ENVIRONMENTAL ASSESSMENT

FOR THE

BIOMASS GASIFIER FACILITY (BGF)

PROPOSING AGENCY

DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

PREPARED BY

THE PACIFIC INTERNATIONAL CENTER FOR HIGH TECHNOLOGY RESEARCH

ASSISTED BY

- HAWAII NATURAL ENERGY INSTITUTE OF THE UNIVERSITY OF HAWAII
- INSTITUTE OF GAS TECHNOLOGY
- THE RALPH M. PARSONS COMPANY

SEPTEMBER 1992

TABLE OF CONTENTS

LIST OF FIGURES iii

LIST OF TABLES iv

ACRONYMS AND ABBREVIATIONS v

EXECUTIVE SUMMARY ES-1

SECTION 1 DESCRIPTION OF THE PROPOSED BGF PROJECT

1.1 Purpose of the Project 4
1.2 Project Location 5
1.3 Background 5
1.4 Overview of Gasification Process . . . 7
1.5 Construction of the Project 9
1.6 Operation of the Project 10
1.7 Alternatives 11

SECTION 2 E.A. USE, RELATED PROJECTS, AND RELATIONSHIP TO PLANS AND STATUTES

2.1 Purpose of an Environmental Assessment 13
2.2 Approval Process 13
2.3 Other Projects 14

SECTION 3 ENVIRONMENTAL SETTING, IMPACTS AND MITIGATION MEASURES

3.1 Air Quality and Climatology 15
3.2 Water Quality 24
3.3 Biological Resources 26
3.4 Public Services and Utilities 28
3.5 Archaeological/Cultural Resources . . 32
3.6 Health and Safety/Risk of Upset . . . 33
3.7 Noise 39
3.8 Traffic and Circulation 41

TABLE OF CONTENTS (Continued)

3.9 Land Use 43
3.10 Socioeconomics 44
3.11 Visual Resources, Aesthetics, and Light and Glare 47
3.12 Geology 48

SECTION 4 ALTERNATIVES TO THE PROPOSED BGF PROJECT

4.1 Project Alternatives 50
4.2 No Action Alternative Impacts 50

SECTION 5 LONG-TERM PRODUCTIVITY VERSUS SHORT-TERM USE OF THE LAND 51

SECTION 6 SIGNIFICANT IRREVERSIBLE ENVIRONMENTAL CHANGES RESULTING FROM THE PROPOSED ACTION SHOULD IT BE IMPLEMENTED 51

APPENDICES

A REFERENCES A-1
B PERSONS AND AGENCIES CONSULTED B-1
C PREPARERS OF THE E.A. C-1
D SIGNIFICANCE CRITERIA D-1
E PROJECT SCHEDULE E-1
F SCOPING MEETING SUMMARY F-1
F SCOPING MEETING INVITEES F-2
G TECHNICAL SUPPORT DOCUMENTATION G-1
G1 BIOMASS GASIFIER FACILITY, PHASE I PROCESS FLOW DIAGRAM G1-1

TABLE OF CONTENTS (Continued)

G2 CONSTRUCTION-RELATED EMISSIONS G2-1

G3 OPERATION-RELATED EMISSIONS DEVELOPMENT G3-1

G4 GENERAL ENGINEERING PROPERTIES OF PAIA SILTY CLAY G4-1

G5 RISK ANALYSIS MATRIX G5-1

G6 EXAMPLES OF TYPICAL SOUND LEVELS . . G6-1

G7 COMPOSITION OF BAGASSE ASH G7-1

H COMMENTS RECEIVED ON DRAFT ENVIRONMENTAL ASSESSMENT H-1

LIST OF FIGURES

1-1 Project Regional Location 3

1-2 Proposed Project Location 6

1-3 Proposed Project Site Plan 12

TABLE OF CONTENTS (Continued)

LIST OF TABLES

3.1-1 Federal and State of Hawaii Ambient Air Quality Standards and BGF Total Concentrations 18

3.1-2 Summary of Air Quality Data 19

3.1-3 Total Estimated Air Emissions from Project Construction Activities (tons/year) . . . 20

3.1-4 Total Estimated Air Emissions from Project Operational Activities (tons/year) 22

3.1-5 BGF Project Impacts on the Haleakala National Park 23

ACRONYMS AND ABBREVIATIONS

ABHI	A&B-Hawaii, Inc.
A&B	Alexander & Baldwin
BGF	Biomass Gasifier Facility
Btu	British thermal units
dBA	decibel
DBED	Department of Business, Economic Development and Tourism
DOE	Department of Energy
DOH	Department of Health
DOT	Department of Transportation
DWS	Department of Water Supply
E.A.	Environmental Assessment
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
FONSI	Finding of No Significant Impact
gpd	gallons per day
HC&S	Hawaiian Commercial and Sugar Company
HNEI	Hawaii Natural Energy Institute
IGT	Institute of Gas Technology
IDLH	Immediately Dangerous to Life or Health
kWh	kilowatt hours
Makai	seaward
Mauka	inland
MECO	Maui Electric Company
mgd	million gallons per day
MSL	mean sea level
mW	megawatts
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NIOSH	National Institute for Operational Safety and Health
NREL	National Renewable Energy Laboratory
OES	Office of Emergency Services
Parsons	Ralph M. Parsons Company
PICHTR	Pacific International Center for High Technology Research
PM	Particulate Matter
PM_{10}	Particulate matter less than 10 microns in diameter
PSD	Prevention of Significant Deterioration
psig	pounds per square inch
ROG	reactive organic gases

ACRONYMS AND ABBREVIATIONS (continued)

scf	square cubic feet
TCLP	Toxicity Concentration Leaching Procedure
tpa	tons per acre
tpd	tons per day
tph	tons per hour
ug/m^3	micrograms per cubic meter
USGS	United States Geological Survey
WRF	Wastewater Reclamation Facility

EXECUTIVE SUMMARY

INTRODUCTION

The Pacific International Center for High Technology Research (PICHTR), assisted by the Hawaii Natural Energy Institute of the University of Hawaii (HNEI), the Institute of Gas Technology (IGT), and the Ralph M. Parsons Company (Parsons), has entered into an agreement with the State of Hawaii and the U.S. Department of Energy (DOE) to design, construct and operate a Biomass Gasifier Facility (BGF). This facility will be located on a site easement, near the Hawaiian Commercial & Sugar Company (HC&S) Paia Sugar Factory on Maui, Hawaii (Figure 1-1). The proposed BGF Project is a scale-up facility, intended to demonstrate the technical and economic feasibility of emerging biomass gasification technology for commercialization.

This Executive Summary summarizes the uses of this Environmental Assessment, the purpose and need for the project, project description, and project alternatives.

Prior to preparation of the Environmental Assessment (E.A.), a public scoping meeting was held on February 4, 1992, in the Meeting Room of the Kahului Public Library on the Island of Maui, Hawaii. The meeting was attended by representatives from PICHTR, HNEI, Engineering-Science (a subsidiary of the Parsons Corporation), HC&S, Maui Electric Company, Innovative Technology Associates, EPA, Inc., Hawaii Department of Health's Clean Air Branch, Office of Hawaiian Affairs and the public. A listing of persons and agencies formally invited, and advised of this meeting is attached in Appendix F.

PURPOSE OF THE ENVIRONMENTAL ASSESSMENT

This E.A. addresses potential environmental impacts resulting from the proposed construction and operation of the BGF. The primary function of the E. A. is to provide a means for giving environmental quality careful, appropriate and timely consideration in the planning and decision-making process for the BGF project.

For environmental assessments for which a negative declaration is anticipated, a draft environmental assessment shall be made available for public review and comment for a period of thirty days. Subsequently, a final environmental assessment shall be prepared to determine whether a negative declaration or an EIS is required.

The Draft Environmental Assessment for the proposed Biomass Gasifier Facility was submitted and notification of its availability was published in the August 8, 1992 Office of Environmental Quality Control (OEQC) Bulletin. No comments were received before the end of the required formal 30-day comment period (postmarked by September 7, 1992). A comment letter from the County of Maui Planning Department was sent on September 10, 1992 to PICHTR. Although this letter was not submitted on a timely basis (before the end of the comment period), it has been included in Appendix H along with PICHTR's September 17, 1992 response letter.

Because the BGF is an "Agency Action" the Hawaii Department of Business, Economic Development & Tourism (DBED) will use this Final E.A. as the basis for their issuance of A Notice of Determination stating that either the action will or will not have significant impact.

PURPOSE AND NEED FOR PROJECT

The purpose of this project is to demonstrate a more efficient technology for converting biomass into electricity as well as for converting biomass into a light transportation fuel such as methanol. If successful, similar plants could be economically used elsewhere to convert locally-available biomass to satisfy local energy and transportation needs.

There are however, a number of technological issues that need investigation and validation before this promising biomass conversion technology could be commercialized at an economically viable scale. The present project's primary objective is to demonstrate the technical and economic viability of biomass gasification, biogas electricity generation, and biogas methanol conversion at pre-commercial scale.

PROJECT DESCRIPTION

The proposed BGF Project would consist of three phases. In Phase I, biomass conversion into low and medium British thermal unit (Btu) biogas would be demonstrated. In Phase II, the biogas would be used to produce electric power using a combustion turbine generator and in Phase III, to produce methanol employing state-of-the-art catalysts. At the present time funding primarily from the DOE and the State of Hawaii is available only for Phase I. If the goals of Phase I are met however, then Phases II and III would likely proceed. The goal of the entire project is to demonstrate the technical feasibility of emerging technologies at commercial scale. This document addresses Phase I installation and the conceptual Phase II and III plans, as foreseen at the present time. It covers the environmental impacts resulting from all phases of the project.

Operation of the gasifier system during Phase I would provide scale-up and operational engineering data from which the commercial feasibility of biomass gasification technology could be assessed. Two different types of biomass feed would be processed in the gasifier system during Phase I: a primary biomass feed of bagasse (the fibrous byproduct from sugarcane) and a secondary feed of whole tree chips. The gasifier would have a processing capability of 100 dry tons per day (tpd) of bagasse or wood chips. Phase I of the project is proposed to run through 1994 including design, construction, and operation of the gasifier. Actual operations would be expected to last one year, including acceptance testing, initial start-up, and an operational period. Dried bagasse would be supplied by the adjacent HC&S Paia Sugar Factory, under a contract for both the site easement and the supply of bagasse. Whole tree chips would be obtained from commercial sources.

In Phase II, the produced biogas would be used in a gas turbine to produce electricity. The gas turbine would be designed to use low to medium Btu gas. A number of power cycles are under current evaluation. These include simple-cycle, steam-injected open cycle, as well as combined-cycle concepts. Phase II would be operational during 1994-1995 and would produce between 3 to 5 mW of electricity.

In Phase III, the low to medium Btu biogas which contains carbon monoxide and hydrogen (together referred to as "syngas"), would be used to produce methanol via a catalytic process. A methanol production unit would be installed as part of this phase. The scale of the methanol demonstration program has yet to be determined, but for this E.A. it is assumed that all of the gas produced would be used for methanol synthesis. Ancillary facilities, such as an oxygen plant, are also proposed to be constructed during this phase. Phase III of the project runs from 1995 to 1996 and could produce up to approximately 4,000 gallons of methanol per day.

PROJECT LOCATION AND SETTING

The proposed BGF is planned to be located on the island of Maui, approximately one mile south of the Island's northern shore, within the Paia Region on land owned by A&B-Hawaii, Inc. (ABHI). The project site is immediately adjacent to the existing HC&S Paia Sugar Factory on the east and is bounded by cultivated sugarcane fields to the north, south and west. About three quarters of a mile north of the project site is the town of Paia and additional cultivated sugarcane fields.

The Paia area has been cultivated in sugarcane for over 100 years. In 1991, approximately 35,767 acres were cultivated with sugarcane. The adjacent HC&S Paia Sugar Factory was built in 1880 and completely rebuilt in 1905, and has a sugarcane processing capacity of 3,800 tons per day.

ALTERNATIVES

Four other sites in Hawaii, with a supply of biomass and drying facilities were considered. However, the present site was found to be most desirable based on its long-term stability and because the supply of bagasse there often exceeds the HC&S Paia Sugar Factory's capability for on-site consumption. Since the success of the proposed BGF Project depends critically on its ability to demonstrate technology viability over a period of time, the stability and availability of the bagasse supply was an important consideration.

With the "No Action Alternative," more efficient technologies to utilize bagasse and whole tree chips as energy resources would not be developed and the potential benefit to the energy supply would not occur.

SUMMARY OF IMPACTS

No significant environmental impacts are foreseen from the project.

CONTENTS OF THIS DOCUMENT

A detailed description of the proposed BGF Project being evaluated is presented in Section 1. The purpose of this E.A., the approval process and the other projects in the area are discussed in Section 2. The environmental setting, potential impacts and any mitigation measures required for each of these impact areas are discussed in Section 3. Section 4 contains a discussion of environmental impacts for the "No Action Alternative". Long-term implications of the proposed BGF Project are discussed in Section 5. Section 6 contains discussion of any irreversible environmental changes resulting from the proposed project. References and supporting documentation are included in the Appendices.

SECTION 1
DESCRIPTION OF THE PROPOSED BGF PROJECT

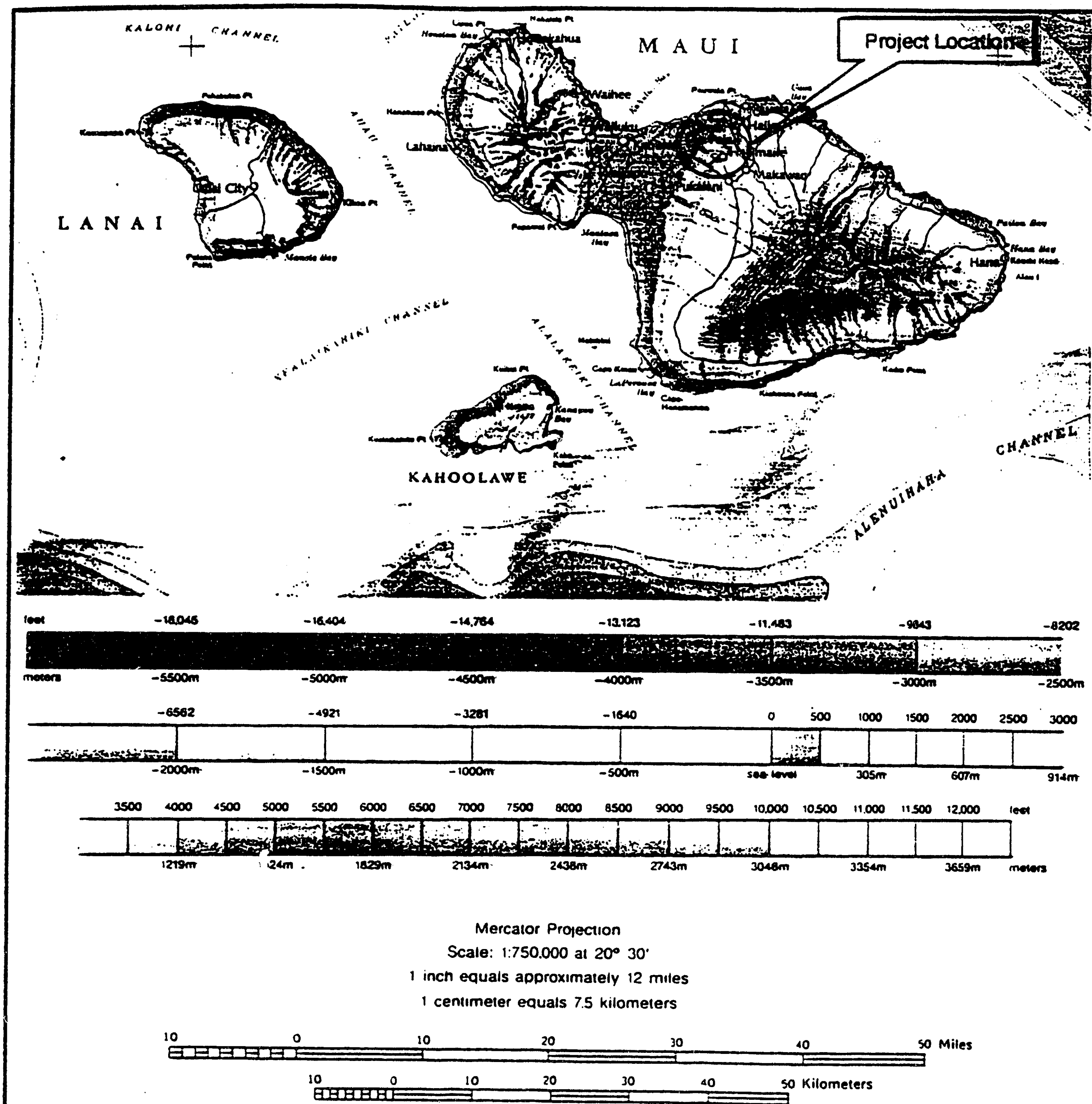
The Pacific International Center for High Technology Research (PICHTR), assisted by the Hawaii Natural Energy Institute of the University of Hawaii (HNEI), the Institute of Gas Technology (IGT) and the Ralph M. Parsons Company (Parsons), has entered into an agreement with the State of Hawaii and the U.S. Department of Energy (DOE) to design, construct and operate a Biomass Gasifier Facility (BGF). The proposed BGF Project is a scale-up facility, intended to demonstrate the technical and economic feasibility of emerging gasification technology for commercialization.

A&B-Hawaii, Inc. (ABHI) will be a major participant in the BGF program through its affiliate, Hawaiian Commercial & Sugar Company (HC&S). The proposed BGF will be located on a site immediately adjacent to the existing HC&S Paia Sugar Factory under terms of an easement agreement with HC&S (Figure 1-1). Dried bagasse for supply to the BGF would also be furnished from the HC&S Paia Sugar Factory under terms of the agreement.

The adjacent HC&S Paia Sugar Factory and the surrounding sugar plantation began operations in 1880 and the factory was completely rebuilt in 1905. Today it has a sugarcane processing capability of 3,800 tons per day.

Operation of the gasifier system during Phase I would provide scale-up and operational engineering data from which the commercial feasibility of biomass gasification technology could be assessed. Two different types of biomass feed would be processed in the gasifier system during Phase I: a primary biomass feed of bagasse and a secondary feed of whole tree chips. Bagasse would be provided from the HC&S Paia Sugar Factory. Whole tree chips would be procured from commercial sources. Most utilities and services needed to operate the gasification facility would be provided by HC&S. Phase I operations of the project, which is expected to last for approximately one year, consist of initial startup, acceptance testing, and a limited operational period.

In Phases II and III, specific uses for the low and medium Btu biogas are explored. In Phase II the produced biogas would be used in a gas turbine to produce electricity. The gas turbine would be designed to use low to medium Btu gas. A number of power cycles are under current evaluation. These include simple cycle, steam-injected open cycle, as well as combined cycle concepts. Phase II would be operational during 1994-1995 and produce between 3 to 5 mW of electricity. In Phase III, the low to medium Btu biogas containing carbon monoxide and hydrogen (together referred to as "syngas") would be used to produce methanol via a catalytic process. A methanol production unit would be installed as part of this phase. The methanol production process involves the following steps: gas cleanup to reduce hydrogen sulfide and particulates; conversion of methane to form carbon monoxide and hydrogen; combination of carbon monoxide and hydrogen to form methanol; and finally methanol purification and storage. Ancillary facilities, such as an oxygen plant, are also proposed to be constructed during Phase III.



References

Base map from U.S.G.S.
1:500,000 scale Hawaiian state map
Maui, Hawaii. Photorevised 1988
Hawaiian Islands - 1:750,000

Site Map
Maui, Hawaii

Regional Location

Figure 1-1

1.1 PURPOSE OF THE PROJECT

The purpose of this project is to demonstrate the technical feasibility of converting biomass (such as bagasse and whole tree chips) into low and medium Btu gas for electricity production at improved efficiencies and for synthesis into methanol.

Sugarcane production is a major agricultural activity on the Island of Maui and in the State of Hawaii. In 1990, over 800,000 tons of raw sugar were produced in the State. In the process of sugar extraction large quantities of bagasse, the fibrous residue of milled sugarcane, are produced. Bagasse represents about 30 percent by weight of processed sugarcane. Almost all the bagasse is now used in conventional boilers to produce steam for on-site use and to generate electrical power for both on-site use and export using steam turbines. Typically, these processes have had low energy conversion efficiencies.

The State of Hawaii, which has no native fossil fuel resources, meets its electrical and transportation fuel needs primarily with imported oil and coal. Emerging technology however, is promising more efficient conversion of biomass to electricity and transportation fuels. Potentially, the state could meet a portion of its transportation fuel and electrical needs with biomass.

The BGF is intended to demonstrate efficient conversion of biomass (bagasse and whole tree chips) to low and medium BTU biogas on a commercial scale. If Phase I is successful, the second phase of the project would demonstrate the use of biogas to produce electricity on an efficient, cost-competitive basis. Phase III would demonstrate the technical and economic feasibility of converting biogas to methanol for potential commercial development. The BGF would serve as a "centerpiece" for the DOE's continuing research on biomass gasification.

As a demonstration project, the proposed scale-up facility would generate useful information on the feasibility, cost, and scientific and engineering requirements of various related emerging technologies. Data obtained from this project could be applied to the design of biomass conversion facilities on a commercial scale not only in Hawaii, but elsewhere.

1.2 PROJECT LOCATION

The Paia region, shown in Figure 1-1, is located along the Island of Maui's northern shore, east of the Wailuku District, in the northwestern-most portion of the Makawao District. Within this region approximately 35,767 acres were cultivated with sugarcane in 1991.

The proposed site is within the Paia region, approximately one mile south of Maui's northern shore and five miles east of the Kahului Airport (Figure 1-2). The BGF would be located on approximately four acres of HC&S land at an elevation of 160 feet above mean sea level (MSL). This site, which slopes gently downhill to the northwest, was used for sugarcane cultivation from 1880 to 1979. For over 12 years it has been out of production and is now used for bagasse storage.

The project site is bounded by the HC&S Paia Sugar Factory to the east and cultivated sugarcane fields to the north, south and west. About three quarters of a mile north of the project site and existing facility are the town of Paia and additional cultivated sugarcane fields.

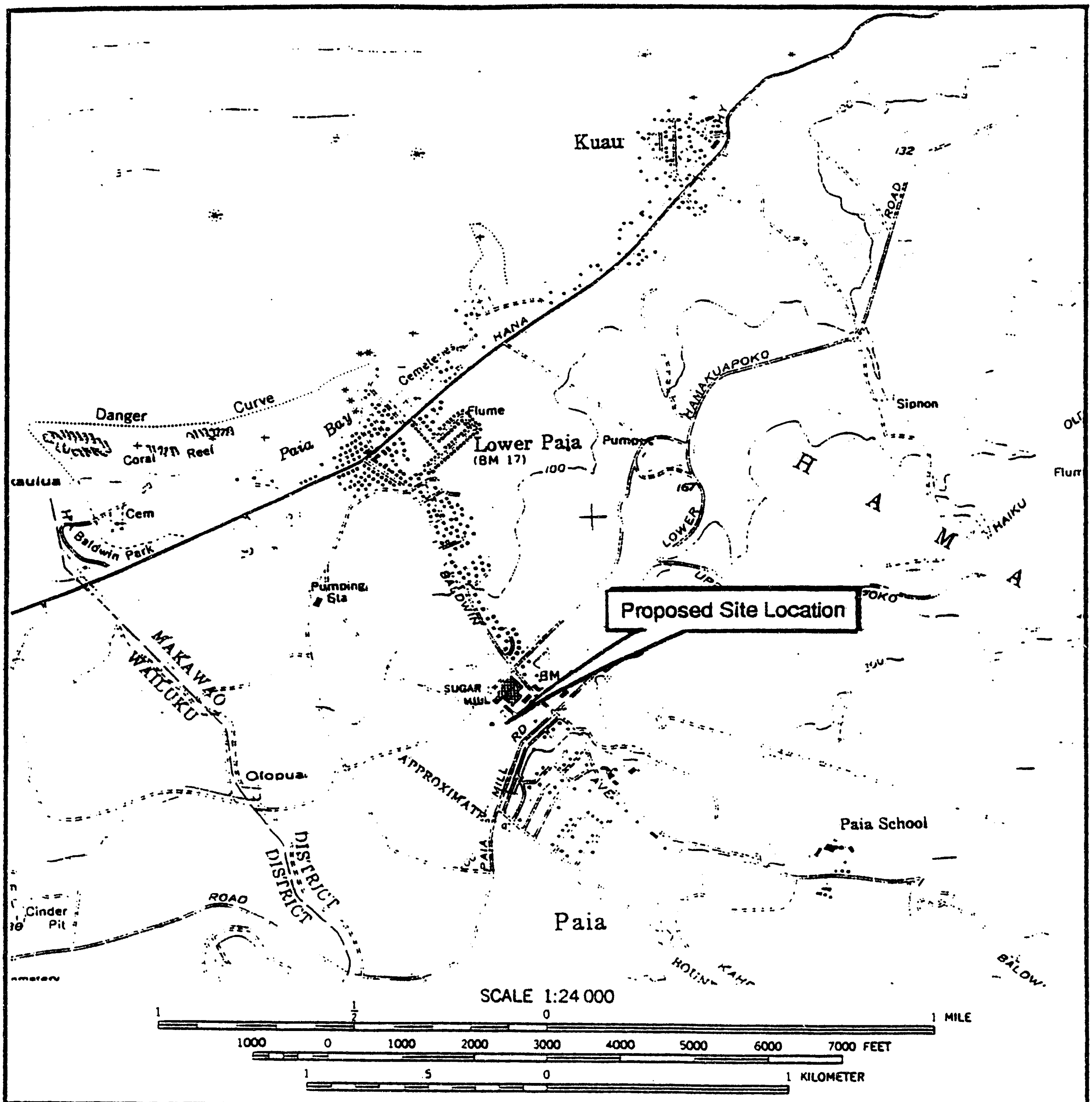
The 1990 combined population of Lower Paia and Upper Paia, which are the population centers nearest the proposed site, was 2,091 (U.S. Census, 1990).

Maui Electric Company (MECO) with the help of cogeneration plants supplies electrical power to the island using a number of resources including biomass, oil, and coal to generate electrical power.

1.3 BACKGROUND

Ownership and History

The proposed site is located immediately adjacent to the HC&S Paia Sugar Factory on the Island of Maui. The HC&S Paia Sugar Factory and the BGF site are owned by ABHI, a wholly-owned subsidiary of Alexander & Baldwin, Inc. (A&B). As noted the BGF will be located on HC&S property under terms of an easement agreement.



References

Base map taken from U.S.G.S. topographic "N2050-W15620/7.5" Burbank, California. Photorevised 1983 Island of Maui - 1:24,000

Paia, Maui

Proposed Site Location

Figure 1-2

1.4 OVERVIEW OF GASIFICATION PROCESS

The proposed BGF gasifier would be designed to process up to 100 dry tons per day of biomass and produce a product gas of at least 100 Btu/scf. This section describes the details of Phase I, demonstration of the gasification process. The associated process flow diagram is included in Appendix G1.

Phase I operations would last about one year, including allowance for a three-month startup period. The operation cycle would coincide with that of the HC&S Paia Sugar Factory and would consist of ten days of operation followed by a four-day shutdown period. Bagasse would be used as the feed during the startup phase and for most of the post-startup phase as well. There would however, be a two-week period in which whole tree chips would be used as the feed. For each type of feed (bagasse and whole tree chips) the gasifier would operate in an air-blown mode.

Bagasse would be received from the adjacent HC&S Paia Sugar Factory via an extended pneumatic transfer line. Air and bagasse would be separated in an 84-inch cyclone (cyclone #1) and the bagasse would be sent to a storage bin. From the covered storage bin, bagasse would be conveyed through an air-locked system to the rotary dryer.

In order to ensure base-loaded operation of the gasifier, approximately 0 to 10 percent "overfeed" bagasse could pass through the dryer. Excess bagasse not fed to the gasifier would be returned to the storage bin. Predried bagasse from the HC&S Paia Sugar Factory has a moisture content of about 30 percent when it enters the dryer. The dryer would reduce the moisture content of the bagasse to 20 percent. The maximum heating rate for the dryer would be around 11.7 MMBtu/hr.

The biomass dryer would be fueled with propane during the startup of each operational cycle, which is expected to last up to approximately eight hours each ten-day interval. Once the gasifier is operating at a steady rate, the dryer would be fueled with the produced biogas. Hot gases from the burner/firebox enter the dryer at approximately 850°F. An induced draft fan would be used to maintain constant dryer outlet velocity.

Dried biomass material would be pneumatically transported to a second 84-inch cyclone (cyclone #2) where the biomass would be separated from the air stream. Approximately 65 percent of the cleaned air would be recycled back to the dryer for heat recovery. The rest of the air would be discharged to the atmosphere.

Cyclone #2 would be located above the gasifier feeder. Biomass would be discharged from cyclone #2 via a rotary air-lock into a slat type conveyor. The slat conveyor is oversized and would convey the biomass to a pin feeder which is located above a weigh belt. The weigh belt would measure the amount of biomass fed to the gasifier.

Discharge from the weigh-belt would be directed to the first of two plug-type feeders which would be operated in series. The first plug-screw feeder would increase the biomass pressure from atmospheric to 140 psig, while the second feeder would increase the biomass pressure from 140 to 325 psig. At 325 psig, biomass would be discharged to a screw, which would inject it into the gasifier.

The gasifier would consist of a vertical cylindrical pressure vessel with alumina beads or other media comprising the fluidized bed. The design temperature for the gasifier is 1,800°F; however the normal operating temperature would be approximately 1,650°F. Steam/air mixtures would enter the bottom of the gasifier and act as agents in the gasification reactions. The biomass would be oxidized and pyrolyzed to form a hot gas mixture containing hydrogen, carbon monoxide, carbon dioxide, some hydrocarbons, nitrogen, and water. This biogas, at 1,650°F, would exit the top of the gasifier to a hot gas cyclone (cyclone #3) for removal of entrained solids. The product biogas would be fully flared during the startup. Once the gasifier is operating at a steady rate, a portion of the biogas would be used as fuel for the dryer. For Phase I only, the remainder would be flared. Particles of ash and char extracted from the product gas in cyclone #3 would be collected in a covered ash tote-bin before being disposed of offsite. A fine water spray would be used for dust control.

Whole tree chips would be used instead of bagasse for ten days of operation. About 1,000 tons of chips would be required. Whole tree chips, gathered by a front-end loader, would be fed directly to a screen and then on into storage and the dryer. In the dryer, their inlet moisture content of approximately 50 percent would be reduced to 20 percent. After the dryer, the whole tree chips would be handled in a manner similar to bagasse, as described above.

Other than the cyclone exhausts and the flare, there would be no air emission discharge points in the system. In addition, since most of the system is covered, fugitive air emissions are expected to be negligible.

1.5 CONSTRUCTION OF THE PROJECT

Figure 1-3 shows the Conceptual Site Plan for the proposed BGF. A list of equipment associated with all three phases of the proposed BGF Project is included on Figure 1-3.

Construction of the proposed four-acre site would consist of site grading, leveling, excavating, trenching and the mechanical, piping and electrical installation. Excavation would involve preparing the foundations for the buildings and equipment. Trenching would be done for installation of utilities.

The construction period for the project is expected to last approximately six to nine months. Hours of construction would be daylight hours (approximately 8 to 12 hours per day), five days per week.

- Construction Equipment List:
  - Farm Tractor
  - Grader
  - Line Truck with Cherry Picker
  - Roller
  - 80 Ton Hydraulic Crane
  - 20 Ton Truck Crane
  - Water Truck
  - Front End Loader
  - 12,000 lb Forklift
  - Paver
  - Small Backhoe with Bucket
  - 15 Ton Trailer
  - 4 Wide Pickups (3 Total)
- Other Equipment
  - Ready Mix Concrete Trucks
  - Delivery Trucks
  - Inspector's Vehicle and Testing Equipment

Not all listed equipment would be used for the entire construction period.

1.6 OPERATION OF THE PROJECT

The entire biomass gasifier project includes three phases; however, Phases II and III are contingent upon the successful operation of Phase I. The three phases are: Phase I, Gasification Plant; Phase II, Electrical Generation; and Phase III, Methanol Production.

Phase I of the project would run through 1994 and include the design, construction, and operation of the gasifier. Both whole tree chips and bagasse would be used to evaluate the effect of the feedstock on the gas composition. The final stage of Phase I is expected to be completed in 1994 and would be a test to validate the mechanical and control subsystems. At the end of this phase, the gasifier's performance would be validated and the system would be available to begin the testing and evaluation of total energy systems in subsequent phases.

Phase II of the project is expected to operate from 1994 to 1995 and would produce three to five mW of electricity. The initial application of the gasifier would be to demonstrate the production of electricity by connecting a hot-gas clean-up system and a 5 mW gas turbine to the gasifier hot-gas output. Currently, the barrier to the use of low-energy gas from biomass gasification is the presence of particulates and alkali metal salts in the gas. These cause both deposition on and corrosion of the turbine hot-section components. In parallel with Phase I of the proposed BGF Program, the DOE National Renewable Energy Laboratory (NREL) Biomass Power Program is developing a hot-gas cleanup research project based on units developed for coal gasifiers. Successful demonstration of the hot-gas cleanup and turbine combination at the proposed BGF site could lead to utility-scale electricity production in advanced turbines using biomass-derived low-energy gases.

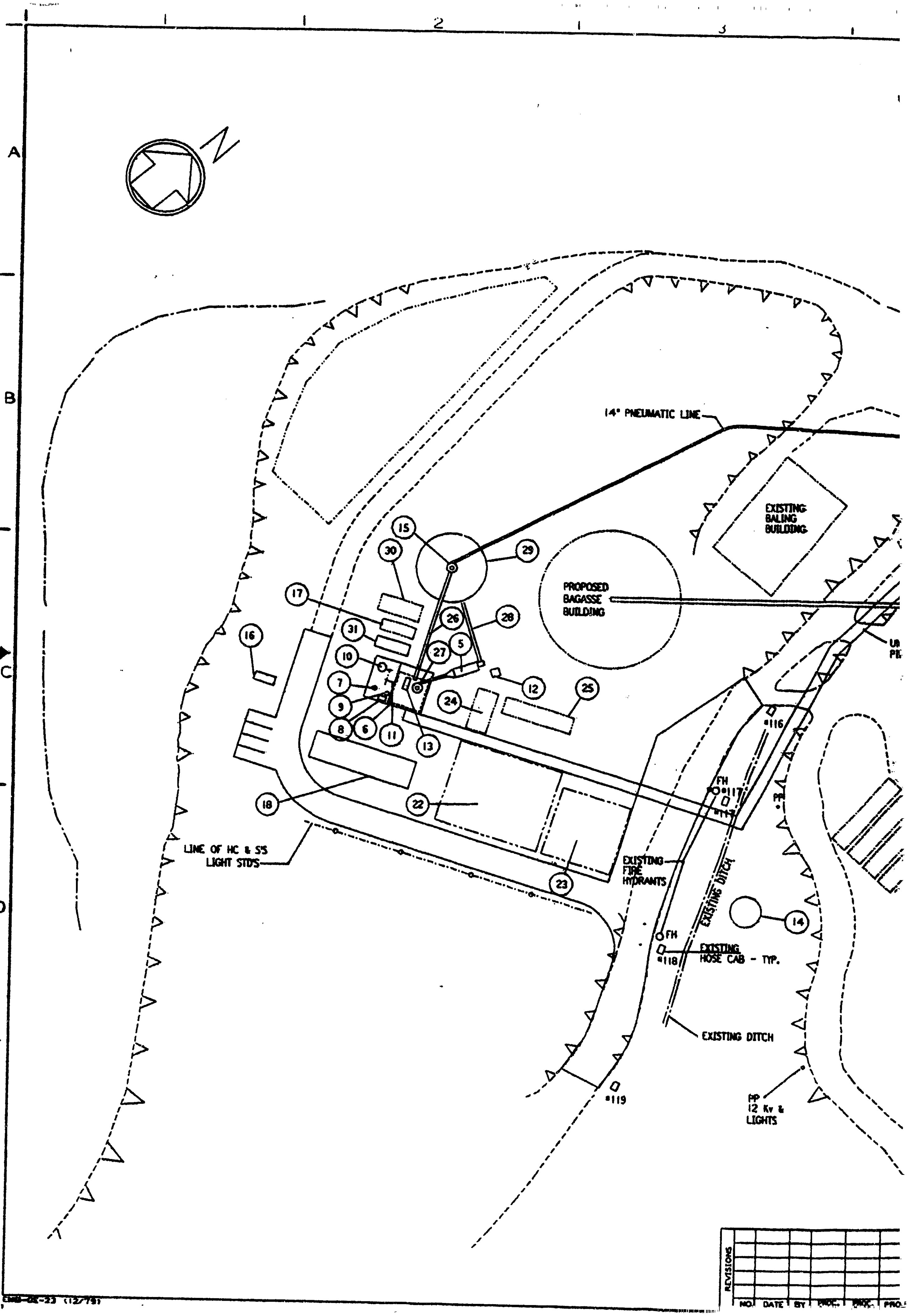
The scale of the methanol demonstration program (Phase III) has yet to be determined, but this E.A. assumes the case in which all of the gas would be used for methanol synthesis. Phase III of the project could be expected to produce approximately 4,000 gallons of methanol per day and would run from 1995 to 1996. Under the auspices of the DOE biofuels program, the gas cleanup and conditioning techniques necessary to economically generate syngas for methanol production are being developed. During the 1991 to 1994 period, researchers would be testing and evaluating catalysts and process technologies at the laboratory scale. To produce syngas and methanol at Paia, it would be necessary to have an on-site oxygen plant.

As currently envisioned onsite storage of methanol would be limited to a single 10,000 gallon storage tank to minimize onsite risk. Methanol production rates during this phase would be integrated with the existing commercial transportation and utilization systems available at the time of operations. Commercial capability for methanol use currently exists in Hawaii and it is anticipated to be available in the future.

As previously mentioned, coincidental with the HC&S Paia Sugar Factory, the facility would operate 24 hours per day for ten days, followed by a four day shutdown, typically for nine months every year. Employment requirements for all phases of operation of the project are estimated at seven persons per day. HC&S would provide the site and most of the utilities and services needed by the gasification plant and would supply bagasse as one of the fuels for the gasifier. Whole tree chips would only be used for ten days of operation in the first year.

1.7 ALTERNATIVES

Alternatives considered for the proposed BGF Project are described in Section 4.



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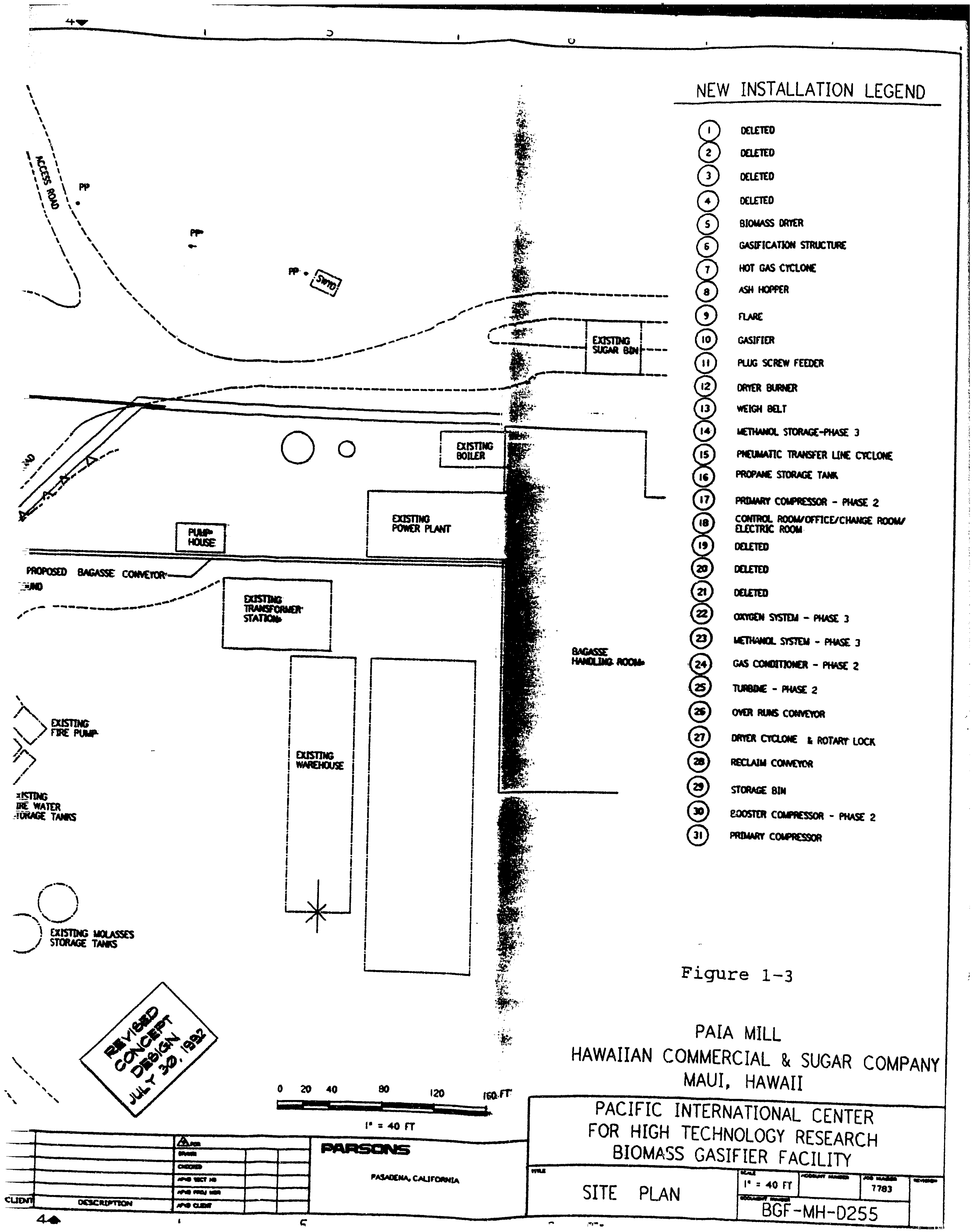

NEW INSTALLATION LEGEND
1 DELETED
2 DELETED
3 DELETED
4 DELETED
5 BIOMASS DRYER
6 GASIFICATION STRUCTURE
7 HOT GAS CYCLONE
8 ASH HOPPER
9 FLARE
10 GASIFIER
11 PLUG SCREW FEEDER
12 DRYER BURNER
13 WEIGH BELT
14 METHANOL STORAGE-PHASE 3
15 PNEUMATIC TRANSFER LINE CYCLONE
16 PROPANE STORAGE TANK
17 PRIMARY COMPRESSOR - PHASE 2
18 CONTROL ROOM/OFFICE/CHANGE ROOM/ ELECTRIC ROOM
19 DELETED
20 DELETED
21 DELETED
22 OXYGEN SYSTEM - PHASE 3
23 METHANOL SYSTEM - PHASE 3
24 GAS CONDITIONER - PHASE 2
25 TURBINE - PHASE 2
26 OVER RUNS CONVEYOR
27 DRYER CYCLONE & ROTARY LOCK
28 RECLAIM CONVEYOR
29 STORAGE BIN
30 BOOSTER COMPRESSOR - PHASE 2
31 PRIMARY COMPRESSOR
ACCESS ROAD
PP
EXISTING SUGAR BIN
EXISTING BOILER
EXISTING POWER PLANT
PUMP HOUSE
PROPOSED BAGASSE CONVEYOR
EXISTING TRANSFORMER STATION
BAGASSE HANDLING ROOM
EXISTING FIRE PUMP
EXISTING WAREHOUSE
EXISTING FIRE WATER STORAGE TANKS
EXISTING MOLASSES STORAGE TANKS
REVISED CONCEPT DESIGN JULY 30, 1992
0 20 40 80 120 160 FT
1" = 40 FT
PAIA MILL
HAWAIIAN COMMERCIAL & SUGAR COMPANY
MAUI, HAWAII
PACIFIC INTERNATIONAL CENTER
FOR HIGH TECHNOLOGY RESEARCH
BIOMASS GASIFIER FACILITY
PARSONS
PASADENA, CALIFORNIA
SITE PLAN
1" = 40 FT
7783
BGF-MH-D255
CLIENT
DESCRIPTION

Figure 1-3

SECTION 2

E.A. USE, OTHER PROJECTS AND RELATIONSHIP TO PLANS AND STATUTES

2.1 PURPOSE OF AN ENVIRONMENTAL ASSESSMENT

The purpose of an Environmental Assessment (E.A.) is to determine if a proposed project will have a significant impact on the environment.

This E.A. was prepared in accordance with both State of Hawaii and DOE/National Environmental Policy Act (NEPA) requirements, namely:

- Environmental Impact Statement Rules, Chapter 200, Title 11, Hawaii Administrative Rules, Department of Health
- Environmental Impact Statements, Chapter 343, Hawaii Revised Statutes
- Environmental Policy Act, Chapter 344, Hawaii Revised Statutes
- Environmental Quality Control Act, Chapter 341, Hawaii Revised Statutes
- A Guidebook for the Hawaii State Environmental Review Process, Prepared by State of Hawaii OEQC, July 1991
- The National Environmental Policy Act of 1969 (NEPA, Public Law 91-190, 42 U.S.C. 4321-4347, as amended, 40 CFR 1500-1508222)
- Department of Energy, National Environmental Policy Act, Final Rule (10 CFR 1021)

2.2 APPROVAL PROCESS

Both the State of Hawaii DBED and the DOE, as the lead agencies, will each make an independent determination of the project's environmental impact. Both the State of Hawaii and the DOE must make a determination of "No Significant Impact" and issue a Negative Declaration and Finding of No Significant Impact (FONSI) respectively or a full EIS will be required. The Negative Declaration or FONSI could require that certain mitigation measures be adopted for the project.

2.3 OTHER PROJECTS

Paia Inn

According to the "Paia Inn: Planning, Engineering, and Environmental Report" (PBR Hawaii, 1991), the proposed Paia Inn development which may consist of up to 300 rooms and 9,250 square feet of commercial and retail space. Retail facilities would consist of a restaurant and businesses to provide rentals, sales and repairs of windsurfing and other water sports equipment and related services. The first 150 units could potentially be built and occupied by 1994 or early 1995. Approximately 208 parking stalls would be provided at the project site.

Kahului Airport

The State Department of Transportation is responsible for ensuring that Hawaii has a safe, efficient, economical, and convenient public transportation system that does not adversely affect environmental quality. As part of the Kahului Airport Master Plan Update study, the ability of the existing airport facilities to meet present and forecasted needs was evaluated, and a list of future facility requirements was developed (State of Hawaii, 1991a). The proposed airport improvements include runway expansion, construction of an additional runway, parking apron for aircraft, an access road, and relocation of helicopter and flight support facilities (State of Hawaii, 1991a). Expansion and construction of such facilities began in 1991.

SECTION 3
ENVIRONMENTAL SETTING, IMPACTS AND MITIGATION MEASURES

This section includes evaluations of the current setting, potential impacts to the environment and socioeconomic conditions related to the three phases of the proposed BGF Project. Environmental rules regarding significance criteria, as set forth in the Appendices for the Guidebook for the Hawaii State Environmental Review Process, (State of Hawaii, 1991b) were used as a basis for determining potential environmental effects of the proposed BGF project. These significant criteria are outlined in Appendix D. Where appropriate, mitigation measures which would be used to minimize potential adverse impacts are presented.

3.1 AIR QUALITY AND CLIMATOLOGY

3.1.1 Setting

3.1.1.1 Climatology

Climate is determined by temperature, rainfall, humidity and prevailing winds. The project site is located on the Island of Maui which has a tropical marine climate. Mean daily temperatures for the project site range between 81.9°F and 69.9°F in the summer, and 80.6°F and 66.1°F in the winter. Annual rainfall averages 25 inches per year, and relative humidity averages 71.2 percent in the winter and 69.5 percent in the summer. Generally, northeast trade winds, with a mean daily wind speed of 13 miles per hour, move air from the ocean to the southwest between Haleakala and the West Maui Mountains. As a result, winds blow from the project site into agricultural areas.

3.1.1.2 Air Quality

The Island of Maui is subject to regulations under the provisions of the Federal Clean Air Act (CAA) and to the Public Health Regulations of the State of Hawaii. The CAA requires the Federal Environmental Protection Agency (EPA) to establish National Ambient Air Quality Standards (NAAQS) for ozone, carbon monoxide (CO), nitrogen dioxide (NO_2), oxides of nitrogen (NO_x), suspended particulate matter (PM_{10}), sulfur dioxide (SO_2), sulfur oxides (SO_x) and lead (Pb). National ambient air quality standards are established at the levels necessary, with an adequate margin of safety, to protect the public health and public welfare from any known or anticipated adverse effects associated with air contaminants. The State of Hawaii has established ambient air quality standards which in some cases are more stringent than the national standards. Hawaii standards seek to protect public health and to prevent the significant deterioration of air quality. The federal and state standards and the BGF total concentrations are shown on Table 3.1-1.

The State of Hawaii operates ambient air monitoring stations to determine the levels of pollutants in the air and to identify any exceedances of the state and federal standards.

Current air quality data is available from the Prevention of Significant Deterioration (PSD) background monitoring station (site 233) for the Maalaea Generating Station, which was operated for six months in 1989. The State of Hawaii Department of Health believes that this data is representative of the Paia area. Monitoring data from the Maalaea site is shown on Table 3.1-2 and indicates that the background ambient air concentrations of pollutants are well below the national and state ambient air quality standards.

3.1.2 Criteria

Construction and operation of a proposed project would result in emissions of various air contaminants at the site. Construction activities are considered to be short-term and intermittent. During operation there would be other emissions directly resulting from the project. In this section the impact of these emissions will be explored.

The EPA has promulgated PSD regulations for areas that have clean air or have achieved the NAAQS. The basic goal of the EPA's PSD requirements is to ensure that the air quality in clean air areas does not significantly deteriorate, while maintaining a margin for future growth. PSD regulations focus on both new and modified stationary sources that create large increases in the emission of certain pollutants. PSD review requirements apply only in certain geographic areas in the United States; specifically, construction in those areas designated under section 107 of the Clean Air Act as "attainment or unclassifiable" for any criteria pollutant (CO, reactive organic gases (ROG), NO_x, SO_x, particulate matter (PM) and Pb). The Island of Maui is designated as either "attainment or unclassifiable" for meeting NAAQS for O_3, CO, NO_2, SO_2, PM and Pb.

In order to construct the BGF a State of Hawaii "Authority to Construct" (ATC) license must be obtained, and such an ATC has been applied for. To obtain an ATC for a new major stationary source or major modification, a PSD review must be conducted as part of the ATC application process. The BGF ATC application review concluded that the BGF came under the 250 TPY of any criteria pollutant standard, and thus it should not be classified as a major source under Federal nor State of Hawaii rules. The State, as well as the Federal EPA, will review and confirm this determination before the ATC is issued.

As criteria for determining the significance of air contaminant emission impacts, EPA's PSD threshold amounts were used to identify potential adverse impacts to air quality during the operational phase of the project.

3.I.2.1 Construction Impacts

Project construction activities would take place in three phases. Phase I construction would occur for nine months. Phase II and Phase III construction are each expected to take three months within the following third and fifth years, respectively. The major source of air contaminants during each construction phase would be fugitive dust and construction equipment exhaust. Exhaust emissions would include CO, NO_x, SO_x, ROG, and PM. Fugitive dust would be generated as a result of soil disturbance during site preparation, excavation, filling, and grading. These fugitive dust emissions would be generated for approximately one month of the nine month construction period and would be controlled by standard and appropriate dust control mitigation measures to meet applicable regulations. Thus they would not pose a significant impact.

Table 3.1-1
Federal and State of Hawaii Ambient Air Quality Standards and BGF Total Concentrations

Pollutant	Federal (ug/m^3)	State (ug/m^3)	BGF Total[b] (ug/m^3)
Ozone (O_3)			
1-hour average	235	100	N/A
Carbon Monoxide (CO)			
1-hour average	40,000	10,000	858
8-hour average	10,000	5,000	400
Nitrogen Dioxide (NO_2)			
Annual average	100	70	23
Sulfur Dioxide (SO_2)			
3-hour average	1,300	1,300	47
24-hour average	365	365	19
Annual average	80	80	4
Total Suspended Particulate Matter			
24-hour average	N/A	150	95[c]
Annual average	N/A	60	—
Suspended Particulate Matter (PM_{10})[a]			
24-hour average	150	N/A	16
Annual average	50	N/A	—

Source: CFR, 1989; State of Hawaii, 1986; Engineering-Science

[a]PM_{10}: Particulate Matter less than 10 microns in diameter, project would have no emissions in this size range, therefore total amount equals baseline concentration.

[b]BGF Total: These concentrations are the sum of BGF Project Impacts and Baseline concentrations at site boundary.

[c] Based on PM_{10} baseline concentration

N/A: Not applicable

Table 3.1-2
Summary of Air Quality Data

Pollutant	Maalaea PSD Site 1989 (ug/m^3)
Carbon Monoxide (CO)	
1-hour average	824
8-hour average	376
Nitrogen Dioxide (NO_2)	
Annual average	6
Sulfur Dioxide (SO_2)	
3-hour average	34
24-hour average	13
Annual Average	3
Total Suspended Particulate Matter	
24-hour average	—
Annual Average	—
Suspended Particulate Matter (PM_{10})[a]	
24-hour average	16
Annual Average	—

Source: State of Hawaii, 1990.

The projected emissions from construction-related equipment were calculated by estimating the number and type of equipment to be used, and the hourly equipment operations for each of the construction phases. Included in the emission projections are mobile source emissions from construction worker vehicles, and project-related trucks traveling ten miles to and from the site. Air contaminant emissions from construction-related equipment were estimated from the specific input data shown in Appendix G2.

Table 3.1-3 shows the total estimated air emissions for each construction phase. Construction phase emissions are well below the yearly PSD thresholds and therefore, would not cause significant air quality impacts.

Table 3.1-3

Total Estimated Air Emissions from Project Construction Activities (tons/year)

Activity	Air Contaminants CO	ROG	NO_x	SO_x	PM
Phase I (9 months in 1992/3)	1.3	0.51	2.8	0.29	0.27
Phase II (3 months in 1994)	0.65	0.25	1.4	0.14	0.14
Phase III (3 months in 1995)	0.65	0.25	1.4	0.14	0.14

Source: Engineering-Science

3.1.2.2 Operational Impacts

Emissions from operations would come from both stationary and mobile sources.

The stationary emission sources during Phase I operations would be: a vent following a cyclone; a cyclone used to separate the bagasse from the pneumatic feed line; and a flare which would burn most of the biogas produced by the gasifier during Phase I.

The stationary sources in Phase II operations would be the same sources as in Phase I except that a 5 mW gas turbine would replace emissions from the flare to demonstrate the use of biogas for production of electricity.

The stationary sources in Phase III operations would be the same as in Phase II except that a methanol plant with a methanol storage tank and an oxygen plant would be substituted for the gas turbine. The scale of the methanol demonstration program has yet to be determined, but for this E.A. it is assumed that all the gas available would be used for methanol synthesis.

For Phase III, pressurized oxygen would be produced by an oxygen plant that employs pressure swing absorption (PSA), a physical separation process that does not involve chemical reactions. The PSA process uses parallel, alternating packed beds of molecular sieve (a synthetic zeolite) that absorbs the nitrogen in the air while allowing the oxygen-rich gas to pass through for use in the gasifier. Under normal conditions, molecular sieve is completely regenerative and should last indefinitely. The electrically-powered oxygen plant would produce the oxygen-rich gas (>90% oxygen, <10% nitrogen and other gases found in air) to be used in the gasifier, and its only emissions would be the nitrogen-rich gas that represents the remainder of the input air, and any air humidity (condensed water) separated in the process. Therefore, the oxygen plant would not emit any criteria pollutants.

Mobile sources during all three phases are estimated at seven employee vehicles traveling an average of ten miles daily, and a 20-ton truck transporting ash to the Landfill/composting facility, traveling 20 miles once a week. During Phase I, it is assumed 20-ton trucks would transport wood chips, making fifty ten-mile round trips.

An air impact screening model was run for Phase I emissions from the BGF to determine the impact on ambient air conditions. Results indicated that ambient air contaminants would not exceed Federal or State standards.

The specific air emissions impact model used was the EPA approved screening model, Screen, Version 1.1 (latest version), from EPA's UNAMAP series. It was determined to be the most appropriate model because Screen can perform all of the single source, short term calculations as required by the EPA's screening procedures documents, including estimating the maximum ground level concentrations. Besides point sources (Cyclones 1 and 2), the proposed project also would have emissions from a flare, which Screen can explicitly handle. Thus, Screen was appropriate for the BGF analysis. Further, because there are nearby plant buildings, and a reasonably close marine environment, Screen was particularly suitable, given its ability to handle building downwash and shoreline fumigation.

Table 3.1-4 shows the combined estimated stationary and mobile source emissions for full scale operation of the entire project. Operational phase emissions do not exceed yearly PSD thresholds and therefore, would not cause significant air quality impacts. The detailed input data used to calculate the operation-related emission estimates are shown in Appendix G3.

The Haleakala National Park on Maui is located approximately 20 km from the proposed BGF project site. Computerized air dispersion modeling on Phase I emissions (worse case) indicated that impacts on the Park will be less than those allowed under PSD increments for a Class I area (refer to Table 3.1-5).

Table 3.1-4

Total Estimated Air Emissions from Project Operational Activities (tons/year)

Operational Activity	Air Contaminants CO	ROG	NO_x	SO_x	PM
Phase I					
Stationary Sources	41.82	15.82	218.81	18.24	56.04
Mobile Sources	0.03	0.01	0.03	0.01	0.01
Total Emissions	**41.85**	**15.83**	**218.84**	**18.25**	**56.05**
Phase II					
Stationary Sources	36.33	13.20	218.81	17.71	32.25
Mobile Sources	0.02	0.01	0.02	0.00	0.00
Total Emissions	**36.35**	**13.21**	**218.83**	**17.71**	**32.25**
Phase III					
Stationary Sources	2.32	1.12	11.62	1.01	28.04
Mobiles Sources	0.02	0.01	0.02	0.00	0.00
Total Emissions	**2.34**	**1.13**	**11.64**	**1.01**	**28.04**

Source: Engineering-Science

Table 3.1-5

BGF Project Impacts on the Haleakala National Park[a]

Pollutant	Project Impacts[b] (ug/m^3)	PSD Class I Maximum Allowable Increases[c] (ug/m^3)
Carbon Monoxide (CO)		
1-hour average	3	N/A
8-hour average	2	N/A
Nitrogen Dioxide (NO_2)		
Annual average	2	2.5
Sulfur Dioxide (SO_2)		
3-hour average	1	25
24-hour average	<1	5
Annual average	<1	2
Total Suspended Particulate Matter (PM)		
24-hour average	3	10
Annual average	<1	5

a. Haleakala National Park, a Class I Air Quality Area, is located 20 km southeast of the proposed project site.

b. Source: Engineering-Science

c. Federal PSD Standards, 40 CFR 51.166 (c) and 40 CFR 52.21 (c). State PSD Standards, HAR 11-60-63. 3 hour and 24 hour standards are maximums not averages.

3.1.3 Cumulative Impacts

Cumulative impacts are produced by the aggregation of individual environmental impacts. They can result from proposed, existing and reasonably-related future projects considered together.

Because this is a research and demonstration project exploring the feasibility of the commercial scale production of alternative sources of fuel and electric power, no concomitant developments are planned or anticipated. In regard to existing air emissions sources, in as much as the impacts of these sources are reflected in the ambient air monitoring data their cumulative impact is addressed. However, there are two other potentially concurrent projects in the general vicinity: the proposed Paia Inn development and the construction of new and upgraded facilities for the Kahului Airport. The first 150 units of the Paia Inn development are proposed to be built and occupied by early 1995. Construction of expanded Kahului airport facilities began in 1991.

3.1.4 Mitigation Measures

No mitigation measures are required.

3.2 WATER QUALITY

This section discusses the potential impacts on groundwater, surface water, and coastal waters in the vicinity of the Site.

3.2.1 Setting

3.2.1.1 Groundwater

The Iao Aquifer, part of the Central Maui Water System, presently supplies potable water to Central Maui and has an estimated sustainable yield of 20 million gallons per day (mgd).

3.2.1.2 Surface Water

Surface water in the area consists of a man-made pond, which covers approximately 3.5 acres, approximately 600 feet north of the project site (Figure 1-2). This pond is used by the HC&S Paia Sugar Factory for collection and storage of clean cooling water.

3.2.1.3 Coastal Water

On August 20, 1990 a series of coastal water samples was collected along the coastline between Spreckelsville Beach and the Kahului Wastewater Treatment Plant (Figure 1-1) (State of Hawaii, 1991a). Spreckelsville Beach is situated approximately two miles southwest of the beach fronting Paia, so that samples from Spreckelsville Beach may be considered representative of Paia coastal water. The results of the analyses along Spreckelsville Beach showed exceedances of water quality-criteria for open coastal waters as established by the State Department of Health (State of Hawaii, 1991a) for the following constituents: total nitrogen, ammonia, nitrate plus nitrite, and turbidity. Only orthophosphate, total petroleum hydrocarbon concentrations, and pH were within the appropriate limits.

3.2.2 Criteria

Determination that a proposed project would have a significant impact on water resources would be made if there are detrimental effects to the water quality of groundwater, surface water, or coastal water.

Discussion of the significance of the environmental impacts of all three phases of the proposed BGF Project follows. Criteria for potential impacts to water quality in the State of Hawaii are outlined in Appendix D.

3.2.2.1 Construction Impacts

Stormwater runoff during construction, or operations, would not change nor exceed that from current site uses. Therefore, there would be no impact.

3.2.2.2 Operational Impacts

Water discharged into the existing HC&S irrigation water storage system during Phase III operations, would be clean and uncontaminated and is not expected to alter the quality of underlying groundwater or nearby coastal waters. Therefore, no significant impacts are expected to occur during operation of the project.

3.2.3 Cumulative Impacts

There are no cumulative impacts to water quality as a result of this project.

3.2.4 Mitigation Measures

Since no significant impacts to water quality are expected, no mitigation measures are required.

3.3 BIOLOGICAL RESOURCES

3.3.1 Setting

The proposed BGF Project site is located in an area utilized for bagasse storage and covers approximately four acres in area. Analysis of the botanical survey performed for a site approximately 0.75 of a mile northwest of the proposed BGF Project site (PBR Hawaii, 1991) and ground photographs taken from various locations on the proposed site were used to determine the potential floral species to be found. According to these sources, the vegetation on the proposed BGF Project site up until 1979 had consisted of a monoculture of sugarcane for decades as a result of agricultural use. Occasional invasive species, some native though consisting primarily of introduced species of low ecological importance, were also present on the project site and its surrounding area. This lack of floral diversity severely limits the quantity and diversity of faunal species which may reside or forage upon the proposed BGF project site.

Analysis of the faunal survey (PBR Hawaii, 1991) was used to determine the potential faunal species likely to be found on the proposed BGF project site. Species encountered are likely to be those species which are fairly common and have adapted to areas disturbed by human activities, such as the northern mockingbird (Mimus polyglottus).

No state- or federally-listed or proposed endangered or threatened species of plants or animals are expected to be found on or in the area of the proposed BGF project site. This was confirmed by the U.S. Fish and Wildlife Service, Pacific Island Division (Personal Contact, Smith, 1992).

3.3.2 Criteria

The following significance criteria are recommended by the State of Hawaii. In most instances, an action shall be determined to have a significant effect on the biological resources of the environment if it:

- Involves an irrevocable commitment to loss or destruction of any natural resource
- Curtails the range of beneficial uses of the environment
- Conflicts with the state's long-term environmental policies or goals
- Involves substantial secondary impacts
- Involves a substantial degradation of environmental quality
- Is individually limited but cumulatively has considerable effect upon the environment or involves a commitment for larger actions
- Substantially affects a rare, threatened, or endangered species or its habitat
- Affects an environmentally sensitive area

In addition, significant adverse impacts to biological resources would occur if native or special status (i.e., candidate, rare, threatened or endangered) floral and faunal species or their habitats (as designated by local, state or federal guidelines) were affected either directly or indirectly from project-related activities.

To be significant, these project-related activities must result in, or have the potential to result in, artificial restriction, limitation, degradation or loss to any of the following:

- Species diversity
- Roosting/nesting/lairing areas
- Normal physiological, behavioral, or ecological processes
- Reproductive capacity or capability
- Fish and wildlife movement, plant dispersion or geographic distribution.

3.3.2.1 Construction Impacts

The proposed BGF project site has been heavily disturbed through previous human activity, consequently only marginal habitat is available to biological resources on, or contiguous to, this site.

Because the site also lacks a truly endemic native population of any floral or faunal species, no significant impacts to biological resources are expected to result from project construction or operation and maintenance activities.

3.3.2.2 Operational Impacts

Operation of the proposed facility is not expected to result in any significant effects on biological resources.

3.3.3 Cumulative Impacts

There are no cumulative impacts to biological resources as a result of this project.

3.3.4 Mitigation Measures

No significant impacts to biological resources are expected, therefore no mitigation measures are deemed necessary.

3.4 PUBLIC SERVICES AND UTILITIES

This section describes the public services and utilities that would serve as the infrastructure for the proposed BGF Project. This section analyzes services which would be provided to this project including fire protection, emergency and medical services, school, water, energy and solid waste disposal.

3.4.1 Setting

Fire Protection, Emergency Services, and Medical Facilities. The BGF fire protection system would be connected to the existing HC&S system (refer to Figure 1-3 which illustrates the existing HC&S fire pump, water storage tanks, and hydrants). There is a fire station located 0.75 miles makai (seaward) of the project site with one fire truck and five firefighters. One other fire station is located six miles mauka (inland), in Makawao.

The Maui Memorial Hospital is located 8.5 miles west of the project site and has a staff of approximately 150 doctors and 300 nurses. Two ambulances operate out of this hospital. An additional ambulance service with one ambulance, works out of Makawao.

School. Paia's elementary school is 1,800 feet mauka (inland) from the project site. The closest residences are approximately 900 feet north of the proposed site.

Water Supply. The Iao Aquifer, part of the Central Maui Water System, presently supplies potable water to Central Maui, with an estimated sustainable yield of 20 million gallons per day (mgd). According to the Maui County Department of Water Supply, the Iao Aquifer had an 87 percent average daily withdrawal rate (17.4 mgd) over a recent 12-month period. This current withdrawal represents an increase from the 1987 average withdrawal of 15.1 mgd (State of Hawaii, 1991a). The 1987 average daily potable withdrawal rates for portions of Paia was 0.4 mgd, or 2.6 percent of the average daily potable withdrawal rate. (see Section 3.4.2 for potable water needs).

Energy Supply. Maui Electrical Company (MECO) supplies electrical power to users on the Island of Maui.

Solid Waste Disposal. There are currently four landfills operating on Maui. They are: the Central Maui, Olowalu, Makani and Hana Landfills, operated by the Maui County Department of Public Works.

3.4.2 Criteria and Impacts

Impacts would be determined to be significant if the demand generated by a proposed project: 1) exceeds the capacity of existing resources; 2) creates the need for substantial improvements or expansion of the existing utility infrastructure; and 3) requires construction of new facilities not already included in regional plans.

Fire Protection, Emergency Services, and Medical Facilities. Existing hospital, medical facilities, the existing HC&S fire protection system and the County's fire protection services are adequate for the proposed BGF Project. Emergency and health facilities would not be impacted by the proposed BGF project.

School. The Paia Elementary School would not be impacted by the project because there would be few or no additional students created by the proposed BGF Project.

Water Supply. Approximately 1,000 to 3,000 gpd of water from the HC&S Paia Sugar Factory would be required for cooling water during Phases II and III. Potable water for drinking and sanitation needs would require 200 gpd, which would be obtained from the County through the HC&S system. This usage is minimal and would not require any significant change to the water supply system. Thus significant impacts to water supply are not anticipated.

Wastewater Treatment. Process water for Phases I and II would be contained in a closed loop system with no discharges to the environment. Approximately 15 gpm of uncontaminated process water would be discharged during Phase III. A portion of this process water would be due to a methanol purification process (a simple distillation process) which would be utilized in the production of low grade transportation methanol fuel. The primary purpose of purification is water removal from the methanol. The discharge from the purification process would be about 22 gpd of process water containing only trace amounts of methanol and other alcohols. This discharge, along with the remaining Phase III process water, would not require any treatment prior release to the existing HC&S irrigation water storage pond for utilization on the sugarcane fields.

For all three phases of this project a septic tank would be used for the wastewater generated by all the personnel at the BGF site during operation.

Energy Supply. The proposed BGF Project would use approximately 1.0 mW to 2.0 mW of electrical power. It would be fully offset by the 3 to 5 mW of power that the facility would generate in the second phase of the project. Assuming an average family of four consumes approximately 800 kilowatt hours (kWh) per month of electricity, and the facility generates power for approximately 238 days of the year, the proposed facility could generate enough energy to sustain approximately 298 families per year (Personal Contact, Jars, 1992). More efficient generation of electricity would have a positive impact on meeting the Island's energy needs. Potential impacts to the energy supply are either temporary or beneficial.

Solid Waste Disposal. A maximum of five tons per day (tpd) of biomass residue ash would require disposal or recycling. Ash collected as a by-product of the biomass gasification process is a mixture of inorganic ash and unburned char. Usable portions of these collected solids may be used as a constituent of compost, soil amendment for the sugarcane fields, or as landfill cover. The State of Hawaii will tentatively approve a Green Composting program for the Island of Maui. A program representative has indicated that the composting program would be able to use the five tons ash generated each day (Personal Contact, Steel, 1992). Because the ash residue is non-hazardous (Appendix G7) and has useful properties for soil enhancement, significant impacts to the solid waste disposal system are not anticipated.

The alkali compounds that might evolve in the product gas during Phase II and III could be potassium or sodium hydroxide or chloride. Experience in coal gasification suggests that such compounds should condense onto solid particles at temperatures of approximately 900 to 1200°F (well above the condensation point for most tars and oils) and therefore could be removed with hot-gas cleanup systems being considered at this time. It is believed that the charalkali metals combination could be considered non-hazardous given the very low concentrations of alkali compounds anticipated and these compounds could be sent to landfill.

As part of the proposed Gas Cleanup System for the Methanol production phase, static beds of iron and zinc oxide could be used to desulfurize the biogas before it passes to the methanol synthesis section of the plant. This process would produce non-hazardous solid wastes of iron and zinc sulfide (estimated amount of 87 tons/yr) that could be sent to landfill. Because of the small amount of waste no significant landfill impact is envisioned.

Two different types of catalysts may be employed in Phase III: tar-cracking catalysts and methanol-synthesis catalysts. Methanol synthesis catalysts, which generally contain cobalt, zinc, and aluminate, normally have lifespans of roughly three years (which substantially exceeds the likely duration of Phase III). Tar-cracking catalysts, usually made from nickel oxide embedded in ceramics, have varying lifespans. These two types of catalysts are classified as non-hazardous when they are new. Whether the deactivated (spent) catalysts would be considered hazardous depends on the nature of the constituents that deposit on the catalysts. Following the practice of the local refineries, the BGF project would send the deactivated catalysts to the mainland for metals recycling.

3.4.3 Cumulative Impacts

There are no cumulative impacts to public services and utilities as a result of this project.

3.4.4 Mitigation Measures

Fire Protection, Emergency Services, and Medical Facilities. Facility staff would receive proper biannual training in fire response and emergency medical treatment procedures. This training would mitigate any impacts to emergency services and fire protection to insignificance.

School. No mitigation measures are required.

Water Supply. No mitigation measures are required.

Wastewater Treatment. No mitigation measures are required.

Energy Supply. No mitigation measures are required.

Solid waste disposal. Impacts associated with ash disposal would be mitigated to insignificance by using the ash in composting or as a soil amendment or landfill cover. Other solid wastes generated by the proposed action would be either non-hazardous and eligible for disposal in available landfills and/or recycled prior to disposal.

3.5 ARCHAEOLOGICAL/CULTURAL RESOURCES

3.5.1 Setting

Based upon maps, aerial photographs and historical reports, the project site is located on a former pond which has been bounded by sugarcane cultivation for approximately 80 to 100 years (Sanborn Insurance Company, 1914, 1929; Federal Emergency Management Agency, 1977; United States Geological Survey, 1965, 1977, 1983; County of Maui, 1983). Consequently, no archaeological remnants are expected to exist on the site.

Historic structures located near the proposed BGF project site are included in the state inventory of properties. These may be eligible for listing in the State and National Registers of Historic Places. Site number 50-50-1614 of the Upper Paia District comprises the area around the HC&S Paia Sugar Factory and includes the railroad depot, mill offices, school, and the Holy Rosary Church (Personal Contact, Hibbard, 1992).

3.5.2 Impacts

Due to intensive sugarcane cultivation for many years, the proposed BGF project site has been extensively disturbed. The Historic Preservation Division of the State of Hawaii Department of Land and Natural Resources does not ascribe archaeological significance to the site (Personal Contact, Griffin, 1992). Therefore, no adverse impacts to archaeological resources are anticipated.

The proposed BGF project would not impact any existing historic structures within site number 50-50-1614 of the Upper Paia District and would not change the agricultural associations of the district. For these reasons the project is not expected to have significant adverse impacts on any historic resources.

In the event that any cultural resources are uncovered on the property during construction, construction activities would be directed away from the remains or temporarily halted until the remains have been evaluated. Evaluation of the remains would be done by a qualified archaeologist who would consult with the State Historic Preservation Division. Appropriate mitigation measures would be determined and implemented prior to allowing construction activities to resume. If the need for further study of the site is indicated, the study would adhere to all applicable requirements of the Department of Land and Natural Resources.

3.5.3 Cumulative Impacts

There are no cumulative impacts to archaeological/cultural resources as a result of this project.

3.5.4 Mitigation Measures

Mitigation measures are not expected to be necessary for archaeological/cultural resources.

3.6 HEALTH AND SAFETY/RISK OF UPSET

In this section health and safety/risk of upset aspects and conditions related to the construction and operation of the BGF are analyzed. Possible upset conditions include: (1) a fire involving the propane or methanol storage tanks and (2) non-operation of the flare system (flame out) with the release of unburned biogas.

During upset conditions, hazardous substances could be released. Methane, hydrogen and carbon monoxide could potentially be released from a non-operating flare system; therefore upset conditions involving the release of these gases are discussed here.

3.6.1 Setting

The BGF would be located close to the existing HC&S Paia Sugar Factory. The project site is bounded on the east by the HC&S Paia Sugar Factory and by cultivated sugarcane fields to the north, south and west. North of the project site is the town of Paia and additional cultivated sugarcane fields. There are no sensitive receptors such as school, hospitals, or residential areas in the immediate vicinity of the proposed site. An elementary school is at a distance of about 1,800 feet from the project site and the nearest residence is located approximately 900 feet from the project site. The Maui Memorial Hospital, located about nine miles west of the facility, is the nearest hospital. The nearest fire station, an emergency response facility, is located about 0.75 mile makai (seaward) of the project site.

3.6.2 Criteria and Impacts

In this subsection, possible impacts of upsets during construction and operation of the biomass facility are discussed.

An accidental release of hazardous materials (methane, hydrogen, and carbon monoxide) from the facility as a result of the non-operation of the flare system (flame out), would be considered significant if it adversely affected neighboring residents and other sensitive receptors. In addition, a fire or explosion involving the propane or methanol storage tanks at the facility, could also be considered significant if it adversely affected neighboring residents and other sensitive receptors.

NEPA guidelines require determining any adverse change in any of the physical conditions within the area affected by the project, including the probability of accidental release.

Accidental release probability can be divided into 3 categories (EPA, 1987):

- Low: Probability of occurrence considered unlikely during expected lifetime of the facility, assuming normal operation and maintenance.
- Medium: Probability of occurrence considered possible during the expected lifetime of the facility.
- High: Probability of occurrence considered sufficiently high to assume event would occur at least once during the expected lifetime of the facility.

It is also necessary to classify accidents according to their severity of consequences to people. There are three categories of classification (EPA, 1987):

- Low: Chemical is expected to move into the surrounding environment in negligible concentrations. Injuries expected only for exposure over extended periods, or when individual personal health conditions create complications.

- Medium: Chemical is expected to move into the surrounding environment in concentrations sufficient to cause serious injuries and/or deaths unless prompt and effective corrective action is taken. Death and/or injuries expected only for exposure over extended periods, or when individual personal health conditions create complications.
- High: Chemical is expected to move into the surrounding environment in concentrations sufficient to cause serious injuries and/or deaths upon exposure. Large numbers of people expected to be affected.

The risk analysis matrix, shown in Appendix G5, combines accidental probability with the severity of consequences to identify situations of major concern, considerable concern, and combinations of concern which may require planning for credible events (EPA, 1987 and Office of Emergency Services, 1989). This matrix has been used to identify the significance of risk in the operation of the biomass facility.

3.6.2.1 Construction

All applicable safety procedures and practices regarding fabrication, installation, testing and startup would be followed during construction of the biomass facility. There would be no hazardous chemicals in or near the facility or construction area. All local, state, and federal regulations would be followed during construction. Thus, the probability of upset conditions occurring during construction of the proposed facility, with any resultant health impacts on workers and on the public, is anticipated to be zero or near zero.

3.6.2.2 Operation

Impact of Non-Operating Flare (Flame Out).

The specific risk from the non-operation of the flare (flame out) would be a function of the probability of its occurrence, the quantity and duration of the release of methane, hydrogen, and carbon monoxide, and the concentration and duration of human exposure to these gases.

Probability of an Accident. The design of all new equipment for the biomass facility would be based on proven safety technology, including an automatic pilot ignition system. In addition, as a part of the operational plan, all rules and regulations would be followed in the operation of the biomass facility. Also, various operating units would be shut down at specific intervals for inspection and maintenance. This would insure that all equipment is in safe and reliable condition. Any necessary repairs or replacement would be performed. In view of the proposed safety features which would be built into the biomass facility, and based on experience with flare systems at other facilities, the probability of a flame out condition would be considered medium.

Health Impact. The criteria used to evaluate the health impacts of atmospheric releases of methane, hydrogen, and carbon monoxide are based on the recommendations made by the Occupational Safety and Health Administration, the National Institute for Operational Safety and Health (NIOSH), and other agencies.

Methane and hydrogen are colorless, odorless and tasteless gases. They are classified as simple asphyxiant gases. Gases of this type have no specific toxicity effect, but they act by excluding oxygen from the lungs. The effect of these gas is proportional to the extent to which they diminish the oxygen in the air that is breathed. Oxygen may be diminished to about 67 percent of its normal percentage in air before appreciable symptoms develop. For this to happen the concentration of the asphyxiant gas would have to be about 33 percent in the mixture of air and gas. Marked symptoms can be produced at concentrations of 50 percent, and a concentration of 75 percent is fatal in a matter of minutes.

Both methane and hydrogen are flammable gases and could be dangerous when exposed to heat or flame in the presence of air. The lower and upper explosive limits of methane in air are 5.3 percent (53,000 ppm) and 15 percent (150,000 ppm), respectively while the lower explosive limit of Hydrogen in air is 4.1 percent (41,000 ppm) (Sax, 1989).

Carbon monoxide is a common air pollutant in the atmosphere, and is a colorless and odorless gas. It is mildly toxic when inhaled by humans and can cause asphyxiations by preventing hemoglobin from binding oxygen. Acute cases of poisoning resulting from short time exposures to high concentrations of carbon monoxide normally do not result in any permanent disability if recovery takes place. The National Institute for Occupational Safety and Health (NIOSH) has determined 1,500 ppm as the level immediately dangerous to life and health (NIOSH, 1991). Carbon monoxide is classified as a flammable gas. The lower and upper explosive limits in air are 12.5 percent (125,000 ppm) and 74.2 percent (742,000 ppm), respectively (Sax, 1989).

Based on the design data for the biomass facility, it is expected that the concentrations of methane, hydrogen, and carbon monoxide in the biogas would be about 6, 12, and 9 percent, respectively. Because the exit temperature of these gases would be very high (about 1,600°F), and the release height would be about 70 feet, the ground concentrations of methane and carbon monoxide would be very low. It is estimated that the gases released from the flare stack would be diluted by a factor of about 50,000 as it reaches the ground. Thus, the ground concentrations of carbon monoxide and methane would be well below the lower explosion limit. In addition, the carbon monoxide ground concentrations would also be significantly lower than the IDLH (Immediately Dangerous to Life and Health) level. Hydrogen is an extremely light gas and would be entirely dispersed into the atmosphere. These conditions indicate that the consequences of the release of hydrogen, methane, and carbon monoxide during flame out conditions at the biomass facility would be low. Since the expected flame out probability is medium and the severity of consequences would be low, the operation of the flare system of the biomass facility would fall under the "no concern" category.

Laboratory testing has shown that approximately 2 percent (or 20,000 ppm), of the product gas would be oil phase composed of a wide range of aromatic hydrocarbons. However, benzene and napthalene would comprise over 55 percent of the mix. No other compound would represent more than 4 percent of the mixture. During normal operation, these compounds would be incinerated during product gas combustion in either the flare or the dryer system burner forming carbon dioxide and water. In the event of a flame out, however, they could be released into the atmosphere. Due to the elevated temperature of the product gas, 1,600+ degrees Fahrenheit, they would be released in vapor phase, rise quickly, and would be fully dispersed in the atmosphere. Any material reaching ground level onsite would be diluted by 50,000 to yield a ground level concentration of 0.4 ppm for the mixture of hydrocarbons. The time weighted averages (TWA) for a normal 8 hour work day for benzene and napthalene are 10 ppm and the short term exposure limit (STEL), for napthalene is 15 ppm (NIOSH, 1991). Actual concentrations for benzene and napthalene would be less than .16 ppm and .06 ppm respectively. Thus they are not seen to pose any potential health risk.

Impacts of Storage of Methanol and Propane

Methanol produced as the end product of Phase III would be stored in an enclosed vessel, on site, above ground, in a 100% capacity bermed storage area. In the event of an accident involving the release of methanol from storage, it would be fully contained in the bermed area.

Methanol is generally considered less hazardous (less flammable) than gasoline from the fire-safety standpoint. Alcohol fuels also have lower burning rates and lower heat flux than gasoline and therefore would cause less extensive damage. The visibility of alcohol fires, especially methanol, however, is poor; therefore detecting and combating alcohol fires could be impaired.

The methanol and propane storage facilities would incorporate all the required safety features and would be operated following all the current rules and regulations. Thus, the probability of a fire involving a propane or methanol tank would be low to medium.

The specific risk during an accidental fire involving a 2,000 gallon propane tank would be a function of the probability of its occurrence, the quantity of propane released and the extent of the hazard area produced.

The hazard area during a fire would not be expected to extend to the residences or other sensitive receptors near the proposed biomass facility. It may be noted that the nearest residence is 900 feet away from the proposed biomass facility. Thus, the consequences of a fire would be considered to be low. In addition the methanol and propane facilities would be located at opposite ends of the site (see Figure 1-3), approximately 360 feet apart, to insure a fire in one would not spread to the other. Since the expected probability of a fire would be low to medium, and the severity of consequences would be low, the impacts of storage of propane and methanol would fall under the "no concern" category.

Because the impacts during the non-operation of flare (flame out) as well as the storage of methanol and propane would fall under the "no concern" category, the operation of the biomass facility would fall under "no concern" category.

3.6.3 Cumulative Impacts

Cumulative impacts are produced by the aggregation of individual environmental impacts. They can result from several projects. Since this is a research and demonstration project exploring the commercial scale production of alternative sources of fuel, no concomitant developments are planned or anticipated. However, there are two other potentially concurrent projects in the general vicinity of the project site: namely, the proposed Paia Inn development, and the construction of new and upgraded facilities for the Kahului Airport. Neither of these two projects is considered to have the potential to produce cumulative health and safety impacts at any sensitive receptors near the proposed biomass facility.

3.6.4 Mitigation Measures

No mitigation measures are required.

3.7 NOISE

3.7.1 Setting

The noise environment of the project site and surrounding area is currently influenced by traffic on Baldwin Avenue and to a great extent by existing cane and bagasse handling equipment, processing and steam producing equipment at the adjacent HC&S Paia Sugar Factory. The noise contours from the Kahului Airport, located approximately 3.3 miles from the project site, are well below an L_{dn} of 55 dBA in the study region (State of Hawaii, 1991a). For reference, noise levels representative of various sources and types of communities familiar to the reader are presented in Appendix G6.

Noise-sensitive land uses in the project study area have been identified and include an elementary school located 1,800 feet mauka of the project site, a number of residences scattered to the southeast and along Baldwin Avenue (approximately 900 to 1,000 feet from the project site) and along Hana Highway (approximately 3,960 feet mauka from the project). The proposed Paia Inn would be located on the Hana Highway near Baldwin Avenue and, if constructed, could also be considered a noise-sensitive receptor location since it would contain sleeping quarters.

3.7.2 Criteria

The recommended noise impact criteria is based on the Environmental Protection Agency's recommendation that hourly average indoor noise levels be less than 45 dBA during daytime hours and less than 32 dBA at night at noise-sensitive receptors. In most cases, these levels protect against sleep interference.

This generally means that hourly average outdoor noise levels during the day would have to be below 55 dBA and below 42 dBA at night in order to achieve the indoor criteria if windows are left open for ventilation.

3.7.2.1 Construction Impacts

Project-related noise activities would include short-term construction activities and the long-term operation of equipment for the biomass gasifier facility. Construction noise would be produced intermittently by equipment such as cranes, a grader, a paver, a roller, a backhoe, a front-end loader, concrete mixer trucks and other vehicles for approximately 8 to 12 daytime hours per day for approximately nine months.

It is important to note that the proposed BGF site and adjacent property are now used for bagasse storage. Presently the bagasse is transported to and from storage by mobile equipment similar to that which would be used for construction. Thus no noise impacts above that now caused by existing HC&S Paia Sugar Factory operations are anticipated during construction.

3.7.2.2 Operational Impacts

During the operational phases of the project equipment such as compressors, pumps, feeders, conveyors, fans, an injector screw, a boiler plant, a gas turbine generator and a methanol plant would produce noise.

In as much as the noise from an unenclosed piece of equipment would be within the range of 85 dBA three feet away from the equipment, noise levels at locations within line of sight 1,000 feet from the project site would be 44 dBA due to natural attenuation. In addition, major noise producing equipment, i.e. the air compressors, will be contained in acoustical enclosures for noise reduction. These enclosures will be designed to insure noise levels at surrounding receptors will be within required levels to meet EPA and local standards. No significant noise impacts from the BGF project are anticipated.

3.7.3 Cumulative Impacts

Cumulative noise impacts at any nearby noise-sensitive receptor during the construction of the project are not expected to exceed noise levels produced by the project itself. It is anticipated that the operational noise levels of the BGF will be no higher than those presently emitted by the existing HC&S Paia Sugar Factory. Over the next six years of project operation however, it is estimated that street traffic noise will increase along Baldwin Avenue. Noise produced by other future developments in the area could also cause an increase in background noise. With this cumulative noise impact in mind, operational phases of the project would include noise mitigation measures to meet the low end of the criteria range to compensate for potential cumulative noise increases in the area.

3.7.4 Mitigation Measures

Consistent with the above Section 3.7.3, operational noise impacts will be given additional study during the actual design stage of the project. As noted, noise control measures such as acoustical enclosures, treatments for the equipment, and the use of noise barrier walls placed between the equipment and impacted areas will be provided.

3.8 TRAFFIC AND CIRCULATION

3.8.1 Setting

3.8.1.1 Existing Roadways

The primary roads that run in the vicinity of the project site include Baldwin Avenue and the Hana Highway. Access to the project site is from Baldwin Avenue through HC&S Paia Sugar Factory property. Brief descriptions of these roadways are presented below.

Baldwin Avenue. Baldwin Avenue is a two-lane collector roadway that runs in a north-south direction. It extends from Hana Highway in Paia on the north to Makawao Avenue to the south. In lower Paia, on-street parking is permitted on both sides of Baldwin Avenue.

Hana Highway. Hana Highway is a State roadway that runs in an east-west direction, carrying traffic between Kahului/Wailuku and the communities along the eastern coast of Maui. The highway is a two-lane roadway with one travel lane running in each direction between Haleakala Highway and the eastern section of Maui. To the west of Haleakala Highway, Hana Highway is a four-lane roadway with two travel lanes in each direction. On-street parking is permitted on both sides of the highway through the town of Paia.

Other Roads. Other roadways in the vicinity of the project area are two-lane roadways. They include Keahua Road, Kaheka Road and Sunny Side Road.

3.8.1.2 Level of Service and Existing Traffic Volumes

Intersection Level of Service Methodology. Level of Service (LOS) is a qualitative measure used to describe the condition of traffic flow, ranging from excellent conditions at LOS A to overload conditions at LOS F.

Existing Peak-Hour Level of Service. The busiest and closest intersection to the project site is Hana Highway/Baldwin Avenue. Traffic in both directions at this intersection is currently operating at a poor level of service (LOS E) during A.M. and P.M. peak hours. The existing A.M. and P.M. peak-hour traffic is estimated at 1,423 and 1,772 vehicles respectively (PBR Hawaii, 1991). The left turn movement from Baldwin Avenue to westbound Hana Highway is operating at a LOS F during both peak hours (PBR Hawaii, 1991).

3.8.2 Criteria

The criteria for determining the significant impacts of this project are based on transportation standards identified in Highway Capacity Manual No. 209 (Transportation Research Board, 1985). These standards indicate that a project would have significant impact if the following condition is met:

- The intersection is projected to operate at a level of Service E or F after addition of project related traffic.

3.8.2.1 Construction Impacts

Construction-related traffic is based on the following assumptions:

- Construction for Phase I would occur over nine months, 8 to 12 hours a day, five days a week.
- Construction traffic related trips for Phases I, II, and III would be generated by approximately 31 construction worker vehicles, three pickup trucks, inspector vehicles, and occasional concrete and delivery trucks.

Traffic. Potential traffic impacts during construction of the proposed BGF project could be caused by construction equipment (trucks, vehicles, etc.) and construction worker vehicles. To minimize the impact of the vehicles on the Baldwin/Hana Highway intersection, construction work would be scheduled so that neither construction nor worker vehicles would normally arrive or depart the site during peak periods. Thus the impact on traffic by the BGF should not be significant.

3.8.2.2 Operational Impacts

When operational, the proposed BGF project is estimated to generate approximately eight vehicle trips per day. This represents an insignificant increase of peak hour traffic volumes at the intersection of Hana Highway/Baldwin Avenue. The addition of these trips on roadways in the vicinity of the project site would also be insignificant.

3.8.3 Cumulative Impacts

There are no cumulative impacts to traffic and circulation as a result of this project.

3.8.4 Mitigation Measures

Mitigation measures to avoid traffic impacts during construction of the project would be the scheduling of construction traffic outside peak traffic periods.

3.9 LAND USE

3.9.1 Setting

Based on a June 26, 1992 letter from the United States Department of Agriculture Soil Conservation Service the project site would be located on land that is <u>not</u> considered prime farmland (Personal Contact, Fujiwara, 1992).

The land on which the proposed BGF would be located is now zoned State Agricultural. Land use classifications adjacent to the proposed gasifier site include agricultural areas to the south, north, and west, and a heavy industrial area to the immediate east. The east side of Baldwin Avenue between the existing HC&S Paia Sugar Factory and Lower Paia and the area to the south of the factory are designated as single-family residential areas.

3.9.2 Impacts

In as much as the proposed use of the BGF site is agricultural related a State Land Use Commission Special Use Permit (administered by the Maui County) will be required. This Permit has been applied for.

3.9.3 Cumulative Impacts

There are no cumulative impacts to land use as a result of this project.

3.9.4 Mitigation Measures

No mitigation measures are required.

3.10 SOCIOECONOMICS

3.10.1 Setting

Population. Estimated population for the State of Hawaii in 1990 was 1.1 million people, of which about 100,504 or nine percent were residents of Maui County. About 91,361 persons or 91 percent of Maui County population reside on the Island of Maui.

Population growth in Maui has greatly exceeded statewide averages. The county's population grew by 54 percent from 1970 to 1980 and 42 percent from 1980 to 1990, while growth rates for the state during the same periods were 25 and 15 percent, respectively.

The rapid growth in the residential population during the last two decades is expected to slow down slightly during the 1990s as Maui County attempts to slow growth (State of Hawaii, 1991a). According to State population and economic growth projections for Maui County however, the total resident population is expected to increase to 145,200 persons in the year 2010, an increase of about 44,696 or 45 percent.

The Paia area is a major population and employment center of Maui County. The area is situated in the northwest region of the Island of Maui and includes the communities of Lower Paia, Upper Paia and Kuau. The Paia area serves as the bedroom community of the Wailuku-Kahului job center (County of Maui, 1983). Secondary population centers include the communities of Haiku and Kuiaha which are located a few miles to the southeast of Paia. The project area was once a large community, comprised of several camps that were inhabited by plantation workers. Currently the area is mostly used for sugarcane production.

De Facto Population. The de facto population is defined as the number of persons physically present in the area, regardless of usual place of residence. It includes visitors and excludes residents temporarily absent. The de facto population of Maui County in 1990 was 137,300 with approximately 34,325 or 25 percent representing visitors. According to State projections, Maui County's de facto population is expected to reach 216,200 by the year 2010, representing an increase of 78,900 or 57 percent over the 1990 total.

Employment. Maui County has one of the strongest economies in the State of Hawaii, primarily due to extensive resort development. In 1990, total employment in the County was 52,600.

Economic Activity. In 1990, gross business receipts of the County grew by 18.9 percent (State of Hawaii, 1991a).

The retail trade sector in 1990 consisted of about 12,800 establishments and generated over $920 million in sales. About $129 million in payroll was generated by this sector.

The service sector in 1990 had 725 service establishments which employed about 12,500 persons and generated about $650 million in receipts. Payroll expenditures in this sector reached $190 million.

The tourism sector in 1990 was the largest employer, employing about 18 percent of primary wage earners. In 1990, Maui County had about 18,000 visitor-units of which about 17,000 units were located on the Island of Maui.

3.10.2 Criteria

A proposed project would have significant socioeconomic impacts if implementation of the project resulted in a population growth of more than five percent. A rapid population growth could cause increases in infrastructure requirements and fiscal and social costs that the local Jurisdiction might not be able to meet.

3.10.2.1 Construction Impacts

Population. Construction of the proposed BGF project would not require importation of non-resident workers to the Island of Maui; therefore, no increase in population would occur. The demand for housing as a result of this project would be insignificant, as most of the construction labor force would come from neighboring communities.

Economic Activity. Direct employment resulting from the Phase I construction is estimated to range from a low of 16 employees in the first month to a high of 45 employees in the fourth month of construction. Maui's construction labor force would not be significantly affected as there is an adequate construction labor pool on the island to accommodate this demand. Phases II and III construction employment estimates would be about half that of Phase I.

Construction expenditures on this project would generate short-term beneficial impacts. The construction phase would generate direct income from expenditures by the project sponsors and indirect income from expenditures by the project contractor in the purchase of goods, services and local construction material such as cement, gravel, sand, and water from businesses on the island. Induced income would be generated when the direct and indirect incomes earned (wages, interests profits etc.) are spent in the local economy. This would be a beneficial impact.

I.10.2.2 Operation

Population/Housing. The operation of the project would not result in any population increase; therefore, additional housing would not be required.

Economic Activity. Project operation employment is estimated at three to four employees for day shifts and two employees for night shifts. This employment would generate direct income in the form of payroll and taxes, a beneficial impact in the long-term. Indirect and induced income resulting from this employment would be insignificant because of the small number of employees the project would generate.

Phase II would generate between 3 and 5 megawatts of electricity. The sale of this electricity to the Maui Electric Company would generate income and revenue for the project. This is a beneficial impact.

Phase III would include production of about 4,000 gallons of methanol which could be used for transportation fuel. This is a beneficial impact in that it could generate revenue and decrease dependence on imported fuel.

3.10.3 Cumulative Impacts

There are no cumulative impacts to socioeconomics as a result of this project.

3.10.4 Mitigation Measures

No significant impacts to socioeconomics are expected; therefore, no mitigation measures are required.

3.11 VISUAL RESOURCES, AESTHETICS, AND LIGHT AND GLARE

3.11.1 Setting

The proposed site is partially visible from Hana Highway and partially obscured by sugarcane and an earthen berm. Architecturally, the proposed BGF project complies with the Paia-Haiku Community Plan (County of Maui, 1983) and is subject to design review by the County.

The Haleakala National Park on Maui is located approximately 20 km from the proposed BGF project site.

3.11.2 Impacts

The proposed BGF project would comply with the Paia-Haiku Community Plan (County of Maui, 1983) aesthetic design requirements.

At the request of the National Park Service, visibility impacts analyses due to the BGF on the Haleakala National Park were performed. The results indicate that the project emissions will cause no visibility impacts either at the Haleakala National Park itself or at any integral vista associated with the Park. (Engineering-Science, 1992) The National Park Service has reviewed analyses and verified the results.

3.11.3 Cumulative Impacts

There are no cumulative impacts on visual resources, aesthetics, or light and glare as a result of this project.

3.11.4 Mitigation Measures

No significant impacts are anticipated with light and glare or aesthetics inasmuch as the project will comply with the Paia-Haiku Community Plan. Thus, mitigation measures are not required.

3.12 GEOLOGY

3.12.1 Setting

The Island of Maui was formed during Pliocene and Pleistocene eras from two volcanoes, a western one (Puu Kukui) and an eastern one (Haleakala). The project site is located on the lower flanks of Haleakala, 160 feet above sea level. Topography of the project site consists of relatively flat terrain, sloping downhill approximately four degrees to the north.

Geologic units at the project site consist of the Honomanu and Kula Volcanic Series. These flows were comprised chiefly of basaltic andesite, andesitic basalt, ash or tuff, and picritic basalt in a "clinker" form. The Kula Volcanic Series overlies the Honomanu Series and contains flows averaging 50 to 200 feet thick in the vicinity of the project site. The flows are fairly permeable, allowing surface water to penetrate to the water table at sea level.

The Honomanu and Kula units are covered by recent alluvium. Soil formed on the recent alluvium is classified as Paia silty clay, a moderately permeable clay having three to seven percent slope. Runoff on the soil is slow, and its erosion hazard is slight. Its engineering properties are described in general terms in a statewide soil survey performed by the United States Department of Agriculture in 1972. Appendix G4 summarizes the general engineering properties of Paia silty clay.

According to Stearns (1942), lava tubes may exist in pahoehoe (smooth lava) layers of the Kula Volcanic Series. Nearby test borings and a generalized cross-section of Haleakala however, do not indicate lava tubes, cinder cones or rift zones in the project vicinity.

Most major earthquakes in the region are caused by fault movement associated with volcanic activity. In Hawaii, some faults are located on volcanoes, while others lie on the ocean floor near the islands. The most significant earthquake affecting Maui occurred on January 22, 1938. This earthquake was assigned a Richter scale magnitude between 6.8 and 6.9. The epicentral location was estimated to be near Pauwela Point, approximately 5 miles northeast of the project site. According to an environmental assessment prepared for the County of Maui (County of Maui, 1981), the Island of Maui is located in Seismic Probability Zone 2, indicating the potential for moderate building damage from an earthquake in the area. Earthquake damage to the proposed plant would be unlikely to affect surrounding sensitive receptors.

Tsunamis have been observed and recorded on all major Hawaiian islands. Since 1946, significant tsunamis recorded for the Island of Maui have occurred in 1946, 1957, 1960 and 1964. Due to the relatively high elevation of the project site, the potential for tsunami inundation is greatly reduced. Based on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map for Paia, the project site is located in a zone of minimal flood hazard (Zone C).

3.12.2 Impacts

The BGF program is not anticipated to have any impact on any of the above described geologic conditions.

3.12.3 Cumulative Impacts

There are no cumulative impacts to geologic resources as a result of this project.

3.12.4 Mitigation Measures

No mitigation measures are required.

SECTION 4
ALTERNATIVES TO THE PROPOSED BGF PROJECT

4.1 PROJECT ALTERNATIVES

Four other sites in Hawaii, with a supply of biomass and drying facilities were considered. The present site was found to be most desirable based on long-term stability of the supply of bagasse which often exceeds the HC&S Paia Sugar Factory's capability for on-site consumption. Because the success of the proposed BGF project depends critically on its ability to demonstrate technology viability over a period of time, the stability and availability of the bagasse supply was an important consideration.

This BGF project is an outgrowth of a competitive proposal submitted by the PICHTR team in response to a national solicitation by the DOE.

Because the proposed BGF project would not have significant environmental effects, there are no environmental advantages to the technical alternatives considered for the project.

4.2 "NO ACTION ALTERNATIVE" IMPACTS

With the "No Action Alternative", the opportunity to demonstrate a superior technology with higher conversion efficiencies using bagasse and whole tree chips would not be explored and the long-term potential benefits to the energy supply of Hawaii and the United States would not occur.

SECTION 5

LONG-TERM PRODUCTIVITY VERSUS SHORT-TERM USE OF THE LAND

This project is a scale-up facility, intended to demonstrate the technical and economic feasibility of emerging technology. The project's short-term effects on the environment would be minor, entailing temporary development of a small site located on the sugar plantation. The bagasse used for the demonstration would be part of the current surplus at the HC&S Paia Sugar Factory. In order of preference, disposal of the non-hazardous bagasse ash would be by composting; return to the cane fields as a soil amendment; or used as a landfill cover. Other solid wastes generated by the proposed action would be either non-hazardous and eligible for disposal in available landfills and/or recycled prior to disposal.

If successful, the project could contribute greatly to the maintenance and enhancement of the environment in several ways. First, the project would demonstrate biomass conversion to be a cost-competitive source of low to medium Btu gas. Improving the contribution of biomass to the global energy profile requires that the biomass be converted into more useful forms of energy such as electricity and liquid fuels. The BGF project could greatly improve this conversion technology. Furthermore, the State of Hawaii, which has no fossil fuel resources and meets its energy needs primarily with imported oil and coal, could meet a portion of its electrical and transportation fuel needs through biomass.

As a demonstration project, its most important function would be to generate information regarding the technical, commercial, and environmental feasibility of biomass conversion.

SECTION 6

SIGNIFICANT IRREVERSIBLE ENVIRONMENTAL CHANGES RESULTING FROM THE PROPOSED ACTION SHOULD IT BE IMPLEMENTED

The proposed BGF Project is not expected to result in any significant irreversible adverse environmental impacts.

APPENDIX A

REFERENCES

PUBLICATIONS

CERL, (U.S. Army Construction Engineering Research Laboratory), 1978. *Construction-Site Noise Control Cost-Benefit Estimating Procedures*, Interim Report N-36, January.

CFR, (*Code of Federal Regulations*), 1989. Title 40, Part 50, Chapter 1, "*National Primary and Secondary Ambient Air Quality Standards*", July.

_____, 1990. Title 40, Part 52, Chapter 1, "*Prevention of Significant Deterioration of Air Quality*", Paragraph 21, July.

_____, 1991. Title 40, Part 772, Chapter 1, "*Procedures For Abatement Of Highway Traffic Noise And Construction Noise*," April.

California Air Resources Board, 1986. *EMFAC7C*.

County of Maui, 1981. *Project Report and Environmental Assessment; Upper Paia Housing Project*. Environmental Impact Study Corporation (EISC).

_____, 1983. *Paia-Haiku Community Plan*, State of Hawaii, April.

EPA, (U.S. Environmental Protection Agency), 1971. *Noise From Construction Equipment and Operations, Building Equipment, and Home Appliances*, NTID 300.1, December 31.

_____, 1974. *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety*, *550/9-74-004*, March.

_____, 1985. *AP-42*.

_____, 1987. *Technical Guidance for Hazard Analysis*. Federal Emergency Management Agency.

Engineering Science, 1990. *PSD Permit Applicaton for Maalaea Maui Generating Station*, Maui Electric Company, Ltd., August.

_____, 1991. *Project Management Plan, Biomass Gasifier, Environmental Compliance*. Pasadena, Engineering-Science, December.

Federal Emergency Management Agency, 1977. *Flood Insurance Rate Map - Paia*.

_____, 1981. *Flood Insurance Rate Map - Maui County, Hawaii*, June 1.

Hawaii Natural Energy Institute, 1989. *Hawaii Integrated Biofuels Research Program, Phase I Final Report*, University of Hawaii at Manoa, October.

_____, 1990. *Hawaii Integrated Biofuels Research Program, Phase II Final Report*. August.

IGT, 1992. Task 1. Preliminary Testing and Conceptual Design Report, April.

Miller, Alan S., et al., 1986. *Growing Power: Bioenergy for Development and Industry*, World Resources Institute, April.

Engineering-Science, 1992. *Visibility Impacts at the Haleakala National Park from the Biomass Gasifier Facility (BGF)*. Pasadena, Engineering-Science, August.

National Institute for Occupational Safety and Health, 1991. *Pocket Guide to Chemical Hazards*, Washington, D. C.

OES (Office of Emergency Services), 1989. *RMPP Guidance for the Preparation of an RMPP*, November.

Pasztor, Janos and Lars A. Kristoferson, 1990. *Bioenergy and the Environment*. Westview Press, Oxford.

PBR Hawaii, 1991. *Paia Inn: Planning, Engineering, Environmental Report*, September.

Reed, T.B., 1981. *Biomass Gasification Principles and Technology*. Noyes Data Corporation, New Jersey.

Sax, N.I., 1989. *Dangerous Properties of Industrial Materials*, Seventh Edition, Van Nostrand Publications, New York, New York.

State of Hawaii, 1986. Department of Health, *Ambient Air Quality Standards* ,Title II, Chapter 59, Administrative Rules.

_____, 1991a. Department of Transportation, Airport Division. *Draft Environmental Impact Statement, Kahului Airport Master Plan Update and Appendix*, September.

_____, 1991b. Office of Environmental Quality Control. *A Guidebook for the Hawaii State Environmental Review Process*, July.

Stearns, Harold T., 1942. *Geology and Ground-Water Resources of the Island of Maui, Hawaii*, Advertiser Publishing Company.

_____, 1985. *Geology of the State of Hawaii*, Second Edition, Pacific Books, Palo Alto.

Transportation Research Board, 1985. *Highway Capacity Manual, Special Report No. 209*.

United States Census, 1990.

United States Department of Agriculture, 1972. *Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai*, State of Hawaii, Soil Conservation Service.

MAPS

Federal Emergency Management Agency, 1977. *Flood Insurance Rate Map: Paia*.

Sanborn Insurance Company, 1914, 1929. *Sanborn Fire Insurance Maps: Paia*.

United States Geological Survey, 1942. *Geologic and Topographic Map: Island of Maui*.

_____, 1965, 1977. *Hawaii Aerial Photo Series: Paia, Maui*.

_____, 1980. USGS Base Map: Topography from U.S.G.S. 1:500,000 scale Hawaiian state map. Published by Raven Maps & Images.

_____, 1983. USGS Quadrangle Map. Edited and published by the Geological Survey. Revised in cooperation with Hawaii Department of Transportation.

APPENDIX B

PERSONS AND AGENCIES CONSULTED

FEDERAL

William Kramer, Biologist	U.S. Department of the Interior Fish and Wildlife Service
Neal Fujiwara, District Conservationist	U.S. Department of Agriculture Soil Conservation Service
Donald Reeser, Superintendent Haleakala National Park	U.S. Department of the Interior National Park Service

STATE OF HAWAII

Tyler Sugihara, Engineer and Wilfred Nagamine, Engineer	Department of Health Clean Air Branch
John Harder, Solid Waste Management Coordinator	Department of Health Solid Waste Branch
Edward Chen	Department of Health Clean Water Branch
Jeyan Thirugnanam, Planner	Office of Environmental Quality Control
Annie Griffin, Archaeologist and Daina Penkiunas, Historian	Department of Land and Natural Resources Historic Preservation Division

COUNTY OF MAUI

Rory Frampton, Planner	Planning Department
David Nakagowa	Department of Health

PRIVATE ORGANIZATIONS

Renata Guzman-Duvall	Hawaii Audubon Society

PERSONAL COMMUNICATIONS

Hibbard, D., 1992. Department of Land and Natural Resources, State Historic Preservation Division. Letter to Nancy Matsumoto of Engineering-Science regarding Paia Sugar Mill, Maui. January 13.

Jars, John, 1992. Department of Water and Power. Personal communication with Lisa Pierce, Engineering-Science. March.

Smith, Robert P., 1992. U.S. Fish and Wildlife Service, Pacific Islands Office, letter to Rosemarie Crisologo, Engineering-Science. January 7.

Steel, Hana Dr., 1992. State of Hawaii Solid Waste Division. Personal communication with Lisa Pierce, Engineering-Science. March.

APPENDIX C

PREPARERS OF THE EA

This Environmental Assessment was prepared with the assistance of the environmental consulting firm of Engineering-Science, under the direction of the Pacific International Center for High Technology Research (PICHTR).

Name	Professional Discipline	Experience	Document Responsibility
PICHTR			
Ruel, Roy	Mechanical Engineer	30 yrs. Mechanical Engineering 15 yrs. Cogeneration	PICHTR Program Manager Technical Review
Neill, Lani	Mechanical Engineer	7 yrs. Mechanical Engineer	PICHTR Project Engineer Technical Review
ENGINEERING-SCIENCE			
Galizio, Jeffrey	Biology	2 yrs. Biology	Biological Resources
Janneh, Mustapha	Planning/Transportation/ Socioeconomics	2 yrs. Planning/Transportation/ Socioeconomics	Traffic and Transportation/ Land Use/Socioeconomics
Jenkins, Rod	Air Quality/Air Toxics/ Risk Assessment	18 yrs. Air Quality/Air Toxics	Air Quality Risk Assessment
Luptowitz, Lisa	Geology/Paleontology	2 yrs. Geology/Paleontology	Archaeological/Cultural Resources
Matsumoto, Nancy	Geology	2 yrs. Geology	Data Coordinator
McBride, Sylvia	English	30 yrs. Business 6 yrs. Technical Editing	Technical Editor
Nand, Krishna, Ph.D.	Chemistry/Physics	25 yrs. Air Quality/	Risk of Upset Noise and Vibration Abatement
Officer, Jay	Biological Sciences	14 yrs. Water Quality Analysis and Inspection	Project Coordinator/ Water Quality
Pierce, Lisa	Environmental Scientist	4 yrs. Environmental Sciences	Public Services and Utilities
Rojas, Angelina M.	Document Production	20 yrs. Document Design, Production and Word processing	Supervisor
Russ, Charles, Ph.D.	Environmental Scientist/ Chemistry	17 yrs. Environmental Sciences/ Hazardous Waste Management/ Chemistry/Industrial Hygiene	Project Manager/ Health and Safety

Name	Professional Discipline	Experience	Document Responsibility
Sahu, Ranajit, Ph.D.	Mechanical Engineer	9 yrs. Mechanical Engineer Air Quality/Energy	Project Description/ Air Quality Technical Review
Smokler, Paul, D. Env.	Environmental Science/ Engineering	19 yrs. Environmental Science/ Engineering	Technical Engineering Direction
Sobel, Connie	Chemistry/Spectroscopy	31 yrs. Research and Development 5 yrs. Industrial Management 3 yrs. Quality Assurance	Quality Assurance
Tuttle, Emery	Environmental Assessment/ Noise and Vibration Control/ Assessment	14 yrs. Environmental Engineering	Noise
Wong, Herman	Air Quality/Meterologist	16 yrs. Air Quality/Modeling	Meteorology

APPENDIX D

SIGNIFICANCE CRITERIA

(a) In considering the significance of potential environmental effects, agencies shall consider the sum of effects on the quality of the environment, and shall evaluate the overall and cumulative effects of an action.

(b) In determining whether an action may have a significant effect on the environment, the agency shall consider every phase of a proposed action, the expected consequences, both primary and secondary, and the cumulative as well as the short and long-term effects of the action. In most instances, an action shall be determined to have a significant effect on the environment if it:

(1) Involves an irrevocable commitment to loss or destruction of any natural or cultural resource;

(2) Curtails the range of beneficial uses of the environment;

(3) Conflicts with the state's long-term environmental policies or goals and guidelines as expressed in chapter 344, Hawaii Revised Statutes, and any revisions thereof and amendments thereto, court decisions or executive orders;

(4) Substantially affects the economic or social welfare of the community or State;

(5) Substantially affects public health;

(6) Involves substantial secondary impacts, such as population changes or effects on public facilities;

(7) Involves a substantial degradation of environmental quality;

(8) Is individually limited but cumulatively has considerable effect upon the environment or involves a commitment for larger actions;

(9) Substantially affects a rare, threatened or endangered species, or its habitat;

(10) Detrimentally affects air or water quality or ambient noise levels; or

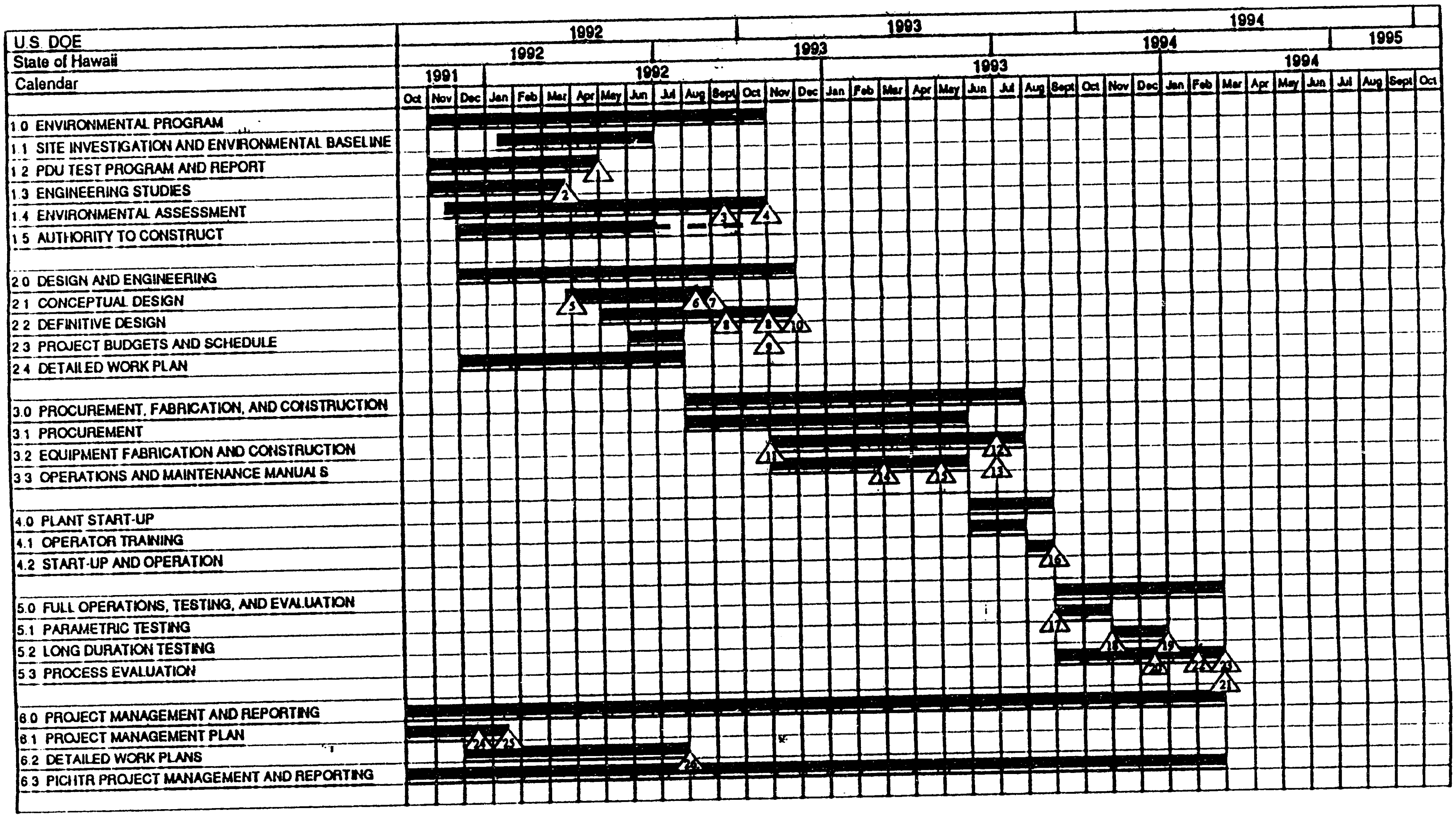
(11) Affects an environmentally sensitive area such as a flood plain, tsunami zone, erosion-prone area, geologically hazardous waters. (EFF. DEC 08 1985) (Auth: HRS *343-6) (Imp: HRS **343-2, 343-6).

Source: U.S. Department of Agriculture, 1972.

APPENDIX E

PROJECT SCHEDULE

Schedule—Biomass Gasifier Facility Project



TASK 1
1 FEEDSTOCK TEST REPORT
2 ENGINEERING DESIGN STUDY REPORTS
3 ENIRONMENTAL ASSESSMENT(DRAFT)
4 DETERMINATION OF SIGNIFICANCE DOE/DBED (ENVIRONMENTAL ASSESSMENT, FINAL)

TASK 2
5 CONCEPTUAL DESIGN REVIEW
6 CONCEPTUAL DESIGN REPORT (DRAFT)
7 CONCEPTUAL DESIGN REPORT (FINAL)
8 DETAILED DESIGN REVIEWS
9 DETAILED DESIGN REPORT (DRAFT)
10 DETAILED DESIGN REPORT (FINAL)

TASK 3
11 SELECTION OF CONSTRUCTION SUB-CONTRACTOR
12 CONSTRUCTION & CHECKOUT COMPLETE
13 DOE READINESS REVIEW
14 OPERATIONS AND MAINTENANCE MANUALS (DRAFT)
15 OPERATIONS AND MAINTENANCE MANUALS (FINAL)

TASK 4
16 STARTUP COMPLETE

TASK 5
17 INITIATE PARAMETRIC TESTING
18 INITIATE LONG DURATION TESTING
19 END ALL TESTING
20 PRELIMINARY EVALUATION REPORT OF COMMERCIAL PLANT (DRAFT)
21 PRELIMINARY EVALUATION REPORT OF COMMERCIAL PLANT (FINAL)
22 TEST REPORT (DRAFT)
23 TEST REPORT (FINAL)

TASK 6
24 PROJECT MANAGEMENT PLAN (DRAFT)
25 PROJECT MANAGEMENT PLAN (FINAL)
26 DETAILED WORK PLAN
27 MONTHLY COST REPORTS

TASK 7
28 OXYGEN PLANT

REV. 7/23/92

APPENDIX F

SCOPING MEETING SUMMARY

A public scoping meeting was held on February 4, 1992, at 7:00 P.M. in the Meeting Room of the Kahului Public Library, on the Island of Maui, Hawaii.

BGSUF personnel in attendance included Roy Ruel and Lani Neill of PICHTR, Charlie Kinoshita of HNEI, Robert Kwok of HC&S and Rosemarie Crisologo, Herman Wong, and Nancy Matsumoto of ES. A total of 17 persons attended the meeting.

Lani Neill moderated the meeting. Roy Ruel introduced the BGSUF Team Members. The purpose of the project, and the design and construction process of the project were reviewed by Charlie Kinoshita. Rosemarie Crisologo presented a summary of the environmental review and approval process.

The meeting was then opened to the public for questions and comments. During this period, the following issues were raised:

- Other alternatives have been studied and found to be infeasible (Robert Kwok)
- Projected project cost and efficiency of carbon conversion (Tom Reed of Innovative Technology Associates (ITA)).
- Nature of the process residue and if it would be burned, landfilled or used as a soil amendment; the moisture content of bagasse; and if the process equipment mix would include a dryer (Bruce Bebe of EPA, Inc.).

The meeting adjourned at approximately 8:30 p.m.

Scoping Meeting Attendees

Name	Affiliation
Roy Ruel	PICHTR
Lani Neill	PICHTR
Charlie Kinoshita	HNEI
Robert Kwok	HC&S
Ken Nakano	HC&S
Eddy Lam	HC&S
Phil Morris	ES
Rosemary Crisologo	ES
Herman Wong	ES
Nancy Matsumoto	ES
Ed Reinhardt	MECO
Tom Joaquin	MECO
Thelma Shimaoka	OHA
Tom Reed	ITA
Tyler Sugihara	DOH - Clean Air Branch
Bruce Bebe	EPA, Inc.
Lynn Lee	Office of Hawaiian Affairs

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County of Maui
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Wailuku, Hawaii 96793

County of Maui
Department of Public Works
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County of Maui
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County of Maui
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Paia, Maui, Hawaii 96779
Attn: Clarence Matsumoto

Maui Street Association
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Attn: Larry Herold

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Attn: Tom Joaquin

Hawaiian Commercial and Sugar
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Attn: Robert Kwok

APPENDIX G

TECHNICAL SUPPORT DOCUMENTATION

G1	BIOMASS GASIFIER FACILITY, PHASE I PROCESS FLOW DIAGRAM
G2	CONSTRUCTION-RELATED EMISSIONS
G3	OPERATION-RELATED EMISSIONS
G4	GENERAL ENGINEERING PROPERTIES OF PAIA SILTY CLAY
G5	RISK ANALYSIS MATRIX
G6	EXAMPLES OF TYPICAL SOUND LEVELS
G7	COMPOSITION OF BAGASSE ASH

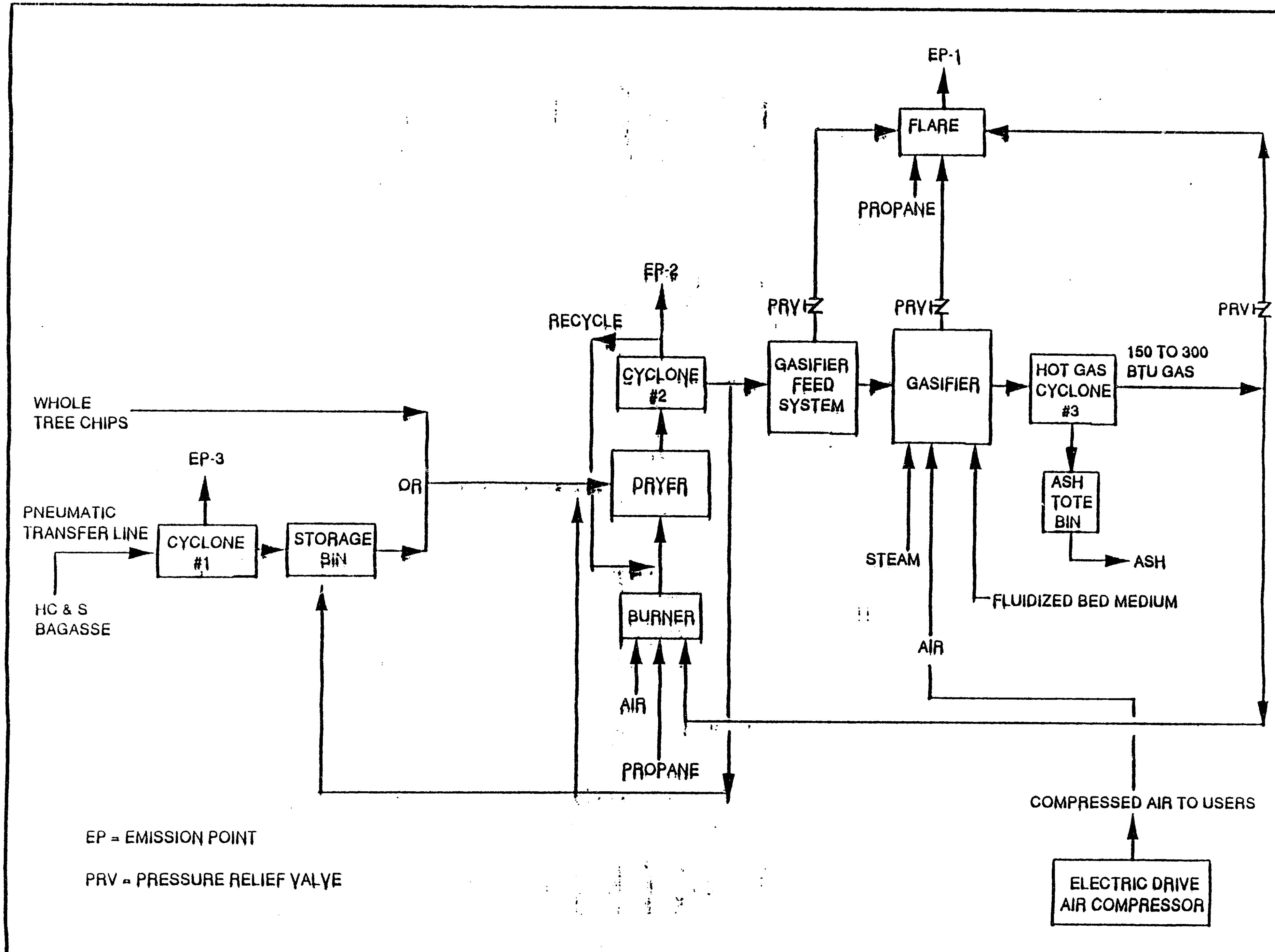

FIGURE G-1: BIOMASS GASIFIER FACILITY, PHASE I
PROCESS FLOW DIAGRAM

APPENDIX G2

CONSTRUCTION-RELATED EMISSIONS

Calculation of the project's air emissions from construction-related activities is based on the overall construction equipment fleet mix and the associated emission factors shown on Table G2-1.

Table G2-1

Emission Factors for Construction Equipment and Vehicles

		Pollutants					
Equipment Type	**Units**	**CO**	**ROG**	**NO_x**	**SO_x**	**PM**	**Factor Source**
Backhoe	lb/hr.	0.434	0.16	2.01	0.133	0.143	AP-42.II-7.1
Cherry picker	lb/hr.	0.434	0.16	2.01	0.133	0.143	AP-42.II-7.1
Concrete truck	lb/mi	0.02	0.006	0.04	0.007	0.007	EMFAC7C
Construction worker vehicles	lb/mi	0.01	0.002	0.003	NA	0.0006	EMFAC7C
Crane	lb/hr	0.67	0.15	1.69	0.14	0.14	AP-42.II-2.1
Delivery truck	lb/mi	0.02	0.006	0.04	0.007	0.007	EMFAC7C
Farm tractor	lb/hr	0.346	1.261	0.121	0.137	0.112	AP-42.11-7.1
Forklift	lb/hr	0.434	0.16	2.01	0.133	0.143	AP-42.11-2.1
Front-end loader	lb/hr.	0.572	0.25	1.89	0.182	0.172	AP-40.II-7.2
Fugitive dust	lb/acre	0	0	0	0	110	AP-42.11.2.1
Grader	lb/hr.	0.151	0.712	0.040	0.086	0.061	AP-42.II-7.1
Hydraulic crane	lb/hr	0.675	0.152	1.69	0.143	0.139	AP-42.3.3-1
Inspector vehicle	lb/mi	0.01	0.002	0.003	NA	0.0006	EMFAC7C
Paver	lb/hr	0.675	0.152	1.69	0.143	0.139	AP-42.II-7.1
Pickup truck	lb/mi	0.01	0.002	0.003	NA	0.0006	EMFAC7C
Roller	lb/hr	0.304	0.067	0.862	0.067	0.050	AP-42.II-7.1
Water truck	lb/hr	1.80	0.191	4.16	0.45	0.255	AP-42.112-1

Sources: Engineering-Science
EPA, 1985
California Air Resources Board, 1986

Projected air emissions from construction-related equipment were calculated by estimating the number and type of equipment used for Phase I, II and III facility construction. It is estimated that this equipment would operate on an average of 2 hours per day and construction operations would take place over a five day work week, 22 days a month. Included in the emission projections are vehicle exhaust emissions from trucking operations and from construction worker's traveling 10 miles to and from the site.

Table G2-2 shows the construction air emission contaminants for the Phase I six-month construction period. The Phase II and III construction periods are expected to each take 3 months using the same equipment mix as identified in Phase I project construction. The estimated project construction-related emissions for each of the subsequent phases therefore would be half of the total emissions projected for the project's Phase I construction.

Table G2-2

Air Emission Pollutants from Construction Equipment Operations (Exhaust Emissions Only)

Construction Activity Equipment	No.	CO	ROG	NO_x	SO_x	PM
		Pollutants (pounds)				
Phase I (6 months)						
Backhoe	1	118.8	39.6	528.0	39.6	39.6
Cherry picker	1	118.8	39.6	528.0	39.6	39.6
Concrete truck	30	264.0	79.2	528.0	92.4	92.4
Construction worker vehicles	31	409.2	79.2	118.8	NA	19.4
Crane	1	171.6	39.6	448.8	39.6	39.6
Delivery truck	2	52.8	13.2	105.6	13.2	13.2
Farm tractor	1	92.4	330.0	26.4	39.6	26.4
Forklift	1	118.8	39.6	528.0	39.6	39.6
Front-end loader	1	145.2	66.0	501.6	52.8	39.6
Grader	1	39.6	184.8	13.2	26.4	13.2
Hydraulic crane	1	184.8	39.6	448.8	39.6	39.6
Inspector vehicle	1	13.2	2.6	3.9	NA	0.8
Paver	1	184.8	39.6	448.8	39.6	39.6
Pickup truck	3	66.0	25.1	145.2	26.4	26.4
Roller	1	79.2	13.2	224.4	13.2	13.2
Water truck	1	475.2	50.4	1098.2	118.8	67.3
Total Emissions						
(pounds)		2534.4	1021.3	5695.7	590.4	549.5
(tons)		1.3	0.51	2.8	0.29	0.27

Source: Engineering-Science

APPENDIX G3

OPERATION-RELATED EMISSIONS

G3.1 STATIONARY SOURCES

The following tables provide data, emission factors, and assumption used to develop operation-related emissions for Phase I, Phase II and Phase III stationary source emissions.

G3.2 MOBILE SOURCES (PHASES I, II AND III)

Mobile source during all three phases are limited to seven employee-vehicles traveling an average of ten miles daily and a 20-ton truck transporting ash to the landfill/composting facility traveling 20 miles once a week. During Phase I only, a 20-ton-truck will transport wood chips from the Port to the site making fifty ten-mile round-trips. The emission factors and estimated emissions for mobile sources are on Tables G3-5 and G3-6.

Table G3-1
Phase I Stationary Source Emissions Analysis
Data, Emission Factors & Assumptions

01-Jun-92
Revision 8

Basis and emission factors:

Equipment	Item	Values		Assumptions
General	Nominal feed rate	100.000	dry tons/day	
	Nom. feed into dryer	142.857	wet tons/day	[30% MC]
	Feed into gasifier	125.000	wet tons/day	[20% MC]
	Overfeed into dryer	10	%	[from RMP]
Cyclone #2 (Dryer)	Heating Rate (propane)	2.750	MMBtu/hr	[from RMP]
	Heating Rate (biogas)	2.339	MMBtu/hr	[from RMP]
	[Above rates are for bagasse. WTC rates 3.77 times higher]			
	[Therefore, 1 cycle WTC = 3.77 cycles bagasse]			
	Heating Value	84500	Btu/gal	[propane]
	Heating Value	128.100	Btu/scf	[biogass]
	Fuel Use	32.544	gal/hr	[propane]
	Fuel Use	304.363	scfm	[biogas]
	Feed out of dryer	137.500	wet tons/day	
	Emission Factors (biogas)			
	ROG	0.262	lb/hr	[80% of AP-42 to account for non-HC composition]
	CO	0.692	lb/hr	[80% of AP-42 to account for non-HC composition]
	SOx	0.302	lb/hr	[=0.0001*913.2/5890 lb-mole/hr/scfm H2S in gas]
	NOx	3.473	lb/hr	[=0.002*913.2/5890 lb-mole/hr/scfm NH3, 80% NH3 to NOx]
	PM	4.583	lb/hr	[Rader cyclone efficiency = 99.96%]
	Emission Factors (propane)			
	ROG	0.015	lb/hr	[from AP-42]
	CO	0.059	lb/hr	[from AP-42]
	SOx	0.000	lb/hr	[assumed negligible]
	NOx	0.286	lb/hr	[from AP-42]
	PM	4.583	lb/hr	[Rader cyclone efficiency = 99.96%]

Table G3-1 (Continued)
Phase I Stationary Source Emissions Analysis
Data, Emission Factors & Assumptions

Flare	Gas Flowrate	5585.637 scfm	[from RMP (with biogas to dryer - bagasse)]
	Gas Flowrate	4742.552 scfm	[from RMP (with biogas to dryer - WTC)]
	Gas Flowrate	5890.000 scfm	[from RMP (without biogas to dryer)]
	Heat Content	128.100 Btu/scf	[max. from RMP]
	Heat Release Rate	42.931 MMBtu/hr	[with biogas to dryer - bagasse]
	Heat Release Rate	36.451 MMBtu/hr	[with biogas to dryer - WTC]
	Heat Release Rate	45.271 MMBtu/hr	[without biogas to dryer]
	Emission Factors (with biogas to dryer - bagasse)		
	ROG	4.808 lb/hr	[80% of AP-42 to account for non-HC composition]
	CO	12.708 lb/hr	[80% of AP-42 to account for non-HC composition]
	SOx	5.542 lb/hr	[=0.0001*913.2/5890 lb-mole/hr/scfm H2S in gas]
	Fuel NOx	63.738 lb/hr	[=0.002*913.2/5890 lb-mole/hr/scfm NH3, 80% NH3 to NOx
	Thermal NOx	2.919 lb/hr	[from AP-42]
	NOx	66.658 lb/hr	
	PM	9.009 lb/hr	[from RMP, e=98.6%]
	Emission Factors (with biogas to dryer - WTC)		
	ROG	4.083 lb/hr	[80% of AP-42 to account for non-HC composition]
	CO	10.790 lb/hr	[80% of AP-42 to account for non-HC composition]
	SOx	4.706 lb/hr	[=0.0001*913.2/5890 lb-mole/hr/scfm H2S in gas]
	Fuel NOx	54.118 lb/hr	[=0.002*913.2/5890 lb-mole/hr/scfm NH3, 80% NH3 to NOx]
	Thermal NOx	2.479 lb/hr	[from AP-42]
	NOx	56.597 lb/hr	
	PM	7.649 lb/hr	[from RMP, e=98.6%]
	Emission Factors (without biogas to dryer)		
	ROG	5.070 lb/hr	[80% of AP-42 to account for non-HC composition]
	CO	13.400 lb/hr	[80% of AP-42 to account for non-HC composition]
	SOx	5.844 lb/hr	[=0.0001*913.2/5890 lb-mole/hr/scfm H2S in gas]
	Fuel NOx	67.212 lb/hr	[=0.002*913.2/5890 lb-mole/hr/scfm NH3, 80% NH3 to NOx]
	Thermal NOx	3.078 lb/hr	[from AP-42]
	NOx	70.290 lb/hr	
	PM	9.500 lb/hr	[from RMP, e=98.6%]
Cyclone #1	Bagasse Rate	142.857 wet tons/day	[from RMP]
	Emission Factor		
	PM	4.762 lb/hr	[Rader cyclone efficiency = 99.96%]

Table G3-2
Phase I Stationary Source Emission Estimates
(tons/year)

Emittant	Cyclone #1	Dryer	Flare	Total
ROG		0.876	14.945	15.821
CO		2.318	39.497	41.815
SOx		1.008	17.227	18.235
NOx		11.624	207.183	218.807
PM	14.286	13.750	28.002	56.037

Basis of calculations:

Project Period	52	weeks/year	
Startup	12	weeks/year	[bagasse only]
Operation (bagasse)	38	weeks/year	
Operation (WTC)	2	weeks/year	[actual]
Operation (WTC)	7.54	weeks/year	[equivalent bagasse]
Utilization (startup)	1		
Utilization (bagasse)	1		
Utilization (WTC)	1		
Propane use	4	hours/week	
Biogas use	116	hours/week	

Hours (Cyclone #1, dryer PM)

Startup	1440	hours/year		
Operations	4560	hours/year		
Total			6000	hours/year

Hours (dryer – no PM)

Startup–propane	48	hours/year		
Startup–biogas	1392	hours/year		
Operations–propa	182	hours/year		
Operations–bioga	5283	hours/year		
Subtotal propane			230	hours/year
Subtotal biogas			6675	hours/year

Hours (flare)

Startup–propane	48	hours/year		
Startup–biogas	1392	hours/year		
Operations–propa	160	hours/year		
Operations–bioga	4408	hours/year		
Operations–bioga	232	hours/year		
Subtotal propane			208	hours/year
Subtotal biogas			6032	hours/year

Source: Engineering–Science

Table G3-3
Phase II Stationary Source Emission Estimates
(tons/year)

Emittant	Cyclone #1	Dryer	Flare	Turbine	TOTAL
ROG		0.88		12.32	13.20
CO		2.32		34.01	36.33
SO_x		1.01		16.70	17.71
NO_x		11.62		207.18	218.81
PM	14.29	13.75		4.21	32.25

Basis of calculations:

1. Hours of operation = 52 weeks/year, 5 days/week, 24 hours/day = 6240 hours/year.
2. No wood chips are input to the gasifier. Only bagasse is used.
3. Only air is used in the gasifier.
4. No flare is in operation. All biogas is routed to the turbine and dryer.
5. Turbine SOx based on fuel sulfur.
6. Other turbine emission factors from AP-42.

Source: Engineering-Science

Table G3-4
Phase III Stationary Source Emission Estimates
(tons/year)

Emittant	Cyclone #1	Dryer	Flare	Methanol Tank	TOTAL
ROG		0.88		0.24	1.12
CO		2.32			2.32
SO_x		1.01			1.01
NO_x		11.62			11.62
PM	14.29	13.75			28.04

Basis of calculations:

1. Hours of operation = 52 weeks/year, 5 days/week, 24 hours/day = 6240 hours/year.
2. No wood chips are input to the gasifier. Only bagasse is used.
3. Enriched air rather than air is used in the gasifier.
4. The turbine in Phase II is not operated in Phase III.
5. Biogas has 16.1 Btu/scf.
6. Methanol produced at 4000 gal/day.
7. Biogas produced at 4595 scfm.
8. Biogas contains 0.01 mole % H_2S.
9. Biogas contains 0.25 mole % NH_3.

Source: Engineering-Science

Table G3-5

Emission Factors for Mobile Sources

Source	Units	CO	ROG	NO_x	SO_x	PM_{10}	Factor Source
Employee Commute	lb/mi	0.011	0.00090	0.0026	NA	0.00063	EMFACTC
20 Ton Haul Truck	lb/mi	0.018	0.0064	0.038	0.0070	0.0073	EMFACTC

Source: EMFAC7C - California Air Resources Board, 1986

Table G3-6

Mobile Source Emission Estimates[1] (tons/year)

Emittant	Employee Commutes	Ash Haul Truck	Wood Chips Haul Truck[2]	Total
CO	0.01341	0.00886	0.00461	0.02688
ROG	0.00108	0.00310	0.00161	0.00579
NO_x	0.00317	0.01820	0.00948	0.03085
SO_x	N/A	0.00339	0.00176	0.00515
PM_{10}	0.00076	0.00349	0.00182	0.00607

Source: Engineering-Science

[1] Based on an average operational schedule of five days/week and 48 weeks/year.

[2] Applicable to Phase I only.

APPENDIX G4

GENERAL ENGINEERING PROPERTIES OF PAIA SILTY CLAY

Depth to bedrock: > 5 feet

Depth to seasonal high water table: > 5 feet

Depth from surface: 0-60 inches

Dominant USDA texture: silty clay and clay

Unified soil classification code: MH

Permeability: 0.63-2.0 inches per hour

Available water capacity: 0.13-0.15 inches per inch of soil

Reaction: 7.4-7.8 pH

Shrink-swell potential: low

Corrosivity to uncoated steel: low

Corrosivity to concrete: low

Stability as a source of topsoil: good

Stability as a source of road fill: good

Soil features affecting highway location: slopes as much as 15 percent

Soil features affecting embankments: all features favorable

Soil features affecting agricultural drainage: practice not applicable or needed.

Soil features affecting irrigation: moderate permeability; slopes as much as 15 percent

Soil features affecting terraces and diversions: all features favorable

Soil features affecting grassed waterways: slopes as much as 15 percent; difficult to establish plants

Soil features affecting foundations for low buildings: slopes as much as 15 percent

Degree and kind of limitations for septic tank filter fields: slight on slopes of 3 to 7 percent; moderate on slopes of 7 to 15 percent

Source: United States Department of Agriculture, 1972.

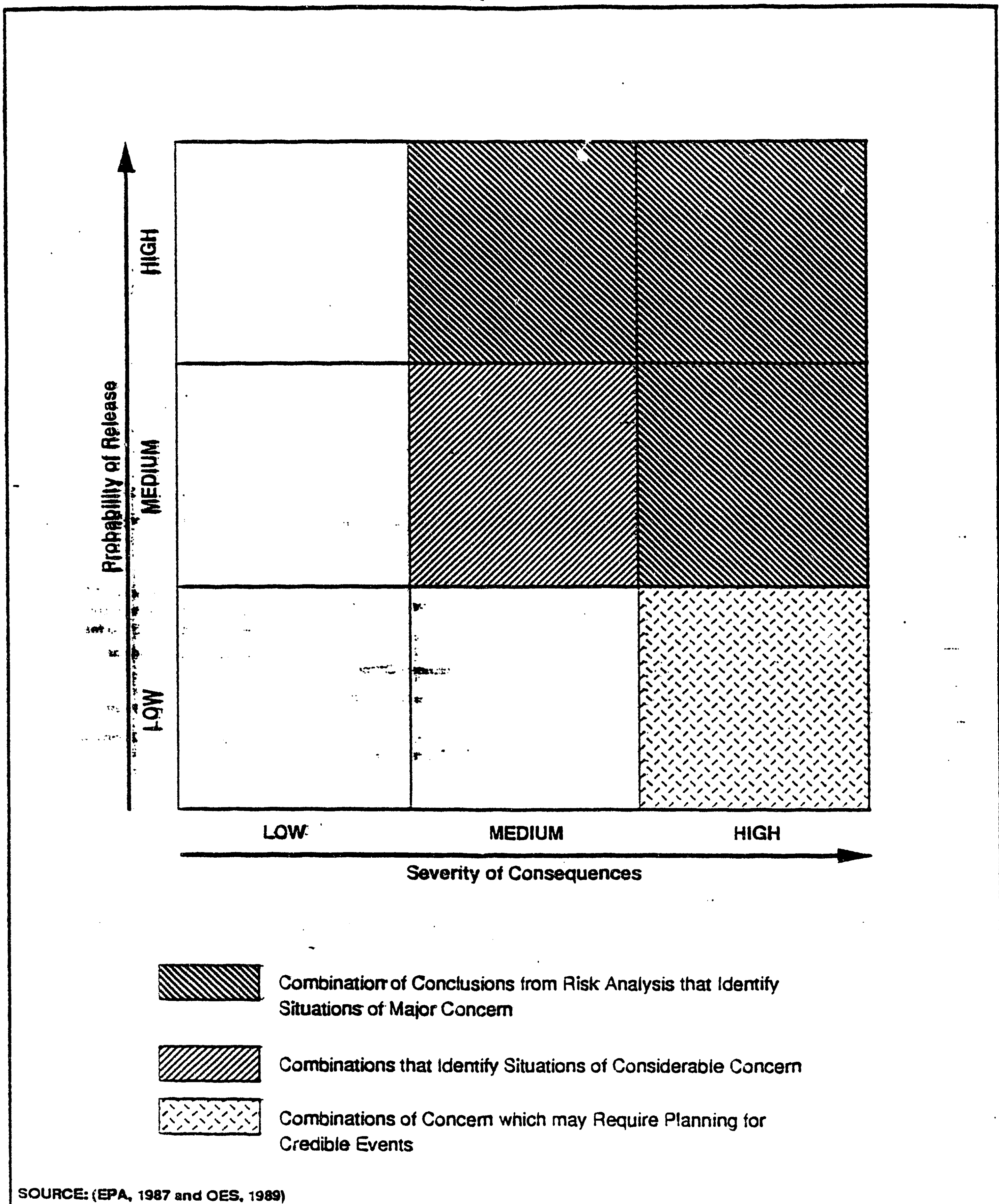

Figure G5-1. Risk Analysis Matrix

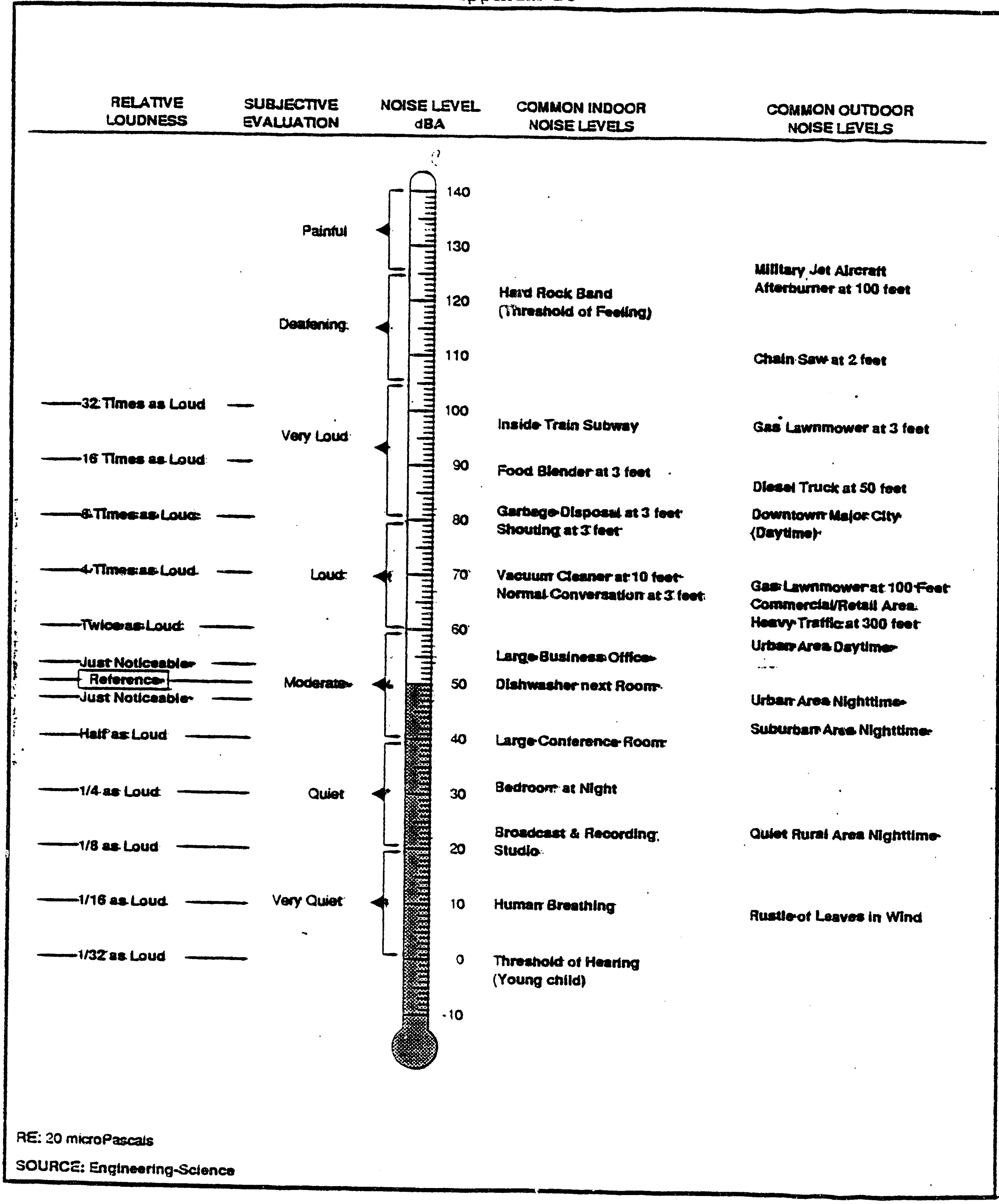

Figure G6-1. Examples of Typical Sound Levels

APPENDIX G7

COMPOSITION OF BAGASSE ASH

Table G7-1. Composition of Bagasse Ash (IGT, 1992)

	Regulatory[a] Level(mg/L)	Sample 01 (mg/L)	Sample 02 (mg/L)	Sample 03 (mg/L)	Detection Limit(mg/L)
Metals					
Silver	5.0	<0.050	<0.050	<0.050	N/A
Arsenic	5.0	0.014	0.013	0.014	N/A
Barium	100.0	0.400	0.400	0.370	N/A
Cadmium	1.0	<0.050	<0.050	<0.050	N/A
Chromium	5.0	<0.050	<0.050	<0.050	N/A
Mercury	0.2	<0.005	<0.005	<0.005	N/A
Lead	5.0	<0.200	<0.200	<0.200	N/A
Selenium	1.0	0.013	0.025	0.039	N/A
Compounds					
Vinyl chloride	–	*	*	*	0.0004
1,1-dichloroethene	0.7	*	*	*	0.0004
Chloroform	6.0	*	*	*	0.0004
Carbon tetrachloride	0.5	*	*	*	0.0004
Benzene	0.5	*	0.12	0.11	0.06
1,2-Dichloroethane	0.5	*	*	*	0.0004
Trichloroethene	0.5	*	*	*	0.0004
2-Butanone	200.0	*	*	*	0.1
Tetrachloroethene	0.7	*	*	*	0.0004
Chlorobenzene	100.0	*	*	*	0.0004
1,4-Dichlorobenzene	7.5	*	*	*	0.0004
o-Cresol	200.0	*	*	*	1
m,p-Cresol	200.0	*	*	*	1
2,4,5-Trichlorophenol	400.0	*	*	*	1
2,4,6-trichlorophenol	–	*	*	*	1
Pentachlorophenol	100.0	*	*	*	2
Pyridine	5.0	*	*	*	0.2
Hexachloroethane	3.0	*	*	*	0.2
Nitrobenzene	2.0	*	*	*	0.2
Hexachlorobutadiene	0.5	*	*	*	0.2
2,4-Dinitrotoluene	0.13[c]	*	*	*	0.2[c]
Hexachlorobenzene	0.13[c]	*	*	*	0.2[c]

[a]EPA Threshold Limits for Toxicity in Determining Characteristic Hazardous Waste, 40 CFR 261.24.

[b]Below Detection Limit

[c]Detection limit is greater than the calculated regulatory level. Detection limit therefore becomes the regulatory level.

APPENDIX H

COMMENTS RECEIVED ON DRAFT ENVIRONMENTAL ASSESSMENT

The Draft Environmental Assessment for the proposed Biomass Gasifier Facility was submitted and notification of its availability was published in the August 8, 1992 Office of Environmental Quality Control (OEQC) Bulletin. No comments were received before the end of the required formal 30-day comment period (postmarked by September 7, 1992). A comment letter from the County of Maui Planning Department was sent on September 10, 1992 to PICHTR. Although this letter was not submitted on a timely basis (before the end of the comment period), it has been included in this Appendix along with PICHTR's September 17, 1992 response letter. As noted in the PICHTR response letter certain parts of the EA have been revised based on the Maui Planning Department comments.

END

DATE FILMED

10/13/93