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Conceptual Design Report of a Refuse-Fired Steam Plant

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CONCEPTUAL-DESIGN REPORT
OF A
REFUSE-FIRED STEAM PLANT

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ABSTRACT

This is a conceptual design report for the installation of a refuse-fired boiler to produce steam. The refuse, mostly paper waste, would come from two adjacent facilities, Sandia National Laboratories, Livermore and Lawrence Livermore National Laboratory. The new steam plant, to be located at SNLL, would produce close to 100% of the steam requirements at SNLL. Unfortunately it does not have an attractive payback.

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A REFUSE FIRED STEAM PLANT
FOR SANDIA NATIONAL LABORATORIES LIVERMORE

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1.0 INTRODUCTION

In accordance with DOE order 4330.2A to reduce, whenever possible, the use of natural gas and petroleum products at DOE facilities by substituting alternate fuels, a study was made of various possibilities that could be applied at Sandia National Laboratories Livermore (SNLL). This study revealed that the paper waste generated at SNLL and Lawrence Livermore National Laboratory (LLNL) is a large enough amount of alternate fuel to produce almost 100% of the steam requirements at SNLL.

Three cases were considered as part of the Conceptual Design.

CASE I:

The existing gas fired steam plant would be kept in use where it is and a new refuse fired steam plant would be constructed near Area 8 which would be connected into the existing steam distribution system.

CASE II:

A new combined steam plant would be provided near Area 8 with both gas fired and refuse fired boilers. The refuse fired boiler would be at a higher pressure and temperature (450 psig @ 600°F) using the steam to drive a turbine-generator before exhausting steam into the existing steam system.

The amount of electricity generated would be approximately 175 KWh on a 24 hour basis, 5 days per week, 50 weeks per year (250 days per year).

CASE III:

A new combined steam plant would be provided near Area 8 with both gas fired and refuse fired boilers. All boilers would be rated to supply 125 psig saturated steam which would be distributed in the existing steam system. No electricity would be generated.

Case I has by far the least capital cost. However, the operating and maintenance costs are much higher because the two separate plants require two separate operating crews. Thus the payback is much longer (16.6 years) for Case I than for Cases II and III which have paybacks of 11.6 and 9.8 years respectively.

Using current energy costs and projections, Case III has the best simple payback (9.8 years). However, the relationship between gas and electricity rates in California has been fluctuating wildly and the comparison of these two cases would necessarily vary.

2.0 BRIEF PHYSICAL DESCRIPTION OF PROJECT

The most complete installation (CASE II) is described. Cases I and III are alternatives to that case. The project provides for the construction of a new boiler plant burning general and paper refuse from Sandia National Laboratories Livermore (SNLL) and Lawrence Livermore National Laboratory (LLNL) sites producing steam and electricity.

Steam and condensate lines for heating and cooling will be extended underground from the new plant to the existing underground distribution system. The generated electricity will be fed into the existing power system. The boiler plant will house a new refuse-fired medium pressure steam boiler, steam turbine generator, switchgear, back-up gas/oil fired boilers, feed-water pumps, deaerator, emergency diesel driven generator, office, toilet, and waste storage and handling area. It will be located on the south side of the arroyo between the arroyo and the Maintenance parking lot (see dwg. C-1). The building will be a steel frame structure with insulated metal side walls and roof approximately 100 ft. x 88 ft. x 30 ft. high with two 3 ft. diameter stacks about 50 ft. high.

Refuse storage will be on the floor of the west end of the plant with enough volume for 900 cu yds which is equivalent to 90 tons. This will be enough for 5 days use, operating 24 hours per day. Ash will be emptied into an open wet pit at the rear of the plant where it will be conveyed into a dumpster for eventual removal by truck to an off-site land fill.

Refuse from the Sandia and Lawrence Livermore sites will be brought to the plant by truck using Sandia Drive from East Avenue.

Water will be supplied from the existing site water system. The sanitary/storm sewer will connect to the existing site sewage system which is extended to the LLNL main for disposal to the City of Livermore water reclamation plant. The oil line will be extended from the oil tank just west of the site and the gas line will be extended from the existing underground gas main at Second and A Streets.

