1376-01	Remove Transformer, G-56, 4500S	635
Al1378-01	Design and Install Return Air Filters, HPRR, 7710	289
Al1378-30	Design and Install Return Air Filters, HPRR, 7710	289
Al1381-01	Install New Thermostats, Wing 5, 4500N	1,767
Al1385-30	Install Canopy Over Dock, 4500N	3,255
Al1388-01	Install Thermostat, 3017	504
Al1389-01	Update Building Drawings, 2000	25
Al1393-01	Install Paging System, 7009	432
Al1395-01	Revise Steam Reducing Station, 4500N	461
Al1401-01	Study and Estimate - Replace A/C Condensers, 3019	29

(FY-1967)

A11402-01	Install Fire Doors, 7001	\$ 3,674
A11410-01	Install Additional Reheat, Room 117A, 4501	330
A11410-01	Install Motorized Valves in Chilled Water System, 4509	29
A11411-01	Install Water Treatment Facilities, 6000	733
A11412-01	Upgrade Health Physics Vestibule, 5000	844
A11420-01	Install Suspended Ceiling in Cafeteria, 2010	1,013
A11424-01	Revise Emergency Power System, 3508	2,384
A11426-01	Recess Exit Doors, 4500S	3,491
A11438-01	Design and Estimate Blowdown and Make-up Perimeter Heat, 4500	35
A11439-01	Install Expansion Tank, Chilled Water System, 4509	1,659
A11440-01	Automate One Compressor, 4509	22
A11442-01	Install Additional Heater and Level Controller, Reheat System, 4500S	1,234
A11443-01	Improve Supply Air Filters, Wing 2, 4500N	6,128
A11447-01	Install Paging System, 4500N Basement	243
A11449-01	Install Exhaust Fan Alarm, 4500N	225
A11450-01	Improve LSS Office, 5000	429
A11456-01	Permanentize Building 2008	22
A11456-30	Permanentize Building 2008	757
A11459-01	Improve Ventilation, Basement of 4501	54
A11462-30	Relocate 250-psi Steam Line South of 2519	34
A11462-56	Relocate 250-psi Steam Line South of 2519	5,388
A11463-56	Separate Process and Potable Water, 2008	3,547
A11475-01	Install False Ceiling, 2518	474
A11475-30	Install False Ceiling, 2518	10
A11475-56	Install False Ceiling, 2518	7,314
A11476-01	Relocate Electric Services, 3104	2,698
A11479-01	Improve Lighting, 7001	4,844
A11494-01	Run Steam Line Underground, 2026	212
A11495-30	Run Steam Line Underground, 3550	50
A11495-56	Run Steam Line Underground, 3550	2,160
A17013-56	Paint 4509, 4510, and 4511	7,533
A17017-01	Increase Water Supply to Photo Lab, 4500N	186
A17019-01	Remove 50-psi Steam Reducing Station, 4500N	287
A17023-01	Install Telephone Wireway, 6025	1,883
A17024-01	Install New Floor Tile, 2500	1,854
A17026-01	Relocate Steam Line, 2525	194
A17026-56	Relocate Steam Line, 2525	8,437
A17028-01	Install Telephone Conduit, 4500N	707
A17034-01	Design and Estimate Additional Make-up Air, Paint Shop	86
A17035-01	Design and Estimate Water Exhaust Filters, Paint Shop	67
A17037-01	Pour Concrete Pad, 7007	5,227
A17039-01	Modify Building 3502	5,416
A17048-01	Alter Filters, Fan No. 1, 4500S	59
A17056-01	Alter Filters, Fan No. 2, 4500S	51
A17058-01	Alter Filters, Fan No. 3, 4500S	43
A71097-01	Upgrade Compressors, 4509	16,668
A71139-01	Permanentize, 2008	277
A71139-30	Permanentize, 2008	1,226
A71155-01	Relocate Steam Line, 2013	18
A71155-30	Relocate Steam Line, 2013	710
A71155-56	Relocate Steam Line, 2013	137
A71161-01	Relocate Steam Line, Second to Third Streets	11,949
A71162-01	Improve Exhaust System, 2000	2,020
A71162-30	Improve Exhaust System, 2000	4,157
A71162-56	Improve Exhaust System, 2000	945
A71164-30	Relocate Steam Line, 2008	215
A71164-56	Relocate Steam Line, 2008	375
A71169-56	Paint 7001, 7002, 7005, and 7018	31,226
A71173-30	Relocate Steam Line Main, Third to Fourth Streets	119
A71173-56	Relocate Steam Line Main, Third to Fourth Streets	2,441
A71175-01	Install Ceiling, 2010	173
A71175-56	Install Ceiling, 2010	12,811
A71185-56	Install Canopy Over Loading Dock, 4500N	12,393

Total of This List: \$255,790

PARTIAL LIST OF ALTERATIONS AND IMPROVEMENTS - FY-1968

A11098-11	Upgrade Air-Conditioning System, 3500E	\$ -507
A11194-01	Separate Potable and Process Water, 3550	1,380
A11221-01	Increase Air Supply to Wing 4, 4500N	1,657
A11300-01	Convert Receptacles to NEMA, 3005 and 3042	22
A11340-01	Review of Heating and Air Conditioning in Cafeteria	1,782
A11344-01	Study and Estimate for Establishing Electric Motor Pool	76
A11359-01	Relocate Steam Reducing Station, 5500	2,361
A11360-01	Relocate Steam Reducing Station to Outside Pit, 3500	477
A11361-01	Design and Estimate Separating Safety Valve Discharge and Diesel Exhaust, 4500N	540
A11373-01	Install Ground Detectors on 480-Volt Systems	43
A11375-01	Revise Condensate Piping on Preheat Coils, 4500S	1,273
A11389-01	Update Building Drawings, Building 2000	26
A11410-01	Install Motorized Valves on Chilled Waterlines, 4509	6,819
A11411-01	Install Water Treatment on Cooling Tower, 6000	1,587
A11411-30	Install Water Treatment on Cooling Tower, 6000	987
A11411-39	Install Water Treatment on Cooling Tower, 6000	4,753
A11426-01	Recess Exit Doors, 4500S	848
A11432-01	Convert Safety Showers to Potable Water, 4500N	90
A11432-30	Convert Safety Showers to Potable Water, 4500N	958
A11438-01	Engineering to Install Blowdown and Make-up Reheat System, 4500 Complex	485
A11439-01	Install Expansion Tank on Chilled Water System, 4509	541
A11442-01	Install Additional Heater and Level Controller, Reheat Water, 4500S	4,355
A11443-01	Upgrade Supply Air Filters, Wing 2, 4500N	107
A11444-01	Revise A/C Ducts, 3504	16
A11449-01	Install Exhaust Fan Alarm, 4500N	671
A11451-01	Install Compressor Capacity Control 4500N A/C System	1,290
A11459-01	Install Ventilation, 4501, Basement	2,626
A11475-56	Install False Ceiling, 2518	3,692
A11495-56	Relocate Steam Supply, 3550	3,346
A17013-01	Paint Building 4509	109
A17013-56	Paint Building 4509	886
A17015-01	Convert Receptacles to NEMA, 4500N	2,579
A17017-01	Increase Water Supply to Photo Lab, 4500N	12
A17019-01	Remove 50-psi Steam Reducing Station, 4500N	316
A17023-01	Install Telephone Wireway, 6025	207
A17026-01	Relocate Steam Line, 2525	330
A17026-39	Relocate Steam Line, 2525	733
A17026-56	Relocate Steam Line, 2525	686
A17034-01	Design and Estimate Additional Air Supply, Paint Shop	2,910
A17035-01	Design and Estimate Water Exhaust Filters, Paint Shop	2,299
A17039-56	Modify Building 3502	1,929
A17048-01	Upgrade Supply Air Filters, Fan No. 1, 4500S	1,217
A17052-01	Strip Building 3003 of Unused Wiring and Conduit	1,148
A17053-01	Revise and Paint Ceiling, 4500N Canteen	289
A17056-01	Upgrade Supply Air Filters, Fan No. 2, 4500S	2,608
A17058-01	Upgrade Supply Air Filters, Fan No. 3, 4500S	1,456
A17063-01	Engineering Study, 2000 Air-Conditioning System	15
A17075-01	Install Decorative Screen on Loading Dock, 4501 and 4505	2,500
A17078-01	Install Alarms on A/C Units, Cafeteria	386
A17086-01	Upgrade Lighting, 2519	2,046
A17087-01	Correct Wiring Deficiencies, 3004	405
A17091-01	Relocate Emergency Generator, 2500	665
A17092-01	Upgrade Rest Room, 7001	4,702
A17093-01	Design and Estimate for Upgrading Lighting, 3037	193
A17095-01	Modify Sump Pump Discharge, Wing 5, 4500N	1,325

(FY-1968)

A17096-01	Relocate A/C Units, 3517	\$ 619
A17109-01	Install Drains in Exhaust Fans, 4500S	315
A17113-30	Study and Estimate Permanentize 3026	1,482
A17114-01	Convert Safety Showers to Potable Water, 4501	24
A17117-01	Construct Shed Roof, East Side, 2018	1,153
A17117-30	Construct Shed Roof, East Side, 2018	131
A17120-01	Relocate Steam and Air Line, 3104	2,506
A17131-01	Install Glass in Doors, 4500S	103
A17137-01	Remove Windows, South End of 7001	14
A17151-01	Improve Safety Valves, Reheat and Perimeter Heat, 4500S	40
A17154-01	Engineering Study, Humidity Control, 4500 Complex	25
A17156-01	Revise Rest Room Exhaust Wing 5, 4500N	509
A17158-01	Revise Surge Tank Connections, Reheat Systems, 4500N	23
A17161-01	Improve Emergency Power Distribution, 4500S	13
A17164-01	Improve Heating and Air Conditioning, 2518 Conference Room	9
A71097-01	Upgrade Compressors, 4509	3,112
A71161-01	Relocate Steam and Air Lines, Second to Third Streets	27
A71161-56	Relocate Steam and Air Lines, Second to Third Streets	7,623
A71162-01	Exhaust System Improvements, 2000	251
A71162-30	Exhaust System Improvements, 2000	1,731
A71162-56	Exhaust System Improvements, 2000	3,251
A71173-56	Relocate Steam Line, Third to Fourth Streets	6,638
A71185-39	Install Canopy Over Loading Dock, 4500N	480
A71185-56	Install Canopy Over Loading Dock, 4500N	10,749
A71189-01	Convert Receptacles to NEMA, ORNL Area	9,987

Total of This List: \$125,066

PARTIAL LIST OF ALTERATIONS AND IMPROVEMENTS - FY-1969

A0009E-A1	Steam Line Tie, 4500S to 4508	\$2,211
A0010E-A1	Install Valve in A/C System, 4509	418
A0010H-A1	Install Valve in A/C System, 4509	3,737
A0024E-A1	Install Automatic Steam Valve with Controls, 2525	664
A0029E-A1	Install Freeze Protection Controls, 4500S	272
A0033E-A1	Alter Duct to Room C-36, 4500S	595
A0038E-A1	Sump Level Probes and Alarm, 5500	389
A0041E-A1	Install Gutter and Insulate Ceiling of Dock, 7018	514
A0045E-A1	Install Water Heater, 2001	1,435
A0046E-A1	Install Steam Reducing Station, 7900	2,638
A0050E-A1	Install Level Probes and Alarm, Sumps, 4500N	367
A0052E-A1	Improve A/C Mixing Box Controls, Wing 5, 4500N	137
A0053E-A1	Install Lube Pumps on Emergency Generators	861
A0059E-A1	Modify Fuel Piping on Emergency Generator, 7930	207
A0063E-A1	Modify Condensate Piping to Prevent Freezing, 2516	2,401
A0068E-A1	Separate Safety Valve Discharge from Diesel Exhaust, 4500N	467
A0068H-A1	Separate Safety Valve Discharge from Diesel Exhaust, 4500N	3,284
A0070E-A1	Review A/C Equipment, 2000	80
A0072E-A1	Enclose Dock, North Side, 2013	1,649
A0074E-A1	Alter Metallography Drains, 4500S	197
A0075E-A1	Install Flow Switches and Solenoid Valves, Vacuum System	48
A0080E-A1	Install Flexible Connections on Safety Valve Discharges, 4500N	16
A0081E-A1	Upgrade 2000 Area Filter Facility	548
A0081H-A1	Upgrade 2000 Area Filter Facility	7,176
A0089E-A1	Install Brake and Limit Switch, 10-Ton Crane, 4501	84
A0090E-A1	Alter Ducts, 2000 Area Filter Facility	194
A0090H-A1	Alter Ducts, 2000 Area Filter Facility	8,071
A0092E-A1	Install Bypass Connections on Backflow Preventer Valves, 4500S	378
A0112E-A1	Separate Process and Potable Water, 2001	506
A0113E-A1	Alter Offices, 2518	794
A0114E-A1	Hot and Cold Potable Water Tie to Wing V, 4500N	85
A0122H-A1	Exterior Painting, Various Buildings	6,016
A0123H-A1	Exterior Painting, 3095	3,573
A0129E-A1	Relocate Steam Line to Underground, 2516	73
A11282-01	Engineering Review, 4500 Complex, Heating and A/C	195
A11344-01	Study and Estimate for Electric Motor Pool	108
A11360-01	Relocate Steam Reducing Station to Outside Pit	542
A11410-01	Install Motorized Valves, Chilled Water Systems, 4509	1,340
A11438-01	Engineering Review, Blowdown and Makeup, Reheat Systems	334
A17019-01	Remove Unused Steam Reducing Station, 4500N	2,803
A17032-01	Design Canopy, West Side, 3017	642
A17111-01	Upgrade Sump Pumps, 4500S and 4508	29
A17119-01	Study and Estimate, Emergency Power, 4500N	410
A17137-01	Remove Windows, South End, 7001	1,921
A17138-01	Replace Windows, 7001	291
A17151-01	Revise Safety Valves, Reheat and Perimeter Heat, 4500N	91
A17154-30	Engineering Study, Humidity Control, 4500 Complex	161
A17162-01	Fresh Air Duct to T-3 and G-56, 4500S	4,666
A17164-01	Improve Heating and Air Conditioning, Conference Room, 2518	152
A17172-01	Bypass Air Surge Tanks, 4500S	130
A17175-01	Install Freeze Protection Thermostats, 4500N	1,120
A17189-01	Install Bypass on Backflow Preventer Valve, 4508	1,736

Total of This List: \$66,756

PARTIAL LIST OF ALTERATIONS AND IMPROVEMENTS - FY-1970

A0029E-A1	Install Freeze Protection, Supply Air Units, 4500S	\$ 793
A0038E-A1	Install Sump Level Alarms, 5500	1,465
A0050E-A1	Install Sump Level Alarms, 4500N	687
A0062E-A1	Replace Doors, 3038	768
A0067E-A1	Replace Radioactive Drains, 4505	2,897
A0069E-A1	Replace Floor Tile, Four Offices, 3026C	485
A0070E-A1	Review and Estimate, Building 2000 A/C System	139
A0071E-A1	Review and Estimate Heating Requirements, East Section 6000	486
A0074E-A1	Alter Drains from Metallography Lab, 4500S	564
A0080E-A1	Install Flexible Joints in Safety Valves, 4500N	2,319
A0081E-A1	Upgrade 2000 Area Filter Facility	3,193
-H1		
A0089E-A1	Install Brakes and Limit Switches, 10-ton Crane, 4501	1,593
A0090E-A1	Alter Ductwork, 2000 Area Filter Facility	7,041
A0092E-A1	Install Bypass Connectings, Backflow Preventer Valve, 4500S	668
A0099E-A1	Upgrade Steam Reducing Stations, 3019 West	2,505
A0100E-A1	Upgrade Steam Reducing Station, 3019 East	1,938
A0104E-A1	Rebuild Steam Safety Valve, 4508	282
A0110E-A1	Correct Condensate Drains, 2000	479
A0112E-A1	Separate Process and Potable Water, 2001	1,614
A0113E-A1	Alter Offices, 2518	2,073
A0114E-A1	Install Alternate Hot and Cold Potable Water, Wing V, 4500N	2,047
A0116E-A1	Connect 50-lb. Steam to Potable Water Heater, 4500N	79
A0123E-A1	Paint Building 3095	1,491
A0129E-A1	Relocate Steam Line, 2516	4,874
A0133E-AA	Hot and Cold Potable Water Ties, 4500S to 4508	62
A0136E-AA	Extend Roof Overhang, 2013 (cancelled)	63
A0137E-AA	Install Air Curtains, 2010	1,548
A0140E-AA	Upgrade Roof, 7005 and Insulate	4,996
A0145E-AA	Close and Block Up Windows 2518 Auditorium	615
A0152E-AA	Design and Estimate Decorative Screen Wall, W. side, 4508	430
A0154E-AA	Construct Field Engineering Offices, 3550	6,716
A1		
A0160E-AA	Install Explosion Proof Lights, Building 2625	716
A0169E-AA	Upgrade Steam Reducing Station, 2018	696
A0179E-AA	Upgrade Steam Reducing Station, 3017	630
A0180E-AA	Install Partitions, Room S-234, 4500S	538
A0181E-AA	Install Filters on Reheat and Perimeter Heat Water Systems, 4500S	857
A0182E-AA	Install Filters on Reheat and Perimeter Heat Water Systems, 4500S	709
A0184E-AA	Upgrade Steam Reducing Station, Building 2001	5
A0185E-AA	Upgrade Steam Reducing Station, Building 2008	476
A0186E-AA	Upgrade Steam Reducing Station, Building 2001	701
A0189E-AA	Relocate Gas Heater, Building 7002	430
A0190E-AA	Relocate Steam Line, East End 2506	731
A0196E-AA	Reduce Noise Level, Carpenter Shop	31
A0211E-AA	Install Monorail and Hoist, 2013	386
A0230H-AA	Install Bussing Area, Cafeteria	3,233
A17154-30	Study and Estimate, Humidity Control, 4500 Complex	167
Total of This List:		<u>\$65,216</u>

PARTIAL LIST OF ALTERATIONS AND IMPROVEMENTS - FY-1971

A0089E-A1	Install Brake and Limit Switches, 10-ton Crane, Bldg. 4501	\$ 1,246
A0104E-A1	Improve Safety Valves, 10-psi Steam, 4508	225
A0183E-AA	Replace Safety Valve, Steam Station 141, 2007	207
A0184E-AA	Replace Safety Valve, Steam Station 144, 2001	268
A0185E-AA	Upgrade Steam Station 108, Bldg. 2008	92
A0186E-AA	Replace Safety Valve, Steam Station 105, 2001	309
A0196E-AA	Reduce Noise Level, Bldg. 7009	8
A0205E-AA	Alter Natural Gas Entrance, 7005	326
A0206E-AA	Alter Natural Gas Entrance, 2026	74
A0207E-AA	Alter Natural Gas Entrance, 7009	21
A0208E-AA	Alter Natural Gas Entrance, 3504	228
A0209E-AA	Alter Natural Gas Entrance, 3500	328
A0211E-AA	Install 1-ton Rail and Hoist, 2013	529
A0212E-AA	Upgrade Steam Station 148, 3003	553
A0213E-AA	Upgrade Steam Station 115, 3074	531
A0214E-AA	Upgrade Steam Station 146, 3013	365
A0215E-AA	Upgrade Steam Station 143, 2000	524
A0230H-AA	Install Bussing Area, Cafeteria	1,440
A0253E-AA	Upgrade Steam Station 164, 3001	1,816
A0254E-AA	Upgrade Steam Station 278, 3034	838
A0266E-AA	Maintenance and Alteration of LOX Storage Tank	476
A0281E-AA	Upgrade Steam Station 234, 3026D	810
A0282E-AA	Upgrade Steam Station 132, 2621	367
A0283E-AA	Upgrade Steam Station 233, 3026D	620
A0284E-AA	Upgrade Steam Station 135, 2517	300
A0285E-AA	Upgrade Steam Station 150, 3004	251
A0290E-AA	Improve Air Supply, Civil Defense, 4500N	992
A0291E-AA	Install Receivers on A/C Units, 3019	964
A0293E-AA	Install Backflow-Preventer Valve, 7710	772
A0303E-AA	Relocate Natural Gas Regulator, 7012	1,022
A0304E-AA	Upgrade Steam Station, 3026C	1,447
A0305E-AA	Upgrade Steam Stations 232 and 238, 3026D	1,278
A0309E-AA	Convert Canteen to Conference Room, 3550	5,097
A0311E-AA	Replace Safety Valve, Steam Station 217, 3044	67
A0318E-AA	Upgrade Steam Station 300, 5500	1,751
A0319E-AA	Replace Backflow-Preventer Valve, 4508	2,006
A0325E-AA	Upgrade Steam Station, 3001	306
A0333E-AA	Upgrade Steam Station, 3038	324
A0335E-AA	Relocate Steam Station 203, 4507	377
A0337E-AA	Install Safety Valve, Steam Station 339, 3028	44
A3288E-AA	Upgrade Steam Station, 3550	788

Total of This List: \$29,987

PARTIAL LIST OF ALTERATIONS AND IMPROVEMENTS - FY-1972

A0155E-AA	Rework North Wall, Bldg. 7003	\$ 721
A0309E-AA	Convert Canteen to Conference Room, 3550	179
A0319E-AA	Improve Backflow-Preventer Valve, 4508	415
A0323E-AA	Upgrade Steam Station 175, 3010	637
A0327E-AA	Upgrade Steam Station 342, 7505	307
A0328E-AA	Upgrade Steam Station 262, 3037	226
A0329E-AA	Upgrade Steam Station 279, 3036	124
A0333E-AA	Upgrade Steam Station, Bldg. 3038	872
A0334E-AA	Insulate Base Steam Lines, 4500N	1,697
A0335E-AA	Relocate Steam-Reducing Station 203, 4507	55
A0337E-AA	Install Safety Valve on Station 339, 3028	326
A0344E-AA	Convert Gas Radiant Heaters for Complete Cut Off, 3012	1,530
A0345E-AA	Alter Cooling Water for A/C Compressors, 4500N	134
A0346E-AA	Alter Steam Service to Isotopes Area	1,523
A0348E-AA	Install Floor Drain in A/C Plenum, 5505	457
A0350E-AA	Install Steam-Reducing Station, 3505	1,103
A0353E-AA	Install 2-inch Vacuum Tie Line, 4500N	450
A0354E-AA	Alter Process Water Supply, 3001	1,318
A0368E-AA	Insulate Chilled-Water Lines, 4501	790
A0369E-AA	Upgrade Steam-Reducing Station, 3502	1,082
A0372E-AA	Clean Out 3018 Stack	1,460
A0373E-AA	Install Humidistats, 4500S	694
A0374E-AA	Upgrade Steam-Reducing Station, 3042	2,245
A0375E-AA	Revise A/C Duct, 2518	561
A0381E-AA	Improve Rest Room, 2519	1,698
A0385E-AA	Improve Filters, 5505, A/C System	1,377
A0398E-AA	Upgrade Steam-Reducing Station, 3517	2,484
A0402E-AA	Upgrade Steam-Reducing Station, 6000	2,027
A0404E-AA	Install Lunch Room, 2013	1,517
A0412E-AA	Install Water Heaters, 2000	1,539
A0413E-AA	Install Canopies, 3025	331
A0414E-AA	Install Overhead Door, 3001	395
A0428E-AA	Install Canopy, 2013	1,276
A0434E-AA	Alter Condensate Lines, Bldg. 2531	1,166
A0437E-AA	Install Additional Process Water, 2000	2,675
A0438E-AA	Enclose Lunch Area, Bldg. 7009	2,739
A0444E-AA	Upgrade Steam-Reducing Station, 6000	995
A0449E-AA	Potable Water Tie, 4500S to 4508	213
A0455E-AA	Insulate and Label Piping, 2000	49
A0460E-AA	Clean Up Attic, 2506	109
A0464E-AA	Upgrade Steam-Reducing Station, 4500S	18
A3288E-AA	Upgrade Steam-Reducing Station, 3550	517

Total of This List: \$40,031

PARTIAL LIST OF ALTERATIONS AND IMPROVEMENTS - FY-1973

A0325E-AA	Upgrade Steam System, 3001	\$ 1,878
A0375E-AA	Revise A/C Duct, 2518	1,878
A0414E-AA	Install Vertical Door, 3001	2,738
A0442E-AA	Improve Rest Room, 2519	2,025
A0445E-AA	Replace Filter Frames, 4500S	519
A0449E-AA	Install Potable Water Tie, 4500S to 4508	146
A0450E-AA	Improve Rest Room, 2018	2,115
A0451E-AA	Install Handrails, 4500N	996
A0452E-AA	Install Handrails, 4500S	103
A0453E-AA	Improve Toilet Facilities, Bldg. 2000	1,602
A0455E-AA	Insulate Bare Pipe and Label, 2000	1,118
A0456E-AA	Increase Air Conditioning, Lab B-54, 4500S	436
A0457E-AA	Install Lights in Attic, 2000	630
A0464E-AA	Upgrade 15-psi Steam System, 4500S	1,126
A0467E-AA	Install Grinder Exhaust, 2013	501
A0472E-AA	Replace Sprinkler Lines, HFIR Cooling Tower	1,150
A0473E-AA	Upgrade Steam-Reducing Station, 3503	1,355
A0487E-AA	Revise Electric Service, Bldg. 7001	992
A0491E-AA	Install Partition, 4500S	950
A0499E-AA	Install Filters in ORELA Chilled Waterlines	14,342
A0500E-AA	Upgrade Toilet, Bldg. 3044	1,071
A0491E-AA	Install Partition, 4500S	950
A0503E-AA	Reroute Waterlines, Attic, Bldg. 2000	529
A0509E-AA	Install Filter-Dryer in Air Line, 7007	533
A0524P-AA	Chilled-Water Reliability Study (George West)	<u>1,333</u>

Total of This List: \$40,066

PARTIAL LIST OF ALTERATIONS AND IMPROVEMENTS - FY-1974

A0445E-AA	Upgrade Filters, Wing 1, 4500S	\$ 10
A0510E-AA	Install Filter-Dryer, 7007	670
A0524P-AA	Reliability Study, Chilled Water	4,754
A0530E-AA	Install Sink and Water Supply, 2631	1,739
A0532E-AA	Upgrade Steam Station, 3504	1,249
A0533E-AA	Upgrade Rest Room, 2525	441
A0535E-AA	Upgrade Rest Room, 2000	212
A0537E-AA	Install Storage Pad, 2631	1,940
A0543E-AA	Wainscot Walls, East Auditorium, 4500N	1,046
A0545E-AA	Revise A/C Duct, 2518	1,853
A0556E-AA	Insulate Walls, 2518	1,177
A0600E-AA	Insulate Walls, 2518	163
A0616E-AA	Insulate Walls, 2525	29
A0625E-AA	Enlarge Access to Wing 2, 4500S	1,031
A0626E-AA	Provide Offices, MIT School, 3001	18,655
A0652E-AA	Install Temperature Limit Controls, 7002	<u>331</u>
Total of This List:		<u>\$35,300</u>

PARTIAL LIST OF ALTERATIONS AND IMPROVEMENTS - FY-1975

A0445E-AA	Upgrade Filters, Wing 1, 4500S	\$ 647
A0531E-AA	Upgrade Steam Station 137, 2525	485
A0545E-AA	Alter A/C Duct, 2518	142
A0600E-AA	Insualte Walls, 2518	848
A0601E-AA	Insulate Auditorium Wall, 2518	898
A0602E-AA	Install Temperature Limit Controls, 2013	1,990
A0603E-AA	Install Storm Sash, 2013	1,288
A0605E-AA	Install Storm Sash, 2018	731
A0607E-AA	Install Temperature Limit Controls, 2018	484
A0608E-AA	Install Temperature Limit Controls, 2506	375
A0609E-AA	Install Temperature Limit Controls, 2069	1,134
A0610E-AA	Install Storm Sash, 2069	587
A0611E-AA	Install Temperature Limit Controls, A/C, 2506	11
A0613E-AA	Install Temperature Limit Controls, 2516	384
A0616E-AA	Insulate Change House Walls, 2525	69
A0617E-AA	Install Storm Sash, 2525	2,808
A0618E-AA	Install Storm Sash, 2518	505
A0620E-AA	Install Storm Sash, 2506	1,335
A0621E-AA	Install Storm Sash, 2516	1,954
A0622E-AA	Insulate Attics	622
A0623E-AA	Upgrade Steam System, 4500N	4,167
A0626E-AA	Construct Offices, MIT School, 3001	9,661
A0628E-AA	Improve Mixing Boxes, Wing 5, 4500N	1,184
A0630E-AA	Weather-Strip Doors, 3044	131
A0631E-AA	Install Storm Sash, 3044	1,733
A0633E-AA	Weather-Strip Doors, 3024	1,622
A0634E-AA	Install Storm Sash, 3024	1,354
A0636E-AA	Weather-Strip, 2567	351
A0639E-AA	Install Ceiling, 2516	1,575
A0641E-AA	Install Storm Sash and Weather Strip, 3074	465
A0643E-AA	Insulate North Wall, 3502	19
A0647E-AA	Weather-Strip Doors, 7002	1,952
A0648E-AA	Weather-Strip Exhaust Louvers, 7002	479
A0649E-AA	Improve Lighting, Change Room, 7002	1,595
A0650E-AA	Install Heating Shutdown Controls, 7002	823
A0651E-AA	Install Storm Sash and Weather Strip, 7002	3,387
A0652E-AA	Install Temperature Limit Controls, 7002	524
A0653E-AA	Upgrade Steam System, 3517	630
A0654E-AA	Alter Process Steam, 3517	141
A0662E-AA	Study and Estimate, A/C Revision, 2518	22
A0663E-AA	Study and Estimate, Reclaim Condensate Engergy	854
A0664E-AA	Study and Estimate, Reclaim Exhaust Air Energy	956
A0695E-AA	Identify and Label Piping, 7000 Area	746
A0704E-AA	Space Conversion, 3001	6,848
A0705E-AA	Install Suspended Ceiling, 2518	1,235
A0712E-AA	Study and Estimate, Chilled-Water Tie, 4500N - 4500S	2,103
A0718E-AA	Temperature Limit and Shutdown Controls, 7005	660
A0719E-AA	Temperature Limit and Shutdown Controls, 7003	559
A0720E-AA	Weather-Strip Doors, 7005	911
A0721E-AA	Install Shutdown Controls, 7007	114
A0722E-AA	Weather-Strip Doors, 7007	421
A0723E-AA	Weather-Strip Doors, 7001	551
A0724E-AA	Weather-Strip Doors, 7058	159

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A0725E-AA	Weather-Strip Doors, 7021	\$ 159
A0726E-AA	Weather-Strip Doors, 7003	586
A0727E-AA	Weather-Strip Doors, 7018	379
A0728E-AA	Weather-Strip Doors, 7015	522
A0729E-AA	Weather-Strip Doors, 7012	379
A0730E-AA	Install Temperature Limit Controls, 7001	2,171
A0731E-AA	Install Temperature Limit Controls, 7058	332
A0732E-AA	Install Temperature Limit Controls, 7021	129
A0733E-AA	Install Temperature Limit Controls, 7018	1,922
A0734E-AA	Install Temperature Limit Controls, 7015	433
A0735E-AA	Install Temperature Limit Controls, 7009	2,336
A0736E-AA	Install Temperature Limit Controls, 7012	2,019
A0740E-AA	Insulate Lunch Room Walls, 7001	1,312
A0741E-AA	Install A/C Shutdown Controls, 7001	830
A0743E-AA	Install Canopy, 2013	2,969
A0744E-AA	Install Shed Roof, 2631-2634	2,152
A0745E-AA	Fence Storage Area, 2013	441
A0750E-AA	Install Storm Sash, 2028	186
A0751E-AA	Study and Estimate, Water Chiller, 2000 and 2024	2,605
A0752E-AA	Reactivate EGCR Facilities	74,285
A0758E-AA	Install Steam Meter, 2518	2,458
A0560E-AA	Insulate Walls, 2013	2,942
A0761E-AA	Install Steam Meter, 2013	35
A0762E-AA	Replace Drain System, Photo Lab, 4500N	12,716
A0782E-AA	Install Sanitary Shower, Women's Change Room, 2518	1,170
A0785E-AA	Insulate Walls, 2525	1,204
A0787E-AA	Sheet Rock Walls, 2018	1,352
A0791E-AA	Install Suspended Ceiling, 2518	2,340
A0793E-AA	Upgrade Rest Room, 3550	3,519
A0794E-AA	Upgrade Steam-Reducing Station, 4501	549
A0798E-AA	Install Entrance Canopy, 7002	1,016
A0801E-AA	Install Temperature Control Valves, 2013	580
A0802E-AA	Install Canopies, 2518	840
A0808E-AA	Study and Estimate, Compressed Air System, 7000 Area	550
A0809E-AA	Physics Division Move	720
A0810E-AA	Install Steam Meter, 3025W	40
A0810E-BB	Install Steam Meter, 3025E	40
A0810E-CC	Install Steam Meter, 3037	38
A0810E-FF	Install Steam Meter, 3042	40
A0810E-GG	Install Steam Meter, 3047E	40
A0810E-HH	Install Steam Meter, 3500E	40
A0810E-JJ	Install Steam Meter, 3508	40
A0810E-KK	Install Steam Meter, 4501	68
A0810E-MM	Install Steam Meter, 5500W	69
A0810E-NN	Install Steam Meter, 5505	70
A0810E-PP	Install Steam Meter, 6000	70
A0810E-RR	Install Steam Meter, 6010	68
A0810E-TT	Install Steam Meter, 7920	69
A0810E-WW	Install Steam Meter, 7930	70
A0812E-AA	Insulate Interior, 7002	433
A0818E-AA	Relocate Chemistry Shop	10,631
A0822E-AA	Install Suspended Ceiling, 2518	396
A0823E-AA	Install Fuel Tank, 7012	12
A0824E-AA	Install Fuel Tank, 7009	2,634

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A0829E-AA	Install Variable Volume Dampers, 4500 A/C	\$ 6,482
A0830E-AA	Relocate Manipulator Boat Shop	2,418
A0860E-AA	Replace Paneling, 2024	937
A0862E-AA	Alter Rest Room Partition, 7009	1,025
A0864E-AA	Install Strainers, Eyewash Fountains	2,404
A0866E-AA	Study and Estimate, Convert Wing 4, 4500N, to Recirculating	2,040
A0870E-AA	Install Vacuum Breakers, Service Sinks	179
A0871E-AA	Repair Water Damage, Bldg. 4500N	5,524
A0874E-AA	Insulate Bare Steam Lines, 2013	1,340
A0876E-AA	Install Automatic Chem Feed Pumps, Cooling Towers	2,536
A0885E-AA	Construct Storage Area, Attic, 4500N	268
A0886E-AA	Modify Fire Alarm System, 3025	4,478
A0890E-AA	Paint EGCR Reactor Facility	22,173
A0898E-AA	Study and Estimate, Recirculate Air, 5500W	284
A0903M-AA	Procure Storm Sash, 4500 Complex	21,721
A0907E-AA	Replace Phone Cabinet Doors, 4500N	4,381
A0900E-AA	Purchase Storm Windows, EGCR	512
		\$287,045
	Less EGCR Start-up	<u>-74,285</u>
	Total of This List	<u>\$212,760</u>

Appendix II
BUILDING LIST

Bldg. # No.	Name	Floor Area	Remarks
1000	Engineering Building	43,580	2,830 ft ² to be added FY-76.
1503	Greenhouse Complex	5,000	Added in FY-75.
1504	Aquatic Ecology Laboratory	5,000	Added in FY-74.
2000	Inspection Engineering & Solid State Laboratories	23,380	
2001	Environmental Sciences Division	25,960	3,280 ft ² added in FY-75.
2003	Process Water Control Station	270	
2007	Health Physics Calibration Lab	1,960	
2008	Health Physics Dosimetry Lab	4,120	
2009	Cafeteria Storage	1,400	
2010	Cafeteria	13,010	3,380 ft ² added in FY-67
2011	Mechanical Properties Lab No. 2	5,160	
2013	West Maintenance Service Center	11,050	
2016	West Portal	2,400	
2017	Emergency Generator for 2011	100	
2018	Electrical and A/C Service Center	6,580	870 ft ² added in FY-66.
2019	Verrahrate Colony House	700	
2024	Inopction Engineering & Environmental Sciences Division Annex	9,770	
2026	High-Radiation Level Analytical Lab	19,240	1,700 ft ² added in FY-68.
2069	Change House	6,490	
2087	Storage	200	
2088	Emergency Generator for 2000	90	
2500	Guard and Fire Headquarters	8,310	3,390 ft ² added in FY-67.
2506	Fabrication Shop and Timekeeping	10,460	
2510	Air Compressor Building	770	
2511	Paint Storage Facility	380	
2516	Machine Tool Repair Shop	5,280	
2517	Personnel Development and Systems Department	2,880	
2518	Plant and Equipment Division Offices	13,720	
2519	Steam Plant	20,160	3,600 ft ² added in FY-69.
2523	Decontamination Laundry	3,040	
2525	Fabrication Department - Shop A	25,350	4,350 ft ² added in FY-71.
2528	Coal Research Laboratory	4,040	
2531	Radioactive Waste Evaporator	7,300	
2567	Craft Support Group Offices	2,250	
2572	Emergency Generator for 2500	200	
2621	Tool Stores	4,000	
2628	Fire Department Storage	640	
2631	Maintenance Equipment Shelter	600	Added in FY-67.
2634	Maintenance Material Storage	600	Added in FY-67.
3000	13.8-kV Substation	1,480	
3001	Graphite Reactor	35,270	
3002	Graphite Filter House	3,540	
3003	Solid State Accelerator Facility	5,040	
3004	Water Demineralizer	3,290	
3005	Low-Intensity Testing Reactor	4,180	
3008	SS Materials Vault	570	
3009	ORR Pump House	180	
3010	Bulk Shielding Reactor Facility	5,200	
3012	Rolling Mill	8,280	
3013	Environmental Processing Laboratory	620	
3017	Environmental Sciences Laboratory	10,200	5,000 ft ² added in FY-71.

<u>Bldg. No.</u>	<u>Name</u>	<u>Floor Area</u>	<u>Remarks</u>
3019	Radiochemical Processing Pilot Plant and High-Level Radiation Analytical Laboratory - A	34,870	
3024	Fabrication Department - Shop B	12,410	
3025	Physical Examination Hot Cells - A and Solid State Division Laboratories	28,850	3,600 ft ² added in FY-74.
3026	Radioisotope Development Laboratory - B and Dismantling and Examination Hot Cells	23,180	
3027	Source and Special Materials Vault	940	
3028	Radioisotope Production Laboratory - A	5,040	
3029	Radioisotope Production Laboratory - B	2,400	
3030	Radioisotope Production Laboratory - C	840	
3031	Radioisotope Production Laboratory - D	840	
3032	Radioisotope Production Laboratory - E	840	
3033	Radioisotope Production Laboratory - F	840	
3034	Radioisotope Area Services	1,170	
3036	Isotope Area Storage and Service	1,170	
3037	Isotopes Division Offices	7,750	
3038	Radioisotope Laboratory	7,420	
3042	Oak Ridge Research Reactor	30,980	
3044	Special Materials Machine Shop	5,800	
3047	Isotope Technology Building	23,350	
3074	Interim Manipulator Repair Facility	3,500	
3080	Reactor Experiment Control Room	1,150	
3082	Storage - Miscellaneous Materials	220	
3085	Pump House - ORR	800	
3088	Standard Pile	60	
3093	Storage Cubicle for Krypton Cylinders	150	
3095	Reactor Area Equipment Building	7,000	
3100	Source and Special Materials Vault	200	
3104	West Research Service Center	6,980	
3105	Waste Monitoring Control Center	500	
3114	Shock Tube Laboratory	2,950	590 ft ² added in FY-75.
3115	Solid State Offices	2,360	
3118	Radioisotope Production Laboratory II	840	
3127	Plutonium Storage Vault		To be added in FY-76.
3500	Instrumentation and Controls	66,000	
3502	East Research Service Center	18,000	7,200 ft ² added in FY-67.
3503	HRL Chemical Engineering Laboratory	10,200	
3504	Environmental Sciences Division Annex - B	4,800	
3505	Fission Product Development Laboratory Annex	5,680	
3508	Chemical Technology Alpha Laboratory	7,580	
3517	Fission Product Development Laboratory	5,000	
3518	Process Waste Water Treatment Plant	590	
3523	Controls Research	1,190	
3525	HRL Examination Laboratory	29,000	
3541	MSR Process Development Laboratory	800	
3542	Storage Building for 3505 and 3517	600	
3544	Process Waste Treatment Plant		2,940 ft ² to be added FY-76.
3550	Research Laboratory Annex	13,970	
3587	Instrument Laboratory Annex	3,120	
3592	Unit Operations Volatility Laboratory	660	

Bldg. No.	Name	Floor Area	Remarks
3598	Emergency Generator for 3500 Area	220	
4500N	Central Research and Administration	451,460	
4500S	Central Research and Administration	340,510	
4501	High-Level Radiochemical Laboratory	80,000	
4505	Unit Operations	40,040	
4507	HRL Chemical Development Laboratory	4,780	
4508	Metals and Ceramics Laboratory	240,000	
4509	Compressor House for 4500	3,000	
5000	Main Portal	5,650	
5500	High-Voltage Accelerator Laboratory	45,000	
5507	Electron Spectrometer Facility	1,100	Added in FY-67.
6000	ORIC	45,780	2,080 ft ² added FY-71.
6003	Modular Office Building		7,040 ft ² to be added FY-76.
6010	Electron Linear Accelerator	18,570	1,900 ft ² added FY-74.
6025	Neutron Physics Office-Laboratory	10,900	4,900 ft ² added FY-75.
7001	General Storage	26,340	
7002	Garage and Utility Shop	22,440	
7003	Welding and Brazing Shop	4,950	
7005	Lead Shop	4,490	
7006	Paint Stores	2,520	
7007	Paint Shop	3,500	
7009	Carpenter Shop	6,950	
7010	Dry Lumber Storage	3,320	
7012	Central Mechanical Shops	26,000	
7013	Acid, Chemical and Flammable Liquid Storage	7,090	
7015	Metal Storage and Cutting Facility	2,400	
7018	Salvage and Reclamation Facility	20,000	
7019	Hazardous Material Storage	1,800	
7020	Interim Grounds Equipment Storage	640	
7021	Fabrication Equipment Storage	1,380	
7025	Tritium Target Fabrication Building	600	
7058	Machine Auxiliaries Storage	960	
7062	Storage - Miscellaneous Material	300	
7063	Emergency Generator for 7003	200	
7065	Facilities Maintenance Storage	950	
7066	Facilities Maintenance Storage	950	
7067	7000 Area Canteen	800	
7500	Nuclear Safety Pilot Plant	9,600	
7503	Molten-Salt Reactor Experiment Building	13,140	
7505	NSPP Storage	1,180	
7506	CPFF Contractor Headquarters	5,000	
7507	Substores	3,000	
7509	Molten-Salt Reactor Office Building	3,810	
7516	Service Shop for 7500 Area	4,000	
7555	Diesel Generator House for 7503	3,000	
7601	Office Building for 7600	36,540	Added in FY-75.
7602	Reactor Service Building	3,950	Added in FY-75.
7603	Turbine Building	13,810	Added in FY-75.
7604	Utility Building	4,420	Added in FY-75.
7605	Stores Building	12,000	Added in FY-75.
7606	Maintenance Building	13,850	Added in FY-75.
7607	River Pump Station	300	Added in FY-75.

<u>Bldg.</u> <u>No.</u>	<u>Name</u>	<u>Floor</u> <u>Area</u>	<u>Remarks</u>
7608	Chlorination Building	530	Added in FY-75.
7609	Stack Monitoring House	780	Added in FY-75.
7610	Valve House	380	Added in FY-75.
7611	Guard House for 7600 Area	340	Added in FY-75.
7702	Control House for TSF	3,280	
7703	Hoist House for TSF	1,500	
7704	Control House No. 2 for TSF	1,770	
7708	Reactor Shield Storage, TSF	3,000	
7709	Health Physics Research Reactor	3,280	
7710	DOSAR Facility - HPRR	7,450	
7804	Change House (Solid Waste Storage Area No. 5)	250	
7812	White Oak Dam Control Building	220	
7819	Interim Decontamination Building	1,550	
7820	Offices (Solid Waste Storage Area No. 5)	480	
7900	High-Flux Isotope Reactor	58,000	1,830 ft ² to be added FY-76.
7901	Electrical Building for HFIR	3,140	
7910	Office Building for 7900	13,400	
7914	Equipment and Parts Storage Building	1,800	
7915	Operations Storage Building	1,800	
7920	Transuranium Processing Plant	28,790	740 ft ² added in FY-74.
7921	Emergency Generator for 7920	200	
7930	Thorium-Uranium Recycle Facility	38,420	
7931	Emergency Generator for 7930	200	
7953	Pump House - HPRR Waterline	270	

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ACRONYMS

A/C (air conditioning)
CI (consumer index)
CPFF (cost plus fixed fee)
DOSAR (Dosimetry Applications Research)
EDP (Electronic Data Processing)
EGCR (Experimental Gas-Cooled Reactor)
ERDA (Energy Research and Development Administration)
G&A (General and Administrative Overhead)
HEPA (high-efficiency particulate air filter)
HFIR (High Flux Isotope Reactor)
HPRR (Health Physics Research Reactor)
HRLAF (High-Radiation-Level Analytical Facility)
HVAC (heating, ventilating, and air conditioning)
I&C (Instrumentation and Controls Division)
LMFBR (Liquid-Metal Fast Breeder Reactor)
MSR (Molten-Salt Reactor)
NSPP (Nuclear Safety Pilot Plant)
ORGDP (Oak Ridge Gaseous Diffusion Plant - K-25)
ORIC (Oak Ridge Isochronous Cyclotron)
ORNL (Oak Ridge National Laboratory)
ORR (Oak Ridge Research Reactor)
OSHA (Occupational Safety and Health Act)
P&E (Plant and Equipment Division)
TRU (Transuranium Processing Plant)
TSF (Tower Shielding Facility)
TUFCDP (Thorium-Uranium Fuel Cycle Development Facility)
UCC-ND (Union Carbide Corporation - Nuclear Division)
3019 (Radiochemical Processing Pilot Plant and High-Level Radiation Analytical Laboratory - A)

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Exhibits

OAK RIDGE NATIONAL LABORATORY
FISCAL YEAR—1975

04/05/75 114347

DEPARTMENT		ACTIVITY NO.		ACTIVITY DESCRIPTION		DIV CODE		REPORT NO		TIME EXPENDED		COST ACCOUNT			
NORMAL MAINT-ORNL BLDG X-10		222105000		G+A-P+E PLANT SERVIS		21		83057		75.00		3063-0000			
OPERATING COST EFFORT DISTRIBUTION		JAN		FEB		MAR		FY TO DATE		OBLIGATIONS		COST PLUS OBLIGATIONS		BUDGET	
CR SWEALIN		S	MM	S	MM	S	MM	S	MY s	S	MY s	S	MY s	\$	%
1	HOURLY LABOR	65L	55391	98.49	116423	87.30	81925	86.60	750851	64.31		750851	64.31		
2	ADP C. & OTHER VCL. - MHL	65L	2189	4.00	6077	4.00	3776	4.00	35017	3.06		35017	3.06		
3	SCIE & TECHNICAL - WKLY	66L	660	1.00	1585	1.04	1162	1.09	11931	.91		11931	.91		
4	SCIE & TECHNICAL - MTHLY	66L	9893	12.00	32093	14.00	18655	13.00	188182	10.46		188182	10.46		
5	TOTAL DIV PAYROL		68133	115.49	156178	106.34	105518	104.69	985981	78.74		985981	78.74		
6	LOANEE - IN LABOR	70L	23321	40.63	49347	39.00	32528	36.45	313486	27.44		313486	27.44		
7	LOANEE - OUT LABOR	70L	17777	30.26	53347	39.33	34303	35.84	302948	25.65		302948	25.65		
8	TOTAL		27035	44.60	53484	28.01	38687	32.40	369547	25.65		369547	25.65		
9	DIV. ADM. ON DIV. LABOR														
10	G & A ON LABOR														
11	TOTAL														
12	SUPPORT - P&E CRAFTS - F&M	50L	57801	99.20	141805	103.70	104568	107.66	848176	71.59	1045796	1893972	71.59		
13	G&A & BURDEN														
14	I&C CRAFTS & ENGRS.	50L	311	.49	559	.39	822	.80	4860	.40		4860	.40		
15	G&A & BURDEN														
16	INSP. ENGINEERING	50L			75	.05	409	.38	1011	.08		1011	.08		
17	G&A & BURDEN														
18	GENERAL ENGINEERING	50L	779	1.54	1136	.54	2067	1.56	14580	1.16	214	14794	1.16		
19	G&A & BURDEN		481		793		779		10959			10959			
20	LABOR FROM K - 25	50L													
21	G & A & BURDEN														
22	LABOR FROM Y-12	50L			79	.04			1302	.08		1302	.08		
23	G&A & BURDEN						33		1015			1015			
24	TOTAL SUPPORT LABOR		58891	101.23	143654	104.72	107866	110.40	869929	73.31	1046010	1915939	73.31		
25	G&A & BURDEN		481		793		812		11974			11974			
26	SHOPS & MAINTENANCE	50M	10167		45216		34246		312767		128174	440941			
27	CONSULTANTS	61M													
28	TRAVEL	62M					35		953			953			
29	R&D SUBCONTRACTS	63M													
30	OUTSIDE PROCUREMENT	64M	1464		2041		2712		22323			22323			
31	STORES SUPPLIES	65M	1624		4059		2326		28181		6758	34939			
32	MISC. CHGS. & CREDITS	70M					21		209			209			
33	COMPUTING SERVICE- ORNL	72M													
34	-CTC	73M													
35	WKD. MTL. & OTHER CHGS. - Y-12														
36	-ORGDP														
37	-OTHER		126		956				1929			1929			
38	TOTAL MATERIALS		13381		52272		39340		366362		134932	501294			
39	Y-12 UTILITIES														
40	ORNL UTILITIES														
41	ANALYTICAL CHEMISTRY														
42	HEALTH PHYSICS														
43	ORR														
44	BULK SHIELDING														
45	HOT CELLS														
46	WASTE DISPOSAL OPER.														
47	M&C LABS														
48	TECH. INFO SERVICES	75M			5		20		192			192			
49	TOTAL OTHER SERVICES				5		20		192			192			
50	SPECIAL DISTRIBUTIONS														
51	TOTAL GROSS COSTS		99788	45.83	250208	132.73	186725	142.80	1618004	98.96	1180942	2798946	98.96	2533000	63.80
52	DISTRIBUTION IN														
53	DISTRIBUTION OUT		99788		250208		186725		1618004						
54	NET OPERATING COSTS														
55	% BUDGET SPENT TO DATE		46.60		56.50		63.80		63.80						

