

Conceptual Design Report

Mechanical Systems Modernization, Phase I

February 1996



Project Number 98-LBL

Ernest Orlando Lawrence Berkeley National Laboratory
University of California, Berkeley, California 94720

Prepared for U.S. Department of Energy under Contract No. DE-AC03-76SF00098

MECHANICAL SYSTEMS MODERNIZATION, PHASE I

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DOE/OAK
CONCEPTUAL DESIGN REPORT
REVIEW CHECKLIST

Project Title: MECHANICAL SYSTEMS MODERNIZATION, PHASE I

Date of CDR: FEBRUARY 1996 Project Location: BERKELEY LAB

In the space provided below, please indicate where the item is located in the CDR, e.g. page number, section, etc. If not applicable, then indicate N/A and explain in writing.

- | | | |
|-----|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1) | <u>1-1</u> | Project justification. |
| 2) | <u>2-1</u> | Detailed description of the project scope. |
| 3) | <u>Section 2</u> | Performance requirements (facility/building/system/process). |
| 4) | <u>Section 3 and 9</u> | Project cost estimate. |
| 5) | <u>3-1</u> | Cost estimate assumptions and methodology. |
| 6) | <u>3-1</u> | Cost estimate date. |
| 7) | <u>3-1</u> | Identification of the originator of the cost estimate. |
| 8) | <u>3-1</u> | Escalation rates used in cost estimate. |
| 9) | <u>3-1</u> | Major areas of cost uncertainties. |
| 10) | <u>3-2</u> | Financial schedule (annual obligation/cost requirements). |
| 11) | <u>Section 2</u> | During Title I Engineering, alternative design solutions will be evaluated to determine the most cost effective solutions for each piece of equipment being replaced. |
| 12) | <u>N/A</u> | Life cycle cost analyses of alternative design solutions will be performed during Title I Engineering. |
| 13) | <u>4-2</u> | Schedule with major milestones and critical path identified (design, procurement, construction, mid-point of construction, environmental compliance and safety analysis). |
| 14) | <u>4-1</u> | Schedule constraints (funding, seasonal, R&D related, etc.). |
| 15) | <u>1-2</u> | Method of performance (acquisition strategy) for design, procurement and construction. |
| 16) | <u>3-7</u> | Work breakdown structure. |
| 17) | <u>Section 8</u> | Safeguards and security requirements. |
| 18) | <u>Section 8</u> | Safeguards and security features incorporated. |
| 19) | <u>Section 1, 7, 9</u> | Energy conservation design/construction features. |

DOE/OAK
CONCEPTUAL DESIGN REPORT
REVIEW CHECKLIST

Project Title: MECHANICAL SYSTEMS MODERNIZATION, PHASE I

- | | | |
|-----|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 20) | <u>Section 1, 7, 9</u> | There are no new energy requirements. More energy efficient design solutions are anticipated to reduce net energy consumption. |
| 21) | <u>Section 8</u> | Health, safety and fire protection hazards/risks. |
| 22) | <u>Section 8</u> | Health, safety and fire protection features. |
| 23) | <u>Sections 4 & 8</u> | Schedule for safety analysis review/documentation. |
| 24) | <u>Section 8</u> | Environmental hazards/risks. |
| 25) | <u>Section 8</u> | Discussion on level of required NEPA documentation. |
| 26) | <u>Section 8</u> | Environmental hazards/risks mitigation features. |
| 27) | <u>Sections 4 & 8</u> | Schedule for NEPA compliance/documentation. |
| 28) | <u>Section 8</u> | Decontamination, decommissioning and disposal requirements. |
| 29) | <u>Section 2</u> | Discussion on project quality assurance to satisfy program and project objectives. |
| 30) | <u>Section 2</u> | Range of facility/building/system/process operating conditions. |
| 31) | <u>Sections 1 & 2</u> | Increased operating reliability is an important objective of this project. Equipment reliability will be considered as a part of life cycle cost analysis during Title I Engineering. |
| 32) | <u>Sections 1 & 2</u> | The useful life of new equipment will be considered with operation being served. An analysis will be performed during Title I Engineering. |
| 33) | <u>Section 1</u> | Discussion on maintenance, repair and replacement of facility. |
| 34) | <u>N/A</u> | Telecommunications requirements. |
| 35) | <u>N/A</u> | Computer equipment requirements. |
| 36) | <u>Section 8</u> | Provision for access and use by the physically handicapped. |
| 37) | <u>N/A</u> | Provision for fallout shelters. |
| 38) | <u>Section 2</u> | Discussion on project uncertainties/risks and effort required to resolve. |
| 39) | <u>3-9</u> | Contingency requirements and analysis. |
| 40) | <u>Section 5</u> | Site development plan (including utilities) drawings. |

DOE/OAK
CONCEPTUAL DESIGN REPORT
REVIEW CHECKLIST

Project Title: MECHANICAL SYSTEMS MODERNIZATION, PHASE I

- | | | |
|-----|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 41) | <u>N/A</u> | Building layout (plan and elevation views) drawings. |
| 42) | <u>N/A</u> | Major equipment layout drawings. |
| 43) | <u>Section 2</u> | Equipment replacement may involve some revisions to existing piping and instrumentation. Any required revisions will be performed during Title I Engineering. |
| 44) | <u>Section 2</u> | Any required revisions to process and HVAC layout drawings will be performed during Title I Engineering. |
| 45) | <u>N/A</u> | Discussion on facility siting, site development plan, site development requirements and real estate issues (easements, permits, etc.). |
| 46) | <u>N/A</u> | Utility service requirements, utility sources, modifications to existing utility arrangements/agreements (easements, permits, etc.). |
| 47) | <u>N/A</u> | List of major standard equipment and special facilities. |
| 48) | <u>N/A</u> | Discussion on space utilization/building efficiency ratio. |
| 49) | <u>Section 6</u> | Construction types and materials. |
| 50) | <u>Section 6</u> | Outline construction specifications. |
| 51) | <u>2-3</u> | Applicable codes, standards, regulations, DOE Orders, etc. |
| 52) | <u>N/A</u> | Design loads (facility/building/system/process). |
| 53) | <u>N/A</u> | Subsurface/geotechnical requirements. |
| 54) | <u>N/A</u> | Strategic Facilities Initiative form. |
| 55) | <u>N/A</u> | Migration plan. |
| 56) | <u>Last Page of Section 9</u> | Protection of Information disclaimer. |

MECHANICAL SYSTEMS MODERNIZATION, PHASE I

SECTION 1

INTRODUCTION

Summary

The Mechanical Systems Modernization, Phase I project will correct serious infrastructure problems in the Building 50 Complex, Building 70/70A Complex, and in Building 58. Research performance is currently inhibited by consistent sub-standard performance of inadequate mechanical systems and the inability of these systems to meet the peak-period demand requirements. Upon completion of the project, the mechanical systems will provide adequate and reliable service to support the research mission. The upgraded systems will also meet modern industrial standards for safe and efficient operation at Ernest Orlando Lawrence Berkeley National Laboratory (Berkeley Lab).

Mechanical systems modernization in the three buildings include:

- Ventilation systems
- Cooling/Chilled water systems
- Heating systems
- Emergency/Standby power supply systems

Project Justification

This project addresses infrastructure problems that pose significant risks to research activities at Berkeley Lab. Modernization of the mechanical systems through routine maintenance work is not feasible since changes in system configuration, capacity, and operating conditions require substantial modifications. These systems are 25 to 30 years old and are inadequate, unreliable, prone to failure and difficult to maintain and repair. In many cases spare parts for the equipment are unavailable.

The project supports the national construction sector goals prepared by the Construction & Building Subcommittee of the National Science and Technology Council for the National Institute of Standards and Technology (NIST). Specifically, the project will accomplish:

- Reduction of operations, maintenance and energy costs and
- Increased durability and flexibility of building mechanical systems

Operations and maintenance cost reductions will result from the more reliable mechanical systems proposed in this project. It is estimated that a minimum of 1% of the equipment cost, or \$20,200, will be saved during the first year of operation. This will result in an equipment lifetime savings of \$223,400.

Energy costs will be reduced through use of more energy-efficient systems. It is estimated that 347,000 kWh and 11,000 therms of energy will be saved annually. This will result in a first-year cost savings of \$22,700 and a lifetime savings of \$270,700. This reduction in energy consumption is equivalent to the following reductions in annual emissions from power plants, according to the Environmental Protection Agency conversion rates for California: 174 tons CO₂, 191 tons SO₂ and 260 tons NO_x. Lifetime pollution reduction resulting from this project amounts to 2,603 tons CO₂, 2,863 tons SO₂ and 3,904 tons NO_x.

CAMP and RPM Ratings

This project was rated using the Capital Asset Management Process (CAMP) evaluation criteria and scored 65 points. This score includes five (5) points for management adjustment to emphasize Berkeley Lab's high priority and urgent need to proceed with this project.

The CAMP system is designed to evaluate the multiple attributes of Capital projects and incorporates consideration of health and safety, mission and investment, environmental and waste management, and security and safeguard concerns. The primary subcategory of concern for this project is within the area of Mission and Investment rating criteria. Scoring results are summarized as follows:

- Mission Capability, Capacity, and Quality: The systems to be upgraded have inadequate capacity and other design constraints that inhibit performance of research missions.
- Asset Condition: Asset condition is poor and missions are threatened due to inability to meet peak-demand requirements and by failures in these aged and stressed systems.

The Risk-Based Priority Model (RPM) which measures the probability and consequence of environmental, safety and health concerns is not applied to this project. This project does not affect such issues; it improves mission performance and capabilities.

Basis of Conceptual Design

The Conceptual Design was done by the Berkeley Lab Facilities Department with support of mechanical, architectural, civil/structural, electrical, and energy management engineering sections.

The cost estimate was prepared by a professional estimator of the Berkeley Lab Facilities Department.

Method of Performance

Engineering, Design, and Construction

Berkeley Lab will assign a project manager who will be responsible for managing the project and reporting status data relative to schedule and cost. An Architect-Engineer firm experienced in this type and size project will be selected and a lump-sum Subcontract will be negotiated and awarded by Berkeley Lab. Contract administration

will be accomplished by the Berkeley Lab Purchasing Department. Inspection will be accomplished by the Berkeley Lab Facilities Department.

Equipment procurement will be performed by Berkeley Lab to ensure the equipment meets laboratory standards for maintainability, durability, flexibility, and energy efficiency. To ensure operational continuity, system construction will be carried out using in-house supervision of labor only forces procured through competitive bidding.

The above method of performance has been selected to accelerate project delivery time from the three years typically required to two years.

Improvement of Delivery Time

A significant national construction goal for infrastructure improvement is shortening of the delivery time of infrastructure projects. To that end, this project has taken the following measures to shorten the schedule to two years (three years are typically required for a project of this type):

- Equipment procurement will be initiated upon completion of Title I. Equipment procurement administrative lead time will be accomplished concurrent with completion of Title II design. Thus, equipment will be available for installation upon completion of Title II and will be installed on a fast track basis.
- Construction will be planned and scheduled to mitigate program disruptions and allow maximum efficiency of construction activities through careful sequencing of the work.
- Innovative technologies such as on-line electronic data interchange will be fully utilized during the execution of this project. Electronic data interchange systems will allow on-line review and comment of critical project data between team members, including Berkeley Lab, A/E, subcontractors and key material and equipment suppliers.

Reliability, Maintainability and Operability

The Title I and II designs will be reviewed for reliability, maintainability and operability. The primary objective of these reviews is to assure the development of systems that will be reliable, safe, and easy to operate, and that can be maintained with minimum resources. A checklist for these reviews will be provided by the Berkeley Lab Facilities Operations and Maintenance staff.