Drawings C-1 and C-4 show the Site Plan with utility connections and general Floor Plan. Drawing C-2 shows a process Flow Diagram and drawing C-3 shows an Electrical Service Diagram.

3.0 PURPOSE, JUSTIFICATION OF NEED FOR, AND SCOPE OF PROJECT

This project was implemented in order to comply with Department of Energy policy to reduce as rapidly as feasible, and ultimately to eliminate for other than unique requirements, the use of natural gas and petroleum products in DOE facilities by fostering the increased use of coal and alternate fuels. The project derives the thermal energy benefits by using the waste products to generate heat and also has the advantage of reducing the volume of plant waste for remote landfill as well as reducing the cost to the Government for landfill operations.

Plant size is based on maximum thermal input that can be extracted from LLNL and SNLL refuse with a 24 hr/day boiler operating time. The plant will operate to produce electricity and steam to meet the thermal demand at SNLL. Two of the present gas/oil fired boilers and auxiliary equipment in the present steam plant, Building 915, will be relocated to the new plant and used for back-up of the new refuse-fired boiler. Building 915 will be removed.

Implementation of this plant would save an estimated 54.5×10^9 Btu/Year of natural gas which would be offset by burning the refuse from the SNLL and LLNL sites.

A simple payback calculation using first year operating cost savings and a total plant capital cost yields paybacks as follows:

CASE I - 16.6 years

CASE II - 11.6 years

CASE III - 9.8 years

4.0 SUMMARY OF CAPITAL, OPERATING & MAINTENANCE, AND ENERGY COSTS

4.1 Capital Costs

In order to develop the capital costs with sufficient accuracy, it was necessary to:

- establish the existing connected plant thermal capacity,
- prepare a steam distribution system,
- prepare the conceptual design including descriptions, equipment lists and associated drawings for the refuse burning plant,
- prepare detailed capital costs,
- apply a 90 percent externality factor.*

Tables 4.1, 4.2, 4.3 and 4.4 show the summary of capital costs in terms of 1985 dollars, 1985 being the estimated mid-point of construction.

1982 costs were escalated at 12 percent per year to obtain the mid-construction estimated cost.

*Externality factor is a reduction of capital investment cost to be applied to energy saving or alternate fuel programs. This factor is prescribed to be 10% by the Life Cycle Cost Manual for the Federal Energy Management Program, NBS Handbook 135, dated December 1980.

4.2 Operating and Maintenance Costs

The operating and maintenance costs are expenses for the SNLL facility based on manhour estimates. The costs are related to:

- 1) Operation and maintenance staff including supervision.
- 2) Fixed and variable maintenance materials.
- 3) Fixed and variable supplies and expenses including costs related to refuse disposal.

In terms of 1985 prices, the total annual operating and maintenance costs are estimated as follows:

	<u>PRESENT BASE CASE</u>	<u>SEPARATE PLANTS</u>	<u>COMBINED PLANTS W/GEN.</u>	<u>COMBINED PLANTS W/O GEN.</u>
Operation & Maintenance Staff	\$ 174,000 (4.5 Men)	\$ 348,000 (9 Men)	\$ 232,000 (6 Men)	\$ 232,000 (6 Men)
Fixed and Variable Costs	<u>116,000</u>	<u>224,000</u>	<u>125,000</u>	<u>121,000</u>
Total	\$ 290,000	\$ 572,000	\$ 357,000	\$ 353,000

4.3 Energy Costs

The energy costs include the costs associated with gas and electrical consumption as well as credit for refuse material.

Using current plant energy consumption and current energy costs, the existing "as is" system and proposed refuse fired system estimated annual energy costs were escalated to 1985 by using annual escalation rates of 13% for electricity and 15% for gas. The results are as follows:

	<u>"AS IS"</u> <u>BASE CASE</u>	<u>SEPARATE</u> <u>PLANTS</u>	<u>COMBINED</u> <u>PLANTS W/GEN.</u>	<u>COMBINED</u> <u>PLANTS W/O GEN.</u>
GAS	\$ 354,000	\$ 38,500	\$ 83,000	\$ 38,500
REFUSE	---	(\$ 126,000)	(\$ 126,000)	(\$ 126,000)
ELECTRIC	\$ 2,240,000	\$ 2,240,000	\$ 2,122,000	\$ 2,240,000

The natural gas costs are based on present day (1982) prices of \$5.05/10⁶ Btu.