UCN-1610A (3-7-71)

CHARGED BY				CHARGED TO				AMOUNT - DOLLARS ONLY					
DEPT.	ACCOUNT	TYPE EXP.	FIRST NUMBER	JOB ORDER	HOURLY LABOR	NON-EXEMPT SALARIES	EXEMPT SALARIES	TOTAL THIS MONTH	FISCAL YEAR - TO DATE				
3063	4460	54	0301		0	0	0	0	25				
3063	4460	54	0303		0	0	0	0	89				
3063	4460	54	0502		0	0	0	0	26				
3063	4460	54	0512		13	0	0	13	13				
3063	4460	56	0520		0	0	0	0	26				
3063	4460	54	0540		13	0	0	13	13				
3063	4460	70	0610		0	0	0	0	35				
3063	4902	40	4435	0174 K8244EA1	0	0	0	0	281				
3063	4902	40	4435	0403 K8308EAA	0	0	0	0	19				
3063	4902	40	4435	0403 K8319J T2	0	0	0	0	277				
3063	7110	52	0000		0	0	0	0	41				
3063	7111	52	0000		13	0	0	13	1184				
3063	7150	52	0000		0	0	0	0	164				
3063	8160	52	0000		13	0	0	13	202				
3063	8161	52	0000		0	0	0	0	405				
3063	8170	52	0000		13	0	0	13	1171				
					33043 *	202 *	2032 *	35277 *	432158 *				
3063	3063	14	0000		252	0	0	252	3723				
					252 *	0 *	0 *	252 *	3723 *				
3017	3063	15	0000		0	0	0	0	42				
3062	3063	15	0000		0	0	0	0	178				
3063	3063	15	0000		3459	107	1447	5013	93977				
3078	3063	15	0000		36	0	0	36	559				
3079	3063	15	0000		36	0	0	36	635				
					3531 *	107 *	1447 *	5085 *	95391 *				
TOTAL OF YOUR PAYROLL													
TOTAL CHARGED BY YOU TO OTHERS													
TOTAL CHARGED YOU BY OTHERS													
TOTAL CHARGED TO YOUR ACCOUNT													
BUDGET FY _____					EXHIBIT 2								
BUDGET FY _____					LABOR COST REPORT								
BUDGET FY _____					UCN-618								

CHARGED BY		CHARGED TO		AMOUNT - DOLLARS ONLY					
DEPT	ACCOUNT	TYPE EXP.	FIRST NUMBER	JOB ORDER	HOURLY LABOR	NON-EXEMPT SALARIES	EXEMPT SALARIES	TOTAL THIS MONTH	FISCAL YEAR - TO DATE
3017	3063	16	0000		0	0	0	0	13
3063	3063	16	0000		0	59	0	59	1966
					0 *	59 *	0 *	59 *	1979 *
3016	3063	17	0000		0	0	0	0	321
3017	3063	17	0000		0	0	0	0	460
3063	3063	17	0000		2536	0	0	2536	29284
3077	3063	17	0000		83	0	0	83	799
3078	3063	17	0000		86	0	0	86	96
3080	3063	17	0000		0	0	0	0	2
					2705 *	0 *	0 *	2705 *	30952 *
3016	3063	18	0000		0	0	0	0	101
3062	3063	18	0000		0	0	0	0	70
3063	3063	18	0000		4138	234	1151	5523	56238
3078	3063	18	0000		36	0	0	36	423
3079	3063	18	0000		108	0	0	108	637
3081	3063	18	0000		0	0	0	0	134
					4282 *	234 *	1151 *	5667 *	57603 *
3063	3063	19	0000		163	0	0	163	1105
					163 *	0 *	0 *	163 *	1105 *
3063	3063	20	0000		0	0	0	0	289
3077	3063	20	0000		0	0	0	0	274
					0 *	0 *	0 *	0 *	563 *
TOTAL OF YOUR PAYROLL									
TOTAL CHARGED BY YOU TO OTHERS									
TOTAL CHARGED YOU BY OTHERS									
TOTAL CHARGED TO YOUR ACCOUNT									
BUDGET FY _____									
BUDGET FY _____									

Exhibit 2

3063 21
 COST ACCOUNT OR DEPT.
 NORMAL MAINT-ORNL BLDG X-10
 UCN - 618
 (125 3-72)

LABOR COST REPORT

P/E 5/31/76
 DATE
 3063

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CHARGED BY		CHARGED TO		AMOUNT - DOLLARS ONLY					
DEPT.	ACCOUNT	TYPE EXP.	FIRST NUMBER	JOB ORDER	HOURLY LABOR	NON-EXEMPT SALARIES	EXEMPT SALARIES	TOTAL THIS MONTH	FISCAL YEAR - TO DATE
3063	3063	22	0000		0 0 *	0 0 *	0 0 *	0 0 *	1488 1488 *
3063	3063	23	0000		0 0 *	53 53 *	0 0 *	53 53 *	53 53 *
3063	3063	28	0000		302 302 *	0 0 *	528 528 *	830 830 *	2178 2178 *
3063	3063	32	0000		33 33 *	0 0 *	10 10 *	43 43 *	246 246 *
3063	3063	34	0000		1388 1388 *	0 0 *	9037 9037 *	10425 10425 *	19189 19189 *
FL	3063	54	0000		0	0	0	0	52
2134	3063	54	0000		0	0	0	0	6
3003	3063	54	0000		0	429	513	942	11944
3011	3063	54	0000		544	0	0	544	5577
3016	3063	54	0000		4894	115	0	5009	57342
3019	3063	54	0000		0	0	0	0	4320
3061	3063	54	0000		104	0	0	104	877
3062	3063	54	0000		1475	0	0	1475	8795
3063	3063	54	0000		39174	730	0	39904	500036
3074	3063	54	0000		0	0	92	92	306
3075	3063	54	0000		427	0	0	427	4664
3077	3063	54	0000		49025	583	0	49608	541844
TOTAL OF YOUR PAYROLL									
TOTAL CHARGED BY YOU TO OTHERS									
TOTAL CHARGED YOU BY OTHERS									
TOTAL CHARGED TO YOUR ACCOUNT									
BUDGET FY _____									
BUDGET FY _____									

Exhibit 2

CHARGED BY	CHARGED TO			AMOUNT - DOLLARS ONLY					
DEPT.	ACCOUNT	TYPE EXP.	FIRST NUMBER	JOB ORDER	HOURLY LABOR	NON-EXEMPT SALARIES	EXEMPT SALARIES	TOTAL THIS MONTH	FISCAL YEAR - TO DATE
3078	3063	54	0000		1083	0	0	1083	18328
3079	3063	54	0000		3271	0	0	3271	24258
3080	3063	54	0000		1080	0	0	1080	13179
3081	3063	54	0000		1716	0	0	1716	30692
3093	3063	54	0000		0	0	0	0	271
3142	3063	54	0000		0	0	0	0	97
3193	3063	54	0000		0	0	0	0	63
3234	3063	54	0000		0	0	0	0	980
3512	3063	54	0000		0	0	0	0	546
3632	3063	54	0000		18	0	0	18	271
4455	3063	54	0000		33	0	0	33	33
					102844 *	1857 *	505 *	105306 *	1224481 *
ENGR	3063	56	0000		0	0	0	0	857
3060	3063	56	0000		0	0	0	0	10487
					0 *	0 *	0 *	0 *	11354 *
3003	3063	65	0000		0	0	0	0	675
3016	3063	65	0000		25	0	0	25	67
3017	3063	65	0000		0	0	1955	1965	22279
3061	3063	65	0000		0	0	0	0	4
3062	3063	65	0000		0	0	0	0	24
3063	3063	65	0000		9449	3732	17357	30538	284478
3077	3063	65	0000		0	0	0	0	64
3078	3063	65	0000		18	0	0	18	222
3079	3063	65	0000		17	0	0	17	364
3081	3063	65	0000		0	0	0	0	31-
TOTAL OF YOUR PAYROLL									
TOTAL CHARGED BY YOU TO OTHERS									
TOTAL CHARGED YOU BY OTHERS									
TOTAL CHARGED TO YOUR ACCOUNT									
BUDGET FY _____									
BLDGET FY _____									

Exhibit 2

3063 21
 COST ACCOUNT OR DEPT.
 NORMAL MAINT-ORNL BLDG X-10
 UCN - 618
 (125 3-72)

LABOR COST REPORT

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 DATE 3063 PAGE NO.

Exhibit 2

CHARGED BY		CHARGED TO		AMOUNT - DOLLARS ONLY					
DEPT.	ACCOUNT	TYPE EXP.	FIRST NUMBER	JOB ORDER	HOURLY LABOR	NON-EXEMPT SALARIES	EXEMPT SALARIES	TOTAL THIS MONTH	FISCAL YEAR - TO DATE
3092	3063	65	0000		0 9509 *	0 3732 *	0 19322 *	0 32563 *	141 308287 *
TOTAL OF YOUR PAYROLL					93937	5117	31552	130516	1426408
TOTAL CHARGED BY YOU TO OTHERS					33043	202	2032	35277	432158
TOTAL CHARGED YOU BY OTHERS					64115	1127	2570	67812	764342
TOTAL CHARGED TO YOUR ACCOUNT					125009	6042	32100	163151	1758592
BUDGET FY _____									
BUDGET FY _____									

Exhibit 2

CHARGED BY DEPT.	CHARGED TO			AMOUNT - DOLLARS ONLY					
	ACCOUNT	TYPE EXP.	FIRST NUMBER	JOB ORDER	HOURLY LABOR	NON-EXEMPT SALARIES	EXEMPT SALARIES	TOTAL THIS MONTH	FISCAL YEAR - TO DATE
3081	3063	17	0001		0 0 *	0 0 *	0 0 *	0 0 *	360 360 *
3016	3063	54	0001		0	0	0	0	20
3019	3063	54	0001		0	0	0	0	19
3061	3063	54	0001		0	0	0	0	1946
3052	3063	54	0001		0	0	0	0	5113
3063	3063	54	0001		661	0	0	661	9160
3075	3063	54	0001		0	0	0	0	102
3077	3063	54	0001		0	0	0	0	2679
3078	3063	54	0001		0	0	0	0	26
3080	3063	54	0001		0	0	0	0	341
3081	3063	54	0001		4764 5425 *	0 0 *	0 0 *	4764 5425 *	51644 71050 *
TOTAL OF YOUR PAYROLL					0	0	0	0	0
TOTAL CHARGED BY YOU TO OTHERS					0	0	0	0	0
TOTAL CHARGED YOU BY OTHERS					5425	0	0	5425	71410
TOTAL CHARGED TO YOUR ACCOUNT					5425	0	0	5425	71410
BUDGET FY _____									
BUDGET FY _____									

Exhibit 2

MAY 1976

O R N L WORK ORDER SUMMARY (C-CLOSED)

REPORT 81338 PAGE 1527 PUN DATE 06/08/76

DIVISION PLANT AND EQUIPMENT		DIV NO. 21						
ACCT TE SUB	ORDER	DESCRIPTION	MATERIAL	LABOR	OVERHEAD	TOTAL	ESTIMATE	BALANCE
C 3063-54-0000 0000 A-0008E-99 COST OF CLOSED ORDERS								
CURRENT								
FY			150	398		548	850	302
TO DATE			150	398		548	850	302
EXEC DIVSN TOTAL								
CURRENT								
FY			187	562		749	850	101
TO DATE			187	562		749	850	101
EXEC DIVSN TOTAL								
S-DIGIT-WO-TOTAL								
CURRENT								
FY			187	562		749	850	101
TO DATE			187	562		749	850	101
C 3063-54-0000 0000 A-0009E-AA REPAINT INTERIOR GARAGE 7002								
CURRENT								
FY			2116	5379		7495	8500	1005
TO DATE			2116	5379		7495	8500	1005
C 3063-54-0000 0000 A-0010E-AA REPAINT 23-42 B3500E								
CURRENT								
FY			682	5858	9	6540	9000	2460
TO DATE			682	5858		6540	9000	2460
3063-54-0000 0000 A-0011E-AA REPAINT B7C02								
CURRENT								
FY							1750	1750
TO DATE							1750	1750

EXHIBIT 3
ORNL WORK ORDER SUMMARY
Report No. 1338

D E T A I L L A B O R C H A R G E S

05-31-76

1748

DIVISION 21

ACCOUNT	JOB ORDER	HOURS	DEPT	BADGE	CRAFT	N A M E	MAN-HRS.	MAN-MOS.
3063 54 0001	G 0702E A1	2.00	3063H	408-94-0064	34	G.K. ADKISSON	2.00	.01
3063 54 0001	G 0702E A1	40.00	3063H	410-11-3444	34	J.M. ELLIS		
3063 54 0001	G 0702E A1	31.00	3063H	410-11-3444	34	J.M. ELLIS		
3063 54 0001	G 0702E A1	37.50	3063H	410-11-3444	34	J.M. ELLIS		
3063 54 0001	G 0702E A1	40.00	3063H	410-11-3444	34	J.M. ELLIS	148.50	.88
3063 54 0001	G 0305E A2	24.00	3081H	260-10-4916	34	C.J. VINES		
3063 54 0001	G 0305E A2	35.50	3081H	260-10-4916	34	C.J. VINES		
3063 54 0001	G 0305E A2	1.00	3081H	260-10-4916	34	C.J. VINES		
3063 54 0001	G 0305E A2	40.00	3081H	260-10-4916	34	C.J. VINES	98.50	.59
3063 54 0001	G 0305E A2	40.00	3081H	406-01-4337	34	T.C. RUSSELL		
3063 54 0001	G 0305E A2	40.00	3081H	406-01-4337	34	T.C. RUSSELL		
3063 54 0001	G 0305E A2	40.00	3081H	406-01-4337	34	T.C. RUSSELL	160.00	.95
3063 54 0001	G 0305E A1	40.00	3081H	410-26-0699	34	F. . BAYLESS		
3063 54 0001	G 0305E A1	40.00	3081H	410-26-0699	34	F. . BAYLESS		
3063 54 0001	G 0305E A1	40.00	3081H	410-26-0699	34	F. . BAYLESS	160.00	.95
3063 54 0001	G 0305E A1	40.00	3081H	411-28-9143	34	W.T. HAZELWOOD		
3063 54 0001	G 0305E A1	46.00	3081H	411-28-9143	34	W.T. HAZELWOOD		
3063 54 0001	G 0305E A1	40.00	3081H	411-28-9143	34	W.T. HAZELWOOD	166.00	.99
3063 54 0001	G 0305E A1	40.00	3081H	412-82-0873	34	G.A. POWERS		
3063 54 0001	G 0305E A1	46.00	3081H	412-82-0873	34	G.A. POWERS		
3063 54 0001	G 0305E A1	40.00	3081H	412-82-0873	34	G.A. POWERS	166.00	.99
3063 54 0001	G 0305E A1	40.00	3081H	426-22-9856	34	G. . HARDIN		
3063 54 0001	G 0305E A1	46.00	3081H	426-22-9856	34	G. . HARDIN		
3063 54 0001	G 0305E A1	40.00	3081H	426-22-9856	34	G. . HARDIN		
3063 54 0001	G 0305E A1	40.00	3081H	426-22-9856	34	G. . HARDIN	170.00	1.01
3063 54 0001	G 0305E A1	4.00	3081H	426-22-9856	34	G. . HARDIN		
3063 54 0001	G 0305E A1	40.00	3081H	428-42-1948	34	B. . GRAHAM		
3063 54 0001	G 0305E A1	8.00	3081H	428-42-1948	34	B. . GRAHAM		
3063 54 0001	G 0305E A1	32.00	3081H	428-42-1948	34	B. . GRAHAM		
3063 54 0001	G 0305E A1	40.00	3081H	428-42-1948	34	B. . GRAHAM	150.00	.89
3063 54 0001	G 0305E A1	46.00	3081H	428-42-1948	34	B. . GRAHAM		
TOTAL SUB		1221.00						7.27
TOTAL ACCOUNT		24748.10						147.31

EXHIBIT 5

DETAIL LABOR CHARGES
Report No. 1748

Procedure
 OAK RIDGE NATIONAL LABORATORY
OPERATED BY
 UNION CARBIDE CORPORATION
NUCLEAR DIVISION

PLANT AND EQUIPMENT DIVISION

Number: D.1.6

Issued: January 20, 1969

Supersedes:

Subject: AUTHORIZED APPROVAL - P & E ACCOUNT CHARGING

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	J. M. Young

Prepared By: *J. L. Miller*

Approved By: *G. F. R. Johnson*

EXHIBIT 6

PLANT AND EQUIPMENT
 DIVISION PROCEDURE
 D.1.6

Procedure
 OAK RIDGE NATIONAL LABORATORY
OPERATED BY
 UNION CARBIDE CORPORATION
 NUCLEAR DIVISION

PLANT AND EQUIPMENT DIVISION

Number: D.1.6

Issued: January 20, 1969

Supersedes:

Page 1 of 4

Subject: AUTHORIZED APPROVAL - P & E ACCOUNT CHARGING

I. SCOPE

This procedure is an adjunct to the Work Order System Procedure SPP-38B. It establishes uniform guidelines for the approval of work requests and/or charges against P & E accounts with emphasis on interdepartmental account charging.

II. PURPOSE

Provide a means for verifying and controlling charges to an account and accurately analyze costs for budgeting and manpower predictions.

III. DEFINITIONS

A. Charge - An expense cost.

B. Interaccount Charges - Charges to an account that were incurred or requested by an executing department of another account code.

C. Account Manager - Person who is delegated the responsibility for budgeting and controlling an account.

D. Work Request - Authorized order to perform work and to be issued on one of the following forms:

Work Order (UCN-2879A), Blanket Work Order Request (UCN-1685), Cross Order (UCN-2211) Job Plan (UCN-4665), Request for Inspection Services (UCN-4313), Request for Engineering Services (UCN-5891), Program Maintenance Instruction Card

IV. RESPONSIBILITIES

A. The following department management personnel are designated as responsible account managers.

Note: Field engineers, who are assigned work orders through P & E Work Order Control originating from other divisions, are managers for those particular orders and are responsible for charges against orders that they hold.

3003 - Field Engineering Department Superintendent; 3009, 3010, 3011, 3032, 3062, 3081 - Field Services Department Head; 3016 - Fabrication Department Assistant Superintendent; 3017, 3019, 3092 - Operations Analysis Department Head; 3063 - Building & Utility Services Department Head; 3077, 3612 - Electrical, A/C and Heating Services Department Head; 3078 - East Research Area Department Head; 3079 - West

Procedure
OAK RIDGE NATIONAL LABORATORY
OPERATED BY
UNION CARBIDE CORPORATION
NUCLEAR DIVISION

PLANT AND EQUIPMENT DIVISION

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Subject: AUTHORIZED APPROVAL - P & E ACCOUNT CHARGING

Research Area Department Head; 3080 - South
Research Area Department Head; 3142, 3143, 3144
3145, 3150, 3151, 3153, 3155, 3235, 3238, 3241,
3242, 3244, 3629 - Materials Department Head.

- B. The account manager or his delegated representative is responsible:

Interaccounts and Intradepartmental Accounts -
Over 80 Man-Hours (ref. Fig. 1)

For reviewing and signing if approving those work requests, which will be charged to his account, that are estimated to exceed 80 man-hours of labor.

Building engineers should be requested to co-sign all orders for their building that exceed 80 man-hours.

Note: After approval, if the work request requires a new job order number or a new phase number, the order will be processed by the Central Work Order Office.

Interdepartmental Accounts - Over 80 Man-Hours

For distribution of approved interdepartmental work requests exceeding 80 man-hours - one reference copy retained by the account manager who approved the work request and the remaining copies sent to the requester for disposition.

- C. The general foreman, field engineer, or appointed representative is responsible:

Interaccounts and Intradepartmental Accounts -
16 thru 80 Man-Hours (ref. Fig. 1)

For reviewing and signing if approving those work requests estimated to require 16 thru 80 man-hours to complete (the account manager may exercise veto power). Work requests under 16 man-hours which bear an approved order number do not require signature approval.

Procedure
 OAK RIDGE NATIONAL LABORATORY
OPERATED BY
 UNION CARBIDE CORPORATION
 NUCLEAR DIVISION

PLANT AND EQUIPMENT DIVISION

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Subject: AUTHORIZED APPROVAL - P & E ACCOUNT CHARGING

Note: Final signature approval of work orders, other than already approved orders in effect, shall be by the account manager or his representative who is on the ORNL authorized signature list.

Interdepartmental Accounts - 16 Thru 80 Man-Hours

1. For notifying the account manager weekly of all orders issued against his account that are estimated to require 16 thru 80 man-hours to complete.
2. For notifying building engineers of all orders issued for their building that are estimated to exceed 16 man-hours.

D. The first line foreman may authorize blanket order work that is estimated less than 16 man-hours. (ref. Fig. 1)

V. REGULATIONS

- A. Any work that requires 16 man-hours, or more, shall be authorized by a properly signed work request.
- B. Building blanket work ("H" Series Orders) that is classified as alteration and/or modification, which will require 16 man-hours or more, shall be authorized on Cross Order Form UCN-2211.
- C. A job performed under an approved blanket order, that is classified as nonrecurring or miscellaneous, shall be limited to 80 man-hours. Frequently, recurring jobs of a similar nature such as relamping, grass mowing, scale calibration, safety shower inspection, etc. are not subject to the 80 man-hour limit.
- D. The Job Plan (Form UCN-4665) may be used as a request to perform work, in lieu of a "ticket" or other work request, provided it is approved by signature and supported by an approved "parent" work order.
- E. Purchase requisitions, stores and bills of material issues may be charged against a work request only by the executing department (or originating

Procedure

OAK RIDGE NATIONAL LABORATORY

OPERATED BY
UNION CARBIDE CORPORATION
NUCLEAR DIVISION

PLANT AND EQUIPMENT DIVISION

Number: D.1.6

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Supersedes:

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Subject: AUTHORIZED APPROVAL - P & E ACCOUNT CHARGING

department by notification to the executing department) to which the work request is assigned.

- F. Purchase requisitions not covered by approved work orders will be reviewed and approved by the manager of the account, or his delegated representative, to which the cost will be charged.

WORK REQUEST - HANDLING

WORK ORDERS		INITIATE*					APPROVE*					CO-SIGN					INFORMATION COPY				
		ACCT. MGR.	BLDG. ENGR.	FIELD ENGR.	GEN. FOREMAN	FOREMAN	ACCT. MGR.	BLDG. ENGR.	FIELD ENGR.	GEN. FOREMAN	FOREMAN	ACCT. MGR.	BLDG. ENGR.	FIELD ENGR.	GEN. FOREMAN	FOREMAN	ACCT. MGR.	BLDG. ENGR.	FIELD ENGR.	GEN. FOREMAN	FOREMAN
> 80 Man-Hrs.	A	X	X	X	X		X					X					X		X		
	J	X	X	X	X		X					X					X		X		
	K	X	X	X	X		X					X					X		X		
	G	X					X										X				
	H*	X	X				X					X					X	X			
***16 - 80 Man-Hrs.	A	X	X	X	X				X	X							X		X	X	
	J	X	X	X	X				X	X							X		X	X	
	K	X	X	X	X				X	X							X		X	X	
	G	X			X	X			X	X											
	H*	X	X		X		X		X								X	X		X	
< 16 Man-Hrs.	A																				
	J																				
	K																				
	G	X			X	X	X				X										
	H	X	X		X	X					X										

*Final signature approval to open a new order through the Central Work Order Office will be by persons on the ORNL Authorized Signature List. The foregoing statement does not apply to orders, such as Blankets, that bear an approved Order Number.

**All alterations and improvements that are estimated require 16 man-hours and over will be authorized on Cross Order Form UCN-2211.

***The account manager reserves the right to veto interdepartmental charges to his account.

WORK ORDER

TO: ☐ I & C ☐ IE ☐ P & E ☐ OTHER				DATE		NUMBER	
TO BE COMPLETED BY ORIGINATOR							
ACCOUNT CHARGE		REQUESTER		DIVISION OR DEPARTMENT		BLDG NO	
						PHONE NO	
REVIEWS		☐ DAVIS-BACON		PERSON TO CONTACT		BLDG NO	
REQUIRED:		☐ BUILDING ALTERATIONS-SYSTEMS-UTILITIES				PHONE NO	
WORK PERMITS		☐ NONE ☐ HAZARDS		QUALITY ASSURANCE LEVELS		RDT FUNDS?	
REQUIRED:		☐ RADIATION ☐ OTHER		☐ I ☐ II ☐ III ☐ IV		☐ Yes ☐ No	
DIVISION APPROVAL		CENTRAL WORK ORDER OFFICE				STARTING DATE	
APPROVED FOR:		☐ PRELIMINARY DESIGN				COMPLETION DATE	
		☐ FINAL DESIGN ☐ Fabrication ☐ Installation ☐ Procurement					
TO BE COMPLETED BY EXECUTING DIVISION				ESTIMATE		FY- TOTAL	
ASSIGNED TO		CODE		ENGINEERING		\$	
BRIEF TITLE				P SHOPS		\$	
				L FIELD			
				N LABOR TOTAL			
				T MATERIAL			
				O DIRECT COST TOTAL			
DETAILED DESCRIPTION OF WORK REQUIRED				P OVERHEAD			
				E CONTINGENCY			
				R UCN TOTAL			
				FIXED PRICE CONTRACTOR			
				CPFF CONTRACTOR			
				TOTAL		\$	

EXHIBIT 7

WORK ORDER
UCN-2879

No. 323131

[illegible]

DISTRIBUTION: WHITE - MAINTENANCE
YELLOW - MAINTENANCE
BLUE - ORIGINATOR

UCN-1685
(3 9-68)

UPON COMPLETION OF THE WORK, MAINTENANCE WILL FILL OUT COLUMNS 1, 2, 3, AND 4 AND RETURN WHITE COPY TO THE ORIGINATOR.

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DISTRIBUTION:
FIC
Engineer
Analyst
Division Office

RDT FUNDS? ☐ Yes ☐ No

☐ NEW JOB OPENER
 10 ☐ REVISED INFORMATION
☐ DELETE ☐ CLOSE

[illegible]

APPROVED

(NOTE: KEY PUNCH COLUMNS 1 - 10 SAME IN CARDS 1 AND 2.)

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PROGRAMMED MAINTENANCE FOR WEEK OF MAR 15, 1976 FOREMAN FIELDS
QUALITY LEVEL

LOCATION 2001- 01 145 EQUIPMENT DESCRIPTION HEATER, MCQUAY, SOUTH WEST UNIT PROPERTY JOB ORDER X-81480 H3001E-C1

ITEM	POINT OF SERVICE	LUB	FREQ	NO	FREQ	REMARKS
2	CK BELT WEAR, TENSION, ALIGNMENT			1	6M	BELT BP-75
3	LUB BLOWER SHAFT BRNGS	WF	GF	2	3M	
4	CHANGE FLTKS 20X25X2			6	6M	07-644-7712
5	CK STEAM TRAP OPERATION			1	Y	
6	BLOW OUT STRAINER			1	Y	
7	CK ELECT COMPONENTS				Y	
8	CLN MTR, FAN, COILS, PLENUM				Y	

EXHIBIT 10
PROGRAMMED MAINTENANCE
CARD

STANDARD COST INFLATION
X-10

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