MECHANICAL SYSTEMS MODERNIZATION, PHASE I

SECTION 2

PROJECT DESCRIPTION

Mechanical systems will be modernized at selected buildings of the Ernest Orlando Lawrence Berkeley National Laboratory (Berkeley Lab) site. During Title I design, each mechanical system proposed will be analyzed to determine modernization needed to meet capacity requirements, standards for safe and efficient operation, and energy efficiency. Titles I and II design may result in adjustments to the actual list of systems that are proposed within the established budget. During Title II design, detailed drawings, specifications and cost estimates will be prepared for each mechanical system to be modernized. Major modernization efforts will consist of the following:

Building 50 Complex

Air supply systems will be upgraded to provide required flow rates and system pressure. Fan supports (vibration isolators) will be upgraded to meet current seismic restraint requirements.

Undersized exhaust and supply ductwork will be replaced to satisfy acoustical and pressure loss requirements.

Balancing and control dampers will be replaced as required and located to provide maintenance access.

Pneumatic control systems will be renovated with new thermostats, control valves, pneumatic operators, damper linkage, static pressure controls, gauges and accessories.

Ventilation systems will be balanced to design flow values. Pneumatic temperature control systems will be calibrated and set.

Cooling tower will be demolished and a new energy efficient cooling tower will be installed.

Chilled water systems will be upgraded to include pumps, chillers, piping, gauges, controls, and valves. Systems will be balanced and calibrated.

Building 70 / 70A Complex

Chilled water systems will be upgraded to include pumps, chillers, piping, gauges, controls, and valves. Systems will be balanced and calibrated.

Compressed air systems will be upgraded to include, piping, filters, gauges, controls, and valves.

Emergency/Standby power supply and distribution system, controls, gauges and accessories will be upgraded.

Building 58

Heating system will be demolished and replaced.

Disposition of Demolished and Removed Equipment

The demolition of cooling tower will produce significant quantities of debris contaminated with water treatment chemicals and cement-asbestos. Replacement of ducts may include asbestos insulation and lead paint. The Subcontract documents will require disposal of these items at an approved dump site. The Subcontractor will provide documentation that these materials have been disposed of in a proper manner.

MECHANICAL SYSTEMS MODERNIZATION, PHASE I

SECTION 3

BASIS OF COST ESTIMATE

The cost estimates for Mechanical Systems Modernization, Phase 1 were prepared by Berkeley Lab's professional estimator.

The construction cost estimate is dated December 1995. The Estimate Summary is included in this section. The detailed construction cost estimate is included in Section 9, Detailed Supporting Data. Escalation is based upon "Anticipated Economic Escalation Rates DOE Construction Projects," updated January 1996, namely, 2.5% for FY 1996, 2.8% for FY 1997, 3.0% for FY 1998, and 3.1% for FY 1999. Escalation rates are compounded from the date of the estimate to the midpoint of construction.

Cost estimate details for ED&I are located in Section 9. Both the Estimate Summary shown in this section and Detailed Cost Estimate in Section 9 have been correlated with the work breakdown structure (WBS) shown in the BA/BO Schedule.

DEPARTMENT OF ENERGY
FY98 FIELD BUDGET REQUEST

ENERGY SUPPLY RESEARCH & DEVELOPMENT: PLANT & CAPITAL EQUIPMENT
MULTIPROGRAM ENERGY LABORATORIES - FACILITY SUPPORT

(Tabular dollars in thousands. Narrative material in whole dollars.)

1. Title and Location of Project: Mechanical Systems Modernization, Phase I
Ernest Orlando Lawrence Berkeley National Laboratory
Berkeley, California

2a. Project No. 98-LBL
2b. Construction Funded

3a. Date A-E Work Initiated (Title I Design Start Scheduled): 2nd Qtr. FY 1998

3b. A/E Work (Titles I & II) Duration: 9 months

5. Previous Cost Estimate:
Total Estimated Cost (TEC)--none
Total Project Cost (TPC)--none

4a. Date Physical Construction Starts: 1st Qtr. FY 1999

4b. Date Construction Ends: 4th Qtr. FY 1999

6. Current Cost Estimate:
TEC--\$4,700
TPC--\$4,760

7. Financial Schedule (Federal Funds):

<u>Fiscal Year</u>	<u>Appropriations</u>	<u>Adjustments</u>	<u>Obligations</u>	<u>Costs</u>
1998	\$ 2,500	\$0	\$ 2,500	\$ 1,482
1999	2,200	0	2,200	3,158
2000	0	0	0	60

1. Title and Location of Project: Mechanical Systems Modernization, Phase I
Ernest Orlando Lawrence Berkeley National Laboratory
Berkeley, California

2a. Project No. 98-LBL
2b. Construction Funded

9. <u>Detail of Cost Estimate:</u>	<u>Item Cost</u>	<u>Total Cost</u>
a. Design and Management Costs.....		\$ 900
1. Engineering, design, and inspection (@ ~22% of Construction Costs, Item c)	\$ 700	
2. Construction management costs.....	0	
3. Project management (@ ~6% of Construction Costs, Item c).....	200	
b. Land and Land Rights.....		0
c. Construction Costs.....		3,150
1. Improvements to land.....	\$ 0	
2. Buildings.....	0	
3. Other structures.....	0	
4. Utilities.....	3,150	
5. Special facilities (Schedule I, Engineered Equipment).....	0	
d. Standard Equipment.....		0
e. Major Computer Items.....		0
f. Removal Cost Less Salvage.....		0
g. Design and Project Liaison, Testing, Checkout and Acceptance.....		0
h. Subtotal (a. through g.).....		\$ 4,050
i. Contingencies (@ ~16% of above costs).....		650
j. Total Line Item Cost [Section 11.a.1.(a)].....		\$ 4,700
k. LESS: Non-Federal Contribution.....		0
l. Net Federal total estimated cost (TEC).....		\$ 4,700

Construction costs have been escalated at 1.9% for FY96, 2.8% for FY97, 3.0% for FY98, and 1.8% for FY99, for a total of 9.8%, compounded to midpoint of construction.

Conceptual design is complete.

MECHANICAL SYSTEMS MODERNIZATION, PHASE I

CONSTRUCTION COST ESTIMATE SUMMARY

Mechanical Systems Modernization		<u>\$2,290,000</u>
Subtotal Direct Cost		2,290,000
General Conditions/Mobilize Estimating Contingency	8%	183,000 <i>In Project Contingency</i> <u>2,473,000</u>
Bond	2%	49,000
Prime Contractor OH & Fee	11%	<u>272,000</u>
Total Estimated Construction Cost at December 1995		2,795,000
Total Escalation to Midpoint of Construction in April 1999	9.8%	\$274,000
Subtotal Escalated Construction Cost		\$3,069,000
Berkeley Lab Overhead		<u>77,000</u>
Construction Cost		\$3,146,000
	SAY	<u>\$3,150,000</u>

MECHANICAL SYSTEMS MODERNIZATION, PHASE I

Overhead Analysis

	Cost Incl Fac Burden	Overhead	Cost Incl Burden & Overhead	TOTAL	SAY
A. ED&I (22% of Const)				702	700
1. Engineering & Design (A&E)	362	24	386		
2. Engineering & Design (In-house)	122	36	158		
4. Inspection	122	36	158		
B. 3. Project Management (6% of Const)	153	45	198	198	200
C Construction				3146	3150
1. Improvements to Land	0	0	0		
2. Buildings	0	0	0		
3. Utilities	3069	77	3146		
4. Special Building Facilities	0	0	0		
5. In-house Support	0	0	0		
D. Relocations	0	0	0	0	
E. Standard Equipment	0	0	0	0	
SUBTOTAL				\$ 4046	\$ 4050
F. Project Contingency (16%)				647	650
TOTAL ESTIMATED COST				\$ 4693	\$ 4700

MECHANICAL SYSTEMS MODERNIZATION, PHASE I

ESCALATION ANALYSIS

Based on DOE "Anticipated Economic Escalation Rates" (dated January 1996).

Construction

Start Construction:	Dec 1998
Construction Period:	10 Months
Finish Construction:	Sep 1999
Midpoint Construction:	Apr 1999
Estimate Date:	December 1995

										%
FY 1996	Jan 1996	-	Sep 1996	9	mo	@	2.5	=	1.9	
FY 1997	Oct 1996	-	Sep 1997	12	mo	@	2.8	=	2.8	
FY 1998	Oct 1997	-	Sep 1998	12	mo	@	3.0	=	3.0	
FY 1999	Oct 1998	-	April 1999	7	mo	@	3.1	=	1.8	
Total Compounded Escalation									9.8	

**MECHANICAL SYSTEMS MODERNIZATION, PHASE I
BA/BO SCHEDULE(K)
FEBRUARY, 1996**

WBS NO.	WBS ELEMENT	TOTAL BUDGET	F Y 1998				F Y 1999				F Y 2000			
			1	2	3	4	1	2	3	4	1	2	3	4
			O N D	J F M	A M J	J A S	O N D	J F M	A M J	J A S	O N D	J F M	A M J	J A S
1	Mechanical Systems Modernization, Phase 1													
1.1	Engr'g, Design & Inspection	700												
1.1.1	LBL Activities	339												
1.1.1.1	Title 1	57	57/57											
1.1.1.2	Title 2	60		20/20	30/30	10/10								
1.1.1.3	Title 3	40							20/20	20/20				
1.1.1.4	Inspection	157						50/50	50/50	57/57				
1.1.1.5	Consultants	25		15/15		10/10								
1.1.2	A/E Activities	361												
1.1.2.1	Title 1	130	130/130											
1.1.2.2	Title 2	146	146/0		0/100	0/66								
1.1.2.3	Title 3	85	85/0						0/30	0/55				
1.2	Construction	3150												
1.2.1	Utilities	3150		1590/0	0/750	0/750	1560/1020			0/630				
1.3	Standard Equipment													
1.4	Relocations													
1.5	Project Management	200									10/10			
1.6	Contingency by Year	650/650	300 / 300				300 / 300				50 / 50			
	Total BA/BO by Year	4700/4700	2453 / 1482				2187 / 3158				60 / 60			
	Cumulative BA/BO by Year		2453 / 1482				4640 / 4640				4700 / 4700			
	Current Funding Plan	4700	2500				2200				0			
	Cumulative Funding Plan by Year		2500				4700				4700			

MECHANICAL SYSTEMS MODERNIZATION, PHASE I

OBLIGATIONS AND COSTS SCHEDULE DETAIL (\$K)

DESCRIPTION	TOTAL	FY 1998		FY 1999		FY 2000	
		O	C	O	C	O	C
<u>LBL Activities</u>							
Engineering							
Title I	57	57	57				
Title II	60	50	50	10	10		
Title III	40			40	40	0	0
Inspection	157			157	157	0	0
Consultants	<u>25</u>	<u>15</u>	<u>15</u>	<u>10</u>	<u>10</u>	<u>0</u>	<u>0</u>
Subtotal	339	122	122	217	217	0	0
<u>Architect/Engineer</u>							
Title I	130	130	130				
Title II	146	146	100	0	46		
Title III	<u>85</u>	<u>85</u>	<u>0</u>	<u>0</u>	<u>85</u>	<u>0</u>	<u>0</u>
Subtotal	361	361	230	0	131	0	0
<u>Construction</u>							
Mechanical Equipment	3,150	1,590	750	1,560	2,400	0	0
<u>Project Management</u>	<u>200</u>	<u>80</u>	<u>80</u>	<u>110</u>	<u>110</u>	<u>10</u>	<u>10</u>
Subtotal	<u>4,050</u>	<u>2,153</u>	<u>1,182</u>	<u>1,887</u>	<u>2,858</u>	<u>10</u>	<u>10</u>
Contingency (16%)	<u>650</u>	<u>300</u>	<u>300</u>	<u>300</u>	<u>300</u>	<u>50</u>	<u>50</u>
 TOTAL	 4,700	 2,453	 1,482	 2,187	 3,158	 60	 60

