Puna Emergency Response

Report on the Review of Hawai'i County Emergency Operations Plan and Puna Geothermal Venture Emergency Response Plan

Visits to Hawai'i August 5-9, 1996 included:

COUNTY OF HAWAI'I CIVIL DEFENSE, FIRE DEPARTMENT AND OTHER LOCAL AGENCIES

PUNA GEOTHERMAL VENTURE, 14-3860 Kapoho-Pahoa Road, Pahoa, HI

STATE OF HAWAI'I DEPARTMENTS OF HEALTH AND CIVIL DEFENSE

Final Report
August 2000

United States Environmental Protection Agency, Region 9

REPORT DISCLAIMER

The contents of this report reflect information concerning the County of Hawaii and Puna Geothermal Venture obtained during a U.S. Environmental Protection Agency (U.S. EPA) review. The emergency response plans review visits were conducted from August 5-9, 1996 and observations as presented in this report provide a snapshot of conditions existing at the facility at that time. They do not represent proposed or ongoing changes at the facility or Hawaii County. The recommendations and observations contained in this report are not mandatory actions that the facility or Hawaii County must implement. In addition, the U.S. EPA makes no assurances that if implemented, the recommendations and observations contained in this report will prevent all future chemical accidents, equipment failures, or unsafe management practices, and/or provide protection from any future enforcement actions under any applicable law or regulation. EPA takes notice that some of the recommendations in the draft report have been adopted already.

TABLE OF CONTENTS

GLOSSARY		iv
EXECUTIVE SUMMARY		iiv
1	INTRODUCTION	1
1.1	Purpose	1
1.2	Scope	1
1.3	Community Concerns	2
1.4	Legal Authorities	2
1.5	Background	3
2	THE REVIEW TEAM	17
3	PLANNING AND OPERATING SAFELY	18
3.1	Guidelines for Facility Emergency Response Planning	18
3.2	Guidelines for County Emergency Response Planning	20
3.3	Operating Safely	23
4	HOW THE REVIEW TEAM EVALUATED THE EMERGENCY RESPONSE PLANS	25
4.1	General	25
4.2	Hawai'i County Emergency Operations Plan	25
4.3	Criteria for Review of the Hawai'i County Emergency Operations Plan	25
4.4	Puna Geothermal Venture Emergency Response Plan	25
4.5	Criteria for Review of the PGV Emergency Response Plan	25
5	COUNTY OF HAWAI'I EMERGENCY OPERATIONS PLAN	27
5.1	General	27
5.2	Basic Plan	28
5.3	Annexes	29
5.4	Geothermal Incident Standard Operating Procedure	31
5.5	Findings and Recommendations	31

6 PUNA GEOTHERMAL VENTURE EMERGENCY RESPONSE PLAN 40
6.1 General 40
6.2 Employee Emergency Plans and Fire Prevention Plans - 29 CFR 1910.38 Findings and Recommendations 41
6.3 Hazardous Waste Operations and Emergency Response - 29 CFR 1910.120 Findings and Recommendations 42
7 OVERARCHING ISSUES 48
7.1 General 48
7.2 Findings and Recommendations 48

TABLES

Table 1: Summary of Hydrogen Sulfide Releases 5
Table 2: Summary of Public Comments 8
Table 3: Components of PGV's Emergency Response Plan 18
Table 4: NRT Guidance 21
Table 5: Summary of Prevention Requirements 24

APPENDICES

Appendix A: Visits to State and County Departments and Agencies -- Field Notes
Appendix B: Visit to the Puna Geothermal Venture Facility -- Field Notes
Appendix C: Emergency Response Plan, Version 6.3, Table of Contents
Appendix D: HAZWOPER/Emergency Response Guidelines and Training Program
Appendix E: PGV Emergency Action Plan and Notification Guidelines
Appendix F: Hawai'i County Emergency Operations Plan, Table of Contents
Appendix G: Hawaii County Fire Department, Emergency Response Procedure to PGV
Appendix H: Request for Documents to Review

APPENDICES [Continued]

Appendix I: Health Consultation

Appendix J: Integrated Contingency Planning "Oneplan" Guidance and EPA Chemical Accident Prevention Regulations 40 CFR Part 68

Appendix K: Compilation of Recommendations

Appendix L: Letter to U.S. Senator Daniel Inouye from Felicia Marcus, EPA Regional Administrator