Costs associated with the refuse were calculated from current disposal costs which includes landfill off-site. By burning the LLNL and SNLL refuse on site an estimated credit results from not having to send it to a landfill. Table 4.5 was developed to calculate the credit for handling the refuse. Escalation of refuse savings to 1985 results in an annual savings of \$126,000.

Electricity for SNLL is purchased from LLNL which in turn buys power from the Western Area Power Administration (WAPA) and Pacific Gas and Electric (PG&E). A recent study by LLNL resulted in a combined 1982 cost (on a 24 hour basis) of 7.7¢/KW hr.

4.4 Summary of Costs

A summary of annual operating and maintenance costs is presented in Table 4.6. Values are given for the existing plant "as is" and the three cases for the proposed refuse fired steam generating plant. Costs are given in 1985 dollars.

TABLE 4.1

CONSTRUCTION COST ESTIMATE - CASE ISeparate Refuse Fired Steam Plant

Site Improvements		\$ 74,000
Paving	\$ 28,000	
Fencing	14,000	
Earthwork	21,000	
Drainage	3,000	
Landscaping	8,000	
Utilities		\$ 178,000
Steam & Condensate	85,400	
Water	26,600	
Sewer	4,400	
Gas	33,000	
Electrical	28,000	
Architectural-Structural		\$ 266,000
Building-3800 sq. ft. @ \$70/sq. ft.		
Mechanical		\$ 1,532,000
Fire Protection	11,000	
Restroom Plumbing	14,000	
Refuse Burning Boiler	1,400,000	
Feedwater Pumps	22,500	
Piping	8,500	
Deaerator	17,000	
Water Treatment	3,000	
Loader	56,000	
Electrical		\$ 28,000
Substation & Cables	14,000	
Motor Control Center	7,000	
Conduit & Wiring	7,000	
TOTAL		\$ 2,078,000

TABLE 4.2

CONSTRUCTION COST ESTIMATE - CASE IICombined Refuse Fired Steam Plant W/Electrical Generation

Site Improvements		\$ 74,000
Paving	\$ 28,000	
Fencing	14,000	
Earthwork	21,000	
Drainage	3,000	
Landscaping	8,000	
Utilities		\$ 304,000
Steam & Condensate	85,400	
Water	26,600	
Sewer	4,400	
Gas	63,000	
Oil	12,600	
Electrical	112,000	
Architectural-Structural		\$ 616,000
Building - 8,800 sq. ft. @ \$70/sq. ft.		
Mechanical		\$ 2,975,000
Fire Protection	18,000	
Restroom Plumbing	14,000	
Refuse Burning Boiler	1,400,000	
(450 psig - 600°F)		
Feedwater Pumps	22,500	
(1100 ft. head)		
Piping	8,500	
Steam Turbine-Generator	700,000	
Back-up Gas Fired Boilers	700,000	
(150 psig - sat.)		
Deaerator	17,000	
Back-up Boiler F.W. Pumps	12,500	
(350 ft. head)		
Piping	12,500	
Water Treatment	3,000	
Emergency Diesel Gen.	11,000	
Loader	56,000	
Electrical		\$ 91,000
Substation & Cables	56,000	
Motor Control Center	21,000	
Conduit & Wiring	14,000	
TOTAL		\$ 4,060,000

TABLE 4.3

CONSTRUCTION COST ESTIMATE - CASE IIICombined Refuse Fired Steam Plant W/O Electrical Generation

Site Improvements		\$ 74,000
Paving	\$ 28,000	
Fencing	14,000	
Earthwork	21,000	
Drainage	3,000	
Landscaping	8,000	
Utilities		\$ 304,000
Steam & Condensate	85,400	
Water	26,600	
Sewer	4,400	
Gas	63,000	
Oil	12,600	
Electrical	112,000	
Architectural-Structural		\$ 616,000
Building - 8,800 sq. ft. @ \$70/sq. ft.		
Mechanical		\$ 1,844,000
Fire Protection	18,000	
Restroom Plumbing	14,000	
Refuse Burning Boiler	1,000,000	
(125 psig - Saturated)		
Back-up Gas Fired Boilers	700,000	
Deaerator	17,000	
Feedwater Pumps	12,500	
Piping	12,500	
Water Treatment	3,000	
Emergency Diesel Gen.	11,000	
Loader	56,000	
Electrical		\$ 81,000
Substation & Cables	56,000	
Motor Control Center	15,000	
Conduit & Wiring	10,000	
TOTAL		\$ 2,919,000

TABLE 4.4

SUMMARY OF CAPITAL COSTS

(Mid Construction - 1985)

<u>Item</u>	<u>Separate Refuse Fired Steam Plant</u>	<u>Combined Refuse Fired Steam Plant W/Elect. Gen.</u>	<u>Combined Refuse Fired Steam Plant W/O Elect. Gen.</u>
A - E Fee @ 18% of Construction Cost	\$ 374,000	\$ 730,000	\$ 525,000
Construction Cost	\$ 2,078,000	\$ 4,060,000	\$ 2,919,000
Contingency @ 20%	\$ 490,000	\$ 960,000	\$ 689,000
TOTAL	\$ 2,942,000	\$ 5,750,000	\$ 4,133,000

TABLE 4.5

WASTE USE AND COST TABLE

1982

<u>Type</u>	<u>lb/yr</u>	<u>Btu/lb</u>	<u>Btu/yr x 10⁹</u>	<u>Saving \$/lb</u>	<u>Annual Saving \$</u>
SNLL Classified	50,000	7660	0.38	-0-	-0-
SNLL Compacted	405,000	7660	3.10	.016	\$ 6,500
SNLL Uncompacted	75,000	7660	0.57	.027	\$ 2,000
LLNL Classified	825,000	7660	6.32	-0-	-0-
LLNL Compacted	4,515,000	7660	35.35	.011	\$50,000
LLNL Uncompacted	1,146,000	7660	8.78	.027	\$31,500
TOTALS:	7,116,000	7660	54.50		\$90,000

$$\text{Savings per million Btu} = \frac{\$90,000}{54.5 \times 10^9} \times 1 \times 10^6 = \$1.65$$

TABLE 4.6

SUMMARY OF 1985 ANNUAL OPERATING COSTS AND PROJECT CAPITAL COSTS

	<u>Base Case Natural Gas</u>	<u>CASE I Separate Refuse Fired Steam Plant</u>	<u>CASE II Combined Refuse Fired Steam Plant W/Elect. Gen.</u>	<u>CASE III Combined Refuse Fired Steam Plant W/O Elect. Gen.</u>
Capital Costs	--	\$ 2,648,000*	\$ 5,175,000*	\$ 3,720,000*
Annual Costs				
Gas	\$ 354,000	38,500	\$ 83,000	\$ 38,500
Refuse	--	(\$ 126,000)	(\$ 126,000)	(\$ 126,000)
Electric	\$ 2,240,000	\$ 2,240,000	\$ 2,122,000	\$ 2,240,000
O&M	\$ 290,000	\$ 572,000	\$ 357,000	\$ 353,000
Total	\$ 2,884,000	\$ 2,724,500	\$ 2,436,000	\$ 2,505,500
Annual Savings	Base	\$ 159,500	\$ 448,000	\$ 378,500
Simple Payback-Years	--	16.6	11.6	9.8

*Includes 90 percent externality factor. Actual estimated costs in 1985 dollars are \$2,942,000, \$5,750,000 and \$4,133,000.

5.0 ENGINEERING AND CONSTRUCTION SCHEDULES

5.1 Engineering and Construction Schedule

An engineering and construction schedule was developed and used for capital cost estimates and budget information. The engineering, construction and startup effort is presented and includes Environmental Licensing, Title I Design, Title I Design Review, Title II Design, Title II Design Review, and Contract Award for construction. The schedule assumes that the Main Plant and Distribution System will be constructed concurrently.

The Title I Design is assumed to start on October 1, 1983 and be completed on January 31, 1984 for a total duration of four (4) months. This will include all preliminary engineering, the preparation of the majority of the specifications, process and instrument diagrams, plot plan and general arrangement drawings.

The Title I Design Review will start upon the completion of Title I Design and be completed by March 1, 1984 for a total duration of one (1) month. The review will be performed by representatives from the Sandia National Laboratories Livermore and the DOE Sandia Area Office.

The Title II Design will have a duration of five months and will start on March 1, 1984 and be completed by July 31, 1984. This work will be based on ground rules and agreement set under Title I Design and will include the issue of specifications and purchase of key equipment, the preparation of all final construction drawings and all test, startup

and operating procedures for the plant. Purchase of key or "long lead" equipment such as the refuse fired boiler unit and the steam turbine driven generator during this phase is necessary to insure completion of construction on schedule by avoiding delays due to lack of delivery of equipment requiring long lead times.

In parallel to the Title I and II design efforts, the environmental licensing effort will be performed with an estimated duration of about eighteen (18) months.

Upon completion of Title II Design, the Title II Design Review will take place, followed by incorporation of comments and corrections. The Title II Design Review will start on August 1, 1984 and end on September 30, 1984 for a duration of two months. This review will be performed by SNLL personnel and various DOE organizations.

The construction bid packages will be issued on October 31, 1984 and the construction contracts will be awarded in January, 1985 or two months from the date of issue.

The construction, building tie-ins, startup and initial operation will be initiated on January 31, 1985 and be completed by January 31, 1986 using a twelve month construction and start-up period.

Title I Design	Oct. 1, 1983	Jan. 31, 1984
Title I Design Review	Feb. 1, 1984	Mar. 1, 1984
Title II Design	Mar. 1, 1984	July 31, 1984

Title II Design Review	August 1, 1984	Sept. 30, 1984
Environmental Licensing	Oct. 1, 1983	Mar. 31, 1985
Purchase of "Key Equipment"	Mar. 1, 1984	June 30, 1985
Bid Period	Oct. 31, 1984	Dec. 15, 1984
Construction Contract	Jan. 31, 1985	Jan. 31, 1986
Startup and Instruction Period	Dec. 1, 1985	Jan. 31, 1986

5.2 Engineering and Construction Funding

Based on the engineering and construction schedule a preliminary funding sequence has been developed based on open competitive bidding for engineering and construction services. Funding requirement dollars have been escalated to the mid-construction period 1985 and based on monies required during the fiscal years during which the project will be designed and constructed. The following FY expenditures are anticipated: (Based on Case III which has the best payback.)

FY 84	-	\$ 500,000
FY 85	-	\$3,000,000
FY 86	-	<u>\$ 633,000</u>
Total		\$4,133,000

6.0 PRELIMINARY ENVIRONMENTAL EVALUATION

6.1 Facility and Waste Characteristics - General

The solid waste to be combusted at the SNLL facility will consist almost exclusively of Type 0 (paper and cardboard trash) and some Type 1 (scrap wood). An average heating value of 7,660 Btu/lb has been assumed. An estimated 3,560 tons/year (14 tons/day) will be combusted for 24-hours/day, 5 days/week, 50 weeks/year duration. Maximum hourly heat input is 9×10^6 Btu/hr.

6.2 Air Quality

Maintenance of existing air quality and prevention of its deterioration is a primary concern. The Livermore area is located in Air Quality Control Region (AQCR) 30. Pursuant to Section 107 of the Clean Air Act (1977), areas which do not meet the National Ambient Air Quality Standards (Table 6-1) are classified as non-attainment. The National Ambient Air Quality Standards States Attainment Status* has the Livermore air quality designated as better than national standards except for photochemical oxidants (PhO_x), which does not meet primary standards and, as such, is classified non-attainment for PhO_x (ozone).

The unit will not have to meet EPA's New Source Performance Standards (NSPS), nor BAAQMD** Regulation 2, Rule 10 for fossil-fuel fired

*FR 8962, March 3, 1978

**Bay Area Air Quality Management District

generators since the incinerator/boiler has a heat input of 9×10^6 Btu/hr, which is considerably less than the NSPS 250×10^6 Btu/hr required heat input. A PSD (Prevention of Significant Deterioration) review will also not be required since estimated discharge emissions of all criteria pollutants are substantially less than 100 tons per year (tpy).

6.2.1 Air Emissions

Combustion of solid waste will result in emissions of three types:

- particulates (both mineral and combustible)
- combustible gases (CO, hydrocarbons and polynuclear hydrocarbons)
- non combustible gases (NO_x , SO_2 , HCl, Dioxins).

The nature and quantity of incinerator pollutants are significantly influenced by the characteristics of the refuse. This is especially important since the refuse to be combusted at the SNLL facility is:

- low in sulfur
- low in nitrogen-fuel content
- contains virtually no organics.

The actual quantity and composition of the waste stream from the SNLL facility will reflect the refuse composition and the design operation of the combustion unit itself. A preliminary evaluation of the facility impact to the existing air quality determines the impact to be negligible.

6.2.2 Particulates (TSP)

Particulate emissions are functions of both incinerator design and refuse composition. An estimated 3.3 tons/year of particulates will

be discharged from the facility. This is based upon a design capacity of 14 tons/day of refuse. The particulate discharge limitation in the BAAQMD is 10 tons/year, corrected to 12% CO₂, by volume*. Compliance with this emissions standard will be easily achieved due to the small capacity of the unit and through proper furnace design which will reduce the combustible content of the particulate through maximum control of the temperatures and mixing in the furnace.

6.2.3 Sulfur Dioxide (SO₂)

An attractive feature of refuse is its very low sulfur content. Average sulfur content of the solid waste is assumed to be 0.16 percent since paper and paper products are the chief waste constituents. For the sulfur compounds found in the refuse, incineration will result in the formation of SO₂. SO₂ emissions for the facility are estimated to be 89.6 lbs/day (22,400 lbs/yr). No substantial amounts of sulfur containing compounds such as demolition plaster waste, wall board and other inorganic sulfates will be fed into the incinerator. Since the unit's SO₂ emissions are minimal, compliance with emissions standards will be attainable without the installation of any sulfur-removal technologies.

6.2.4 Carbon Monoxide (CO)

Carbon monoxide is formed as an intermediate product of the chemical reaction between carbonaceous fuels and oxygen. CO emissions from the SNLL facility are estimated to be only 35,000 lbs/yr (140 lbs/day),

*BAAQMD, Regulation 2, Rule 2

which is equivalent to 17.5 tons per year. The Livermore Valley site area is designated "attainment" and such minimal emissions of CO should not affect acquisition of a construction permit.* No regulations exist which would regulate CO emissions for a unit of this small design capacity and maximum heat input.

6.2.5 Hydrogen Chloride (HCl)

The principal source of HCl in the incinerator effluent is a product of the combustion of halogenated polymers, primarily polyvinyl chloride (PVC), and to a much lesser extent, polyvinylidene chloride (Saran). Since these materials appear in typical refuse primarily as housewares, textiles, packaging, toys, etc., they will not be found in quantities meriting attention at the SNLL facility which is burning primarily paper and paper products. Therefore, any resulting HCl emissions will be at concentration levels barely detectable and should not warrant concern. To date, there are no regulations governing HCl emissions.

6.2.6 Nitrogen Oxides (NO_x)

Nitrogen=fuel content of refuse is very low. Less than 100 ppm of NO_x will be emitted into the atmosphere by the SNLL facility.

BAAQMD, Regulation 9, Rule 3 regulating nitrogen oxide emissions from heat transfer operations will not be applicable since the standard is

*Due to the localized nature of CO, some areas in AQCR 30 are designated non-attainment for CO. As such, any facility having the potential emission rate of 100 tons/year of any pollutant, prior to the application of air pollution control (APC) devices, is designated as a "major new source" and subject to the provisions of non-attainment. Since however, emissions from the SNLL facility for carbon monoxide are estimated to be only 17.5 tons per year, the provisions of non-attainment (i.e., emissions offset) would not, in any case, be applicable, and should not affect acquisition of a construction permit.

imposed for any new or modified heat transfer operation designed for a maximum heat input of 250×10^6 Btu/hr. No other regulations exist which would regulate NO_x emissions for a unit of this capacity and maximum heat input.

6.2.7 Hydrocarbons

Hydrocarbon emissions from incinerators do not constitute a large fraction of the total emitted pollutant weight. These pollutants are important, however, as a result of the role of hydrocarbons* in photochemical oxidant (PhO_x) formation. Rarely is PhO_x emitted directly into the atmosphere. Proper incinerator design can effectively destroy the hydrocarbon content of waste gas streams.

6.2.8 Dioxins

The EPA has conducted an evaluation of resource recovery facilities using a series of assumptions designed to represent the "worst case" possible. This evaluation resulted in the EPA concluding that dioxin emissions from the combustion of municipal wastes are far below the level of a credible health risk.

The EPA has not developed an emissions standard for tetrachlorinated dioxins and feels that such a standard is not deemed to be necessary.

*All carbon-hydrogen containing compounds, including aldehydes, ketones, paraffinic and unsaturated hydrocarbons.

6.3 Solid Waste

Approximately 1.5 percent of the feedstock is incombustible material. Ash volume is assumed to be 25 percent of input volume. An estimated 420 lbs/day (52.5 tons/year) will result in solid waste (ash) requiring disposal. This bottom ash, in addition to any other noncombustible materials, will be automatically discharged from the incinerator to ash-filled dumpsters. Trucks will haul the ash from the facility site to an approved sanitary landfill for ultimate disposal.

6.4 Water

Fresh water will be required to sustain the SNLL facility. This will be supplied by the existing water system presently supplying the site. All process wastewater will be discharged into the sewage system. Water treatment will be conducted offsite.

6.5 Odor

BAAQMD, Regulation 7, Rule 1 places general limitations on odorous substances which can be detected by citizens beyond the property boundaries and emissions standards on certain odorous compounds.* Malodorous air should not be a problem at the SNLL facility since:

- there is no removal of moisture by drying with air prior to combustion
- the waste to be combusted contains virtually no organic materials

*Dimethylsulfide (CH_3)₂S, ammonia, mercaptans, phenols ($\text{C}_6\text{H}_5\text{OH}$) and trimethylamine (CH_3)₃N. None of these regulated compounds will be found in the SNLL gaseous waste stream.

- residue disposal is offsite in an approved sanitary landfill.

Spillage of refuse from processing and storage areas can also be maintained at acceptable levels by the use of seals and equipment enclosures.

6.6 Noise

Noise levels will be increased over existing levels due to increased activities and the quantities and complexities of equipment associated with refuse-fired boilers. The Federal Occupational Safety and Health Administration (OSHA) limits the time workers may spend in areas with high sound levels. Depending on recorded equipment sound levels, equipment sound controls may be necessary. The facility is adequately removed, however, from identified sensitive receptors (i.e., health care facilities) thus, no acoustical problems should be encountered off-site.

6.6.1 Vehicular Noise

Approximately 7 compactor trucks will be delivering solid waste to the site daily. No interruption of street traffic is expected. Based on this minimal amount of delivery traffic, a function of the small feedstock requirements (14 tons/day), no environmental impact from vehicular noise or travel is anticipated.

6.7 Health and Safety

A potential health hazard may arise due to storage of feedstock (refuse) since a small amount of some organics will be in the refuse. Proper safeguards should be taken to ensure control of potential

health hazards such as rodent infestation. Fire hazards inherent in refuse operations will also require mitigative measures.

6.8 Consequences of Construction

A preliminary evaluation of the construction impact to the environment was performed. Minimal impacts are anticipated. Impacts, such as temporary disruptions to normal vehicular traffic and construction equipment noise will be of a short duration and are consonant with typical construction activities.

Any impacts to the ambient air quality during construction will also be minimal. Increases in dust will be a temporary impact of construction which will be mitigated by dust suppression methods.

Good construction practices and all OSHA guidelines and safeguards to workers should be followed stringently with any special precautions or proper control measures implemented, when necessary.

TABLE 6-1

NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS)

(40 CFR 50)

Pollutant	Averaging Time	Maximum Allowable Concentration	
		Primary Standard	Secondary Standard
Sulfur Oxides (SO ₂)	Annual arith. mean	0.03 ppm	-
	24-hr maximum	0.14 ppm	-
	3-hr maximum	-	0.5 ppm
Particulates	Annual geom. mean	0.03 ppm	0.02 ppm
	24-hr maximum	0.10 ppm	0.06 ppm
Carbon Monoxide	8-hr maximum	9 ppm	9 ppm
	1-hr maximum	35 ppm	35 ppm
Photochemical Oxidants	1-hr maximum	0.06 ppm	0.06 ppm
Nonmethane Hydrocarbons	3-hr maximum	0.06 ppm	0.06 ppm
Nitrogen Dioxide	Annual arith. mean	0.05 ppm	0.05 ppm
Lead	Monthly average	0.0006 ppm (proposed 12-14-77)	

PARKING LOTS

EAST AVENUE

EXIST. GAS

PARKING

EXIST. STEAM & CONDENSATE

NEW 2" OIL
EXIST. 4" SEWER
EXIST. OIL TANK
NEW 4" SEWER
EXIST. ELECTRICAL
MANHOLE #8
NEW UNDERGROUND
ELECTRICAL

NEW
STEAM
PLANT

NEW
4" GAS

NEW 8" WATER
NEW 3" CONDENSATE
NEW 6" STEAM

ARROYO SECO

SNLL PROPERTY LINE

SNLL PROPERTY LINE

SANDIA DRIVE

100 0 300
SCALE IN FEET

W.O. PROJ.	REV. LET.	CHANGED ITEM WAS	DATE	CHG. BY	CK. BY	APP. BY
REVISIONS						
TITLE REFUSE FIRED STEAM PLANT SITE PLAN						
LOCATION LIVERMORE, CA						
	SIGNATURE	DATE	SANDIA LABS.			
DRAWN	MER	6-82	PLANT ENGINEERING DEPT.			
CHECKED			DATE JUNE 82 DWG. NO.			
APPROVED			SCALE: NOTED C-1			
APPROVED

GAS/OIL FIRED
BACK-UP BOILERS

PYROLYTIC REFUSE
FIRED BOILER

FLOW DIAGRAM

NOT TO SCALE

W.O. PROJ.	REV. LET.	CHANGED ITEM WAS	DATE	CHG. BY	CK. BY	APP. BY
REVISIONS						
TITLE REFUSE FIRED STEAM PLANT FLOW DIAGRAM						
LOCATION LIVERMORE, CA						
DRAWN	SIGNATURE	DATE	SANDIA LABS. PLANT ENGINEERING DEPT.			
CHECKED	ELLIS					
APPROVED	<i>ELLIS</i>					
APPROVED						
DATE: MAY 82			DWG. NO.			
SCALE: NOTED			C-2			

WO.

PROJ.

Sandia Laboratories
PLANT ENGINEERING
LIVERMORE, CALIFORNIA

**REFUSE FIRED STEAM PLANT
ELECTRICAL SERVICE DIAGRAM**

DRAWN	ELLIS	MAY 82
APPRV	<i>[Signature]</i>	
SCALE	NONE	
DWG. NO.	C-3	

SANDIA DRIVE

W.O. PROJ.	REV. LET.	CHANGED ITEM WAS	DATE	CHG. BY	CK. BY	APP. BY
REVISIONS						
TITLE REFUSE FIRED STEAM PLANT FLOOR PLAN						
LOCATION LIVERMORE, CA						
DRAWN	SIGNATURE MER	DATE 5/82	SANDIA LABS. PLANT ENGINEERING DEPT.			
CHECKED			DATE:			
APPROVED			DWG. NO. C-4			
APPROVED			SCALE:			

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