MECHANICAL SYSTEMS MODERNIZATION, PHASE I

CONTINGENCY ANALYSIS

	Estimated Cost (\$K)	Contingency (%)	Contingency (\$K)
<u>LBL Activities</u>			
Engineering			
Title I	57	10	6
Title II	60	5	3
Title III	40	20	8
Inspection	157	5	8
Consultants	25	20	5
<u>Architect/Engineer</u>			
Title I	130	16	20
Title II	146	20	29
Title III	85	25	21
<u>Construction</u>			
Mechanical Equipment	3,150	17	546
<u>Project Management</u>	<u>200</u>	2	<u>4</u>
Subtotal	4,050		650
Contingency (~16%)	<u>650</u>		
TOTAL	4,700		

MECHANICAL SYSTEMS MODERNIZATION, PHASE I

SECTION 4

BASIS OF TIME SCHEDULE

It is assumed that project funding will be made available for commitments by the Berkeley Lab on January 1, 1998.

Prior to that time, Berkeley Lab will evaluate environmental conditions and prepare recommendations of NEPA documentation for DOE consideration beginning in October 1997 for completion by December 1997. It is anticipated that the environmental evaluation will result in a categorical exclusion.

A/E selection will take place between January and July of 1997, during which time the Design Program necessary for A/E fee negotiations and Project Management Plan for DOE will also be completed.

A/E fee negotiation will take place between October and December of 1997 contingent upon assurance by DOE/SF that the project is in the FY 1998 budget.

The Project Time Schedule that follows is based upon the foregoing assumptions.

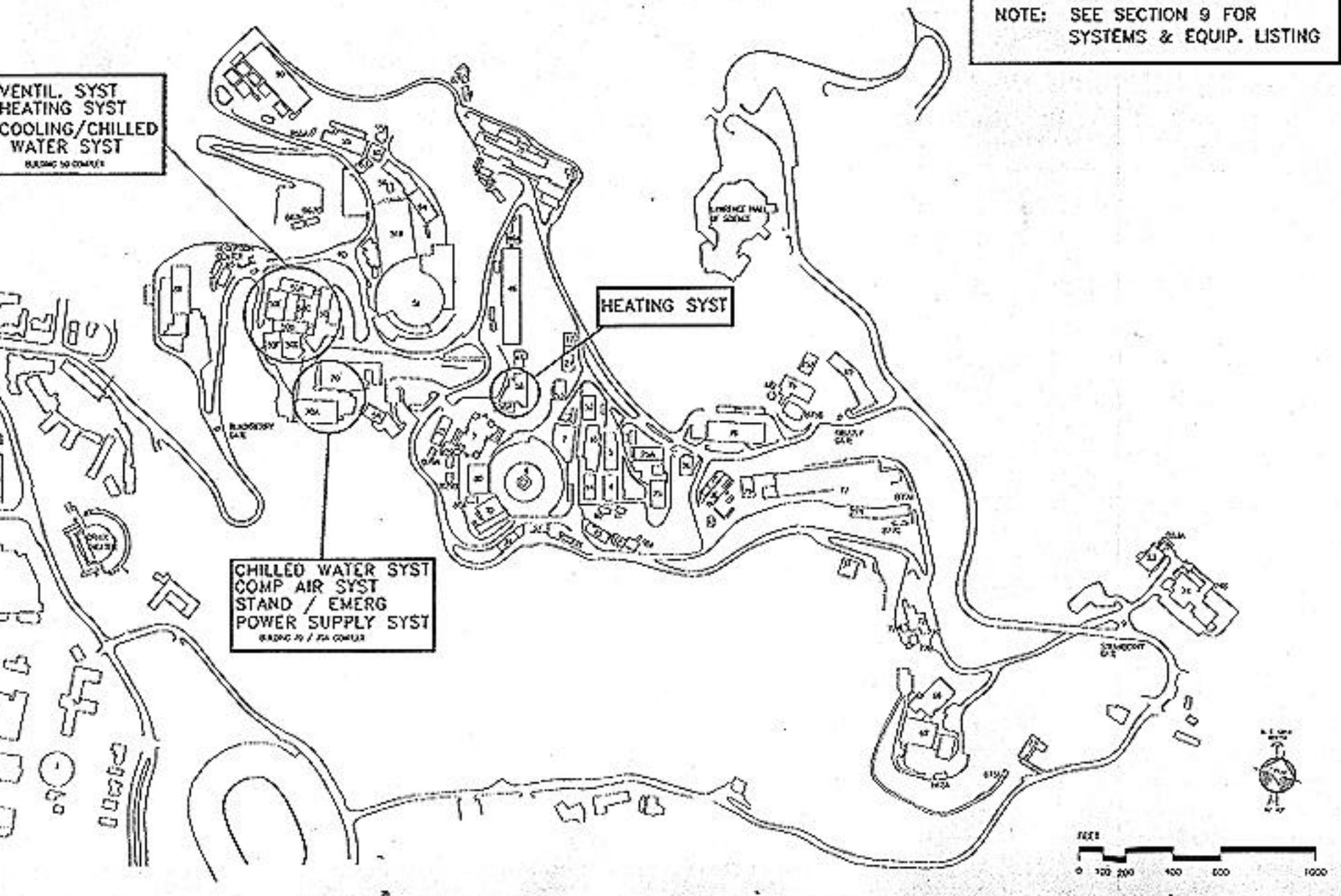
MECHANICAL SYSTEMS MODERNIZATION, PHASE I

TIME SCHEDULE

Activities	Fiscal Year 1997				Fiscal Year 1998				Fiscal Year 1999				Fiscal Year 2000			
	1st	2nd	3rd	4th												
NEPA/SARS					■											
A/E SELECTION		■	■	■												
A/E NEGOTIATION					■											
FUNDING AUTHORIZATION					◆											
TITLE I						■										
TITLE II							■	■								
BID AND AWARD									■							
TITLE III										■	■	■				
EQUIPMENT PROCUREMENT							■	■	■							
CONSTRUCTION										■	■	■				

VENTIL. SYST
HEATING SYST
COOLING/CHILLED
WATER SYST
BUILDING 10 COMPLEX

NOTE: SEE SECTION 9 FOR
SYSTEMS & EQUIP. LISTING



MECHANICAL SYSTEMS MODERNIZATION PHASE I

SITE PLAN

ERNEST ORLANDO LAWRENCE
BERKELEY NATIONAL LABORATORY

BERKELEY LABORATORY

MECHANICAL SYSTEMS MODERNIZATION, PHASE I

DATE: 12/95

PREP BY: J. Eastman

JOB NO:

PREP FOR: P.Orozco

PROJ ID	EQUIP TYPE	BLDG NO	DESCRIPTION	QTY	UNIT	NEW EQPT LAB & MAT'L	DEMOLITION	RETROFIT	TOTAL COST	CUMULATIVE TOTAL
ESTIMATE DETAIL - DIRECT COSTS										
BUILDING 50 COMPLEX										
1	BR	50	Bryan Mod. L-48 water tube hot water boiler, dual fired with normal input 3,200,000 btu/h and min input 1,600,000 btu/h. Includes piping, valves, pumps & guages for complete system	2	EA	\$159,764	\$3,520	\$6,240	\$169,524	\$169,524
2	GP	50, 50C-F	Pacific Pumping Co. 1-1/2M-LR31 base mounted chilled water pump - cast iron construction with 5 hp motor.	2	EA	\$7,775	\$915	\$1,825	\$10,515	\$180,039
3	GP	50, 50C-F	1/4 hp sump pump.	1	EA	\$437	\$214	\$103	\$753	\$180,792
4	AHU	50, 50C-F	Ceiling hung air handling unit with 6 row chilled water cooling coil and filter section.	1	EA	\$4,836	\$440	\$520	\$5,796	\$186,587
5	AHU	50, 50C-F	Drayer-hansen 2H14 ceiling hung air handling unit with chilled water coil, filter section and 3 hp motor.	1	EA	\$11,396	\$440	\$520	\$12,356	\$198,944
6	AHU	50, 50C-F	Dunham Bush HAH-B22 air handling unit with 3/4 hp motor, chilled water cooling coil and filter section.	1	EA	\$7,775	\$550	\$650	\$8,975	\$207,919
7	CDP	50	Ventilation and control dampers	140	EA	\$152,841	\$22,750	\$7,000	\$182,591	\$523,745

BERKELEY LABORATORY

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ESTIMATE DETAIL - DIRECT COSTS										
8	AF	50, 50C-F	AF-Air Filter, dbl pack, horizontal type 22,400CFM	1	EA	\$28,800	\$440	\$520	\$29,760	\$553,505
9	BL	50, 50C-F	American Blower Mod. HS size 200 SISW utility exhaust fan with 1-1/2 hp motor.	1	EA	\$3,957	\$303	\$358	\$4,617	\$558,122
10	BL	50, 50C-F	American Blower Mod. HS size 245 SISW utility exhaust fan with 2 hp motor.	1	EA	\$3,957	\$303	\$358	\$4,617	\$562,738
11	BL	50, 50C-F	American Blower Mod. HS size 182 SISW utility exhaust fan with 3/4 hp motor.	1	EA	\$3,355	\$275	\$325	\$3,955	\$566,693
12	DW	50, 50C-F	Replace undersized and rusted ductwork. Clean and seal remaining ductwork	25,000	LBS	\$137,397	\$32,000	\$0	\$169,397	\$736,090
13	BAL	50, 50C-F	Balance air handling & distribution	1	LS	\$10,651			\$10,651	\$746,741
14	CNTRLS	50, 50C-F	Pneumatic controls, control valves, operators, static pressure controls, etc.	1	LS	\$133,235			\$133,235	\$341,154

BERKELEY LABORATORY

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PROJ ID	EQUIP TYPE	BLDG NO	DESCRIPTION	QTY	UNIT	NEW EQPT LAB & MAT'L	DEMOLITION	RETROFIT	TOTAL COST	CUMULATIVE TOTAL
ESTIMATE DETAIL - DIRECT COSTS										
15	ACU	50A	75 Ton Chiller on Ground Floor	2	EA	\$101,056	\$5,856	\$10,000	\$116,912	\$863,653
16	GP	50A	Weinman 2GB-1 base mounted heating hot water circulating pump with 2 hp motor.	1	EA	\$1,890	\$162	\$444	\$2,495	\$866,148
17	GP	50A	Pacific Pump 11-30955-733201 base mounted, cast iron, bronze trimmed, tower water circulating pump with 7-1/2 hp motor.	1	EA	\$4,857	\$732	\$1,140	\$6,729	\$872,877
18	CT	50A	Marley Co. Mod. 5875 Permatower - 154 gpm, 90F in & 75F out with 65F wet bulb temp. To be reinforced fiber plastic, Ceramic Cooling Tower Co.	2	EA	\$71,280	\$14,480	\$5,000	\$90,760	\$963,637
19	GP	50A,B	Pacific Pumping Co. 3MB-CBL base mounted pump with cast iron construction and 5 hp motor.	5	EA	\$12,515	\$2,288	\$2,938	\$17,740	\$981,377
20	ARU	50B	Carrier Mod. 19D-131 #19D15-204 centrifugal water chiller.	2	EA	\$161,724	\$22,000	\$12,000	\$195,724	\$1,177,101
21	CT	50B	CT-Cooling Tower, 120t	1	EA	\$35,276	\$1,320	\$1,560	\$38,156	\$1,215,256

BERKELEY LABORATORY

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JOB NO:

PREP FOR: P.Orozco

PROJ ID	EQUIP TYPE	BLDG NO	DESCRIPTION	QTY	UNIT	NEW EQPT LAB & MAT'L	DEMOLITION	RETROFIT	TOTAL COST	CUMULATIVE TOTAL
ESTIMATE DETAIL - DIRECT COSTS										
22	AHU	50B	Dunham Bush HAH-B22 air handling unit with 3/4 hp motor, chilled water cooling coil and filter section.	1	EA	\$7,775	\$550	\$650	\$8,975	\$1,224,232
23	AHU	50B	Buffalo Mod. G - Size G-153-PC with chilled water cooling coil and filter section.	1	EA	\$11,300	\$402	\$475	\$12,176	\$1,236,407
24	AF	50A	AF-Air Filter, dbl pack, horizontal type 22,400CFM	2	EA	\$57,600	\$880	\$1,040	\$59,520	\$1,295,927
25	BL	50B	Recold Corp. Mod. AF utility fan located in Penthouse Mechanical Room above the 6th Floor.	1	EA	\$16,221	\$9,000	\$6,500	\$31,721	\$1,327,649
26	PIPING	50A/B	Chilled water piping, cooling tower piping systems, valves, gauges and controls.	1	LOT	\$221,539	\$48,000		\$269,539	\$1,597,188
			S/T BLDG 50 COMPLEX						\$1,597,188	
BUILDING 58/58A										
26	AC	58	AC-air conditioning unit , split system, 10t	2	EA	\$18,746	\$1,100	\$6,160	\$26,006	\$1,623,194

BERKELEY LABORATORY

MECHANICAL SYSTEMS MODERNIZATION, PHASE I

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JOB NO:

PREP FOR: P.Orozco

PROJ ID	EQUIP TYPE	BLDG NO	DESCRIPTION	QTY	UNIT	NEW EQPT LAB & MAT'L	DEMOLITION	RETROFIT	TOTAL COST	CUMULATIVE TOTAL
ESTIMATE DETAIL - DIRECT COSTS										
27	UH	58	UH-Unit Heater, NG driven, 125,000BTUH w/6' ladder	3	EA	\$6,870	\$975	\$975	\$8,820	\$1,632,013
28	UH	58	UH-Unit Heater, NG driven, 62,500BTUH w/6' ladder	1	EA	\$1,571	\$195	\$195	\$1,961	\$1,633,974
29	UH	58	UH-Unit Heater, NG driven, 35,000BTUH w/6' ladder	1	EA	\$1,433	\$163	\$163	\$1,758	\$1,635,732
30	UH	58	Janitrol Size UBS-100-94 nat gas fired unit heater.	2	EA	\$2,439	\$275	\$325	\$3,039	\$1,638,771
31	UH	58A	UH-Unit Heater, Electric driven, 500 W w/6' ladder, flue, gas piping, supports, etc.	7	EA	\$29,823	\$2,275	\$2,275	\$34,373	\$1,673,144
32	CNTRLS	58 / 58A	Pneumatic controls, control valves, operators, static pressure controls, etc. for above	1	LS	\$15,220			\$15,220	\$1,688,364
33	BAL	58 / 58A	Balance air handling & distribution	1	LS	\$5,325			\$5,325	\$1,693,689
			S/T BLDG 58						\$96,501	

BERKELEY LABORATORY

MECHANICAL SYSTEMS MODERNIZATION, PHASE I

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JOB NO:

PREP FOR: P.Orozco

PROJ ID	EQUIP TYPE	BLDG NO	DESCRIPTION	QTY	UNIT	NEW EQPT LAB & MAT'L	DEMOLITION	RETROFIT	TOTAL COST	CUMULATIVE TOTAL
ESTIMATE DETAIL - DIRECT COSTS										
BUILDING 70/70A										
34	ARU	70	60 Ton Chiller on Ground Floor	1	EA	\$41,858	\$3,660	\$9,000	\$54,518	\$1,748,207
35	PIPING	70	Chilled water piping, cooling tower piping systems, valves, gauges and controls.	1	LOT	\$147,608	INCL W/EQ		\$147,608	\$1,895,815
36	GP	70A	Bell & Gossett M2 Series Universal (Hydro-Flo U-7T 11Y) base mounted chilled water circulating pump with 1/6 hp motor.	2	EA	\$1,374	\$384	\$323	\$2,080	\$1,897,896
37	GP	70A	Bell & Gossett PHVC 4-6 6X, Size 1 - 1-1/2 HV hot water circulating pump with 1/6 hp motor.	1	EA	\$703	\$244	\$165	\$1,112	\$1,899,008
38	GP	70A	Bell & Gossett PHVC 4-6 6X, Size 1 - 1-1/2 HV hot water circulating pump with 1/6 hp motor.	1	EA	\$703	\$244	\$165	\$1,112	\$1,900,120
39	GP	70A	Bell & Gossett Series 90-1 1/4AA chilled watwr circulating pump with 1/4 hp motor.	1	EA	\$863	\$122	\$203	\$1,187	\$1,901,307
40	GP	70A	TACO Mod 120C-12-470 chilled water circulating pump. with 1/6 hp motor.	1	EA	\$703	\$244	\$165	\$1,112	\$1,902,419

BERKELEY LABORATORY

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PROJ ID	EQUIP TYPE	BLDG NO	DESCRIPTION	QTY	UNIT	NEW EQPT LAB & MAT'L	DEMOLITION	RETROFIT	TOTAL COST	CUMULATIVE TOTAL
ESTIMATE DETAIL - DIRECT COSTS										
41	GP	70A	Bell & Gossett base mounted 1-1/2 AB centrifugal pump for low conductivity water service. Replacement must be brass, bronze or stainless steel.	2	EA	\$6,050	\$1,500	\$1,420	\$8,970	\$1,911,389
42	PIPE	70A	Chilled water piping, cooling tower piping systems, valves, gauges and controls.	1	LOT	\$171,920	INCL W/EQ		\$171,920	\$2,083,309
43	EG	70A	Deisel engine driven emergency generator. Will use existing fuel storage system. Replace & mderinize stand by light & power system, wiring and controls	1	EA	\$117,160	\$2,255	\$3,998	\$123,413	\$2,206,721
44	KC	70A	Air compressor, oil-less, 15HP, 120 gal. tank - package. Complete compressed air system, incl piping, gauges, controls and valves.	1	EA	\$79,882	\$1,155	\$1,365	\$82,402	\$2,289,123
			S/T BLDG 70/70A						\$595,434	

MECHANICAL SYSTEMS MODERNIZATION, PHASE I

ED&I ANALYSIS (\$K)

Berkeley Lab Activities

Engineering

• Title I (3.9 MM at 14.3/mo) Proj Team 3 x 0.43 time x 3 mos	=	3.9MM	=	57
• Title II (4.1 MM at 14.3/mo) Proj Team 3x 0.23 time x 6 mos	=	4.1MM	=	60
• Title III (2.8 MM at 14.3/mo) Proj Team 1 x 0.15 time x 18 mos	=	2.8MM	=	40
• Inspection (11.0 MM at 14.3/mo) Inspectors 1 x 0.61 time x 18 mos	=	11.0MM	=	157
• Consultants				25
Seismic			10	
Other			15	
				339

A/E Activities

11% of Designed Construction Costs (\$3,150)

	<u>Design Services</u>	<u>Construction Support</u>	<u>Total</u>	<u>% of Total Fee</u>
Title I			130	36
Title II			146	41
Title III			86	24

*See attached A/E Fee Proposal Estimate Form

Total Estimated ED&I	700
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December 1995 LBL Engineering Rate: \$13.1K/MM

Escalation to April 1999 at 9.8%: \$14.3K/MM

Mechanical Equipment Replacement

ED&I Analysis
(\$ K)

LBNL Activity					
Title I	4.0	\$14.3			57
	3	44%	3	4.0	
Title II	4.2	\$14.3			60
	3	23%	6	4.2	
Title III	2.8	\$14.3			40
	1	16%	18	2.8	
Inspection	10.9	\$14.3			157
	1	61%	18	10.9	
Consultants					25
Seismic				10	
Other				15	
A/E Subcontract					
	12%	3140			361
Title I 30%	36%			130	
Title II 50%	41%			146	

MER ED&I Analysis

Title III 20%

24%

85

ED&I

December 1995 LBNL Engineering Rate		\$13.1	\$K/MM
Escalation to (APR 1999)	9.5%	\$14.3	\$K/MM

700

MECHANICAL EQUIPMENT REPLACEMENT, PHASE I

Contingency Analysis Worksheet

LBL Activities

Engineering			
Title I	35	5%	2
Title II	60	5%	3
Title III	25	5%	1
Inspection	115	5%	6
Consultants	25	10%	3
Architect/Engineer			
Title I	130	10%	13
Title II	215	10%	22
Title III	85	12%	10
Construction			
Mechanical Equipment	3,090	18%	547
Project Management	210	2%	4
Subtotal	3,990		610
Contingency (~22%)	610		
TOTAL	4,600	4,946	

DEPARTMENT OF ENERGY
 FY 1998 FIELD BUDGET PROCESS
 PROJECT DATA SHEETS
ENERGY SUPPLY RESEARCH & DEVELOPMENT: PLANT & CAPITAL EQUIPMENT
MULTIPROGRAM ENERGY LABORATORIES - FACILITY SUPPORT

(Tabular dollars in thousands. Narrative material in whole dollars.)

1. Title and location of project:	Mechanical Equipment Replacement, Phase I Berkeley Lab Berkeley, California	2a. Project No.: 98-LBL 2b. Construction funded
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3a. Date A-E work initiated (Title I design start scheduled):	2nd Qtr. FY 1998	5. Previous Cost Estimate:
3b. A/E work (Titles I & II) duration:	9 months	Total Estimated Cost (TEC): none Total Project Cost (TPC): none

4a. Date physical construction starts:	1st Qtr. FY 1999	6. Current estimate: TEC: \$4,500
4b. Date construction ends:	4th Qtr. FY 1999	Date: 12/95 TPC: \$4,550

7. <u>Financial Schedule (Federal Funds):</u>	<u>Fiscal Year</u>	<u>Appropriations</u>	<u>Adjustments</u>	<u>Obligations</u>	<u>Costs</u>
	1998	\$ 700	\$0	\$ 700	\$ 490
	1999	3,800	0	3,800	1,395
	2000	0	0	0	2,615

10. <u>Detail of Cost Estimate:</u>		<u>Item Cost</u>	<u>Total Cost</u>
a. (1)	Engineering, Design, and Inspection (at ~23% of Construction Costs, Item b)		\$ 690
	(2) Project Management (at ~7% of Construction Costs, Item b)		210
b.	Construction Costs		2,950
	(1) Mechanical Equipment	\$2,950	
c.	Relocations/Removals		<u>0</u>
		Subtotal	3,850
d.	Contingency (at ~17% of above costs)		<u>650</u>
		Total Estimant Costs (TEC)	\$4,500

Construction costs have been escalated at 2.5% for FY96, 3.1% for FY97, 3.3% for FY98, 3.4% for FY99; compounded to midpoint of construction.

Conceptual design is complete.