Appendix M: Correspondence on January 2000 Release

Appendix N: Comment Letters to Draft Report

Appendix O: EPA's Response to Comments

Appendix P: Referral Letters

Appendix Q: Hydrogen Sulfide Literature Review

Glossary of Acronyms

ATSDR	Agency for Toxic Substances and Disease Registry
CAMEO	Computer Aided Management of Emergency Operations
CAP	Chemical Accident Prevention Program
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
CSA	Chemical Safety Audit
DOI	Department of the Interior, U. S.
DOL	Department of Labor, U. S.
DOT	Department of Transportation, U. S.
EAP	Emergency Action Plan
EMT	Emergency Medical Technician
EOC	Emergency Operations Center
EOP	Emergency Operations Plan
EPA	Environmental Protection Agency, U. S.
EPCRA	Emergency Planning and Community Right-to-Know Act
ESRF	Emergency Steam Release Facility
ERP	Emergency Response Plan
FEMA	Federal Emergency Management Agency, U. S.
HDOH	Hawaii Department of Health
HIOSH	State of Hawai'i Department of Labor and Industrial Relations, Hawai'i Occupational Safety and Health Division
HAZMAT	Hazardous Materials
HAZWOPER	Hazardous Waste Operations and Emergency Response
HRS	Hawai'i Revised Statutes
H2S	Hydrogen Sulfide
ICS	Incident Command System
IDLH	Immediately Dangerous to Life and Health
NICS	National Institute for Chemical Studies
NRT	National Response Team
NRT-1	National Response Team-1 Hazardous Materials Emergency Planning Guide
NRT-1A	National Response Team-1A Criteria for Review of Hazardous Materials Emergency Plans
OSC	On-Scene Coordinator
PGV	Puna Geothermal Venture
PHA	Process Hazards Analysis
PM10	Particulate Matter 10 microns or less in diameter
PPE	Personal Protective Equipment
ppm	parts per million
PSM	Process Safety Management
RBDS	Radio Broadcast Data System
RMP	Risk Management Plan
RMPP	Risk Management and Prevention Program
SARA	Superfund Amendments and Reauthorization Act
SOP	Standard Operating Procedure
UFC	Uniform Fire Code
USC	United States Code

Executive Summary

This report summarizes a review of emergency response capabilities for Hawai'i County and Puna Geothermal Venture (PGV). The U. S. Environmental Protection Agency (EPA) assembled an independent team of experienced individuals (the "Review Team"). EPA tasked them to review emergency response plans and conduct site visits and interviews. This project was a follow-up to the EPA's 1995 compliance inspection of the PGV facility and a response to community requests. The purpose of the project was to provide an independent evaluation of the emergency response plans, with the long–term objective of preventing chemical accidents and improving emergency response capabilities.

The review team conducted site visits in Hawai'i from August 5 through August 9, 1996. During that time, team members received information from state and local agencies, PGV, and the community (composed primarily of area residents). EPA held public meetings at the Pahoa Community Center and the University of Hawai'i, Hilo Campus Center to discuss the review. These meetings offered the review team an opportunity to meet with residents of the Puna area.

Many who attended the public meetings expressed strong concerns about their health and safety being jeopardized by the operation of the PGV facility. A major release of hydrogen sulfide from the facility is the principal hazard to the community. The public also expressed concern about the need for public alert and notification systems and plans for shelter-in-place and evacuation. Some meeting attendees raised concerns that PGV management was concealing details about operations and potential emergencies from the neighboring community. Other meeting attendees expressed confidence in the capabilities of the PGV management to operate the facility safely and efficiently.

The Hawai'i County Emergency Operations Plan is a multiple hazards plan that primarily addresses natural disasters, terrorism, and war. Annex M of this plan, the Oil and Hazardous Substances Response Plan, was the section reviewed in detail by the review team. The review team found Annex M in urgent need of an update to bring it into compliance with Emergency Planning and Community Right-to-Know laws and address public concerns. Annex M is not complete, and the County and State have not updated the plan since they signed it in 1990.

The Oil and Hazardous Substances Response Plan (Annex M) acknowledges accidental releases of hazardous substances as human-made hazards. However, it does not address the public and environmental threats from a serious release of hazardous substances from an operating facility (e.g., PGV). The plan also lists several appendices as "under preparation." However, at the time of the review, these appendices were still missing.

In particular, the Review Team was concerned about the capability of local responders to carry out a timely response in the PGV facility. Hawai'i County responders need to evaluate their capacity for emergency response and their ability to participate as part of an Incident Command System. The Hawai'i County Fire Department, Pahoa Substation should work with PGV to gauge the potential severity of an incident.

During the site visit to PGV, facility personnel explained both the technology and procedures within their respective areas of responsibility. Overall, the facility's internal planning, preparedness and response activities are covered in PGV's Emergency Response Plan. PGV seems able to respond to most incidents, except fire. However, at the time of the review the PGV Emergency Response Plan did not fully address coordination issues between the facility and the local response agencies. The Review Team has concerns over public alert and notification procedures and the ability of the facility and County to carry out a coordinated, timely response. PGV's historical, and continuing, reluctance to communicate and cooperate with its neighbors interferes with effective emergency management.

The Review Team recommends that the County form a technical work group to evaluate evacuation needs, resources, and procedures. The technical work group should include representatives from the County Civil Defense Agency and Fire Department, HDOH, the University of Hawai'i, and EPA. Work group members should confer with PGV technical staff on the details of facility operations. Technical issues under evaluation are extremely important and will require a great deal of thought, research, and professional judgement.

Both PGV and the County need to coordinate their planning activities and conduct joint training exercises before they can understand the capabilities of local fire, police and medical units. The results of the initial training exercise will likely reveal deficiencies in the emergency response plans. Joint exercises held at least annually would identify how to update and improve the emergency response plans. Periodic exercises also would be refresher training for PGV personnel and local hazardous materials (hazmat) responders. As required by the Emergency Planning and Community-Right-to-Know Act, the County and PGV need to designate community and facility emergency coordinators. These emergency coordinators should take the lead on planning and carrying out the exercises.

The review team concluded its work with specific findings and recommendations for improving emergency response capabilities and safety management systems. These recommendations address Hawai'i County and PGV emergency response plans and procedures. EPA issued the draft report for a 100-day public review and comment period, after which EPA reviewed and responded to all commentors' letters.

Comment letters and EPA's response to comment document are included as an attachment in the final report. In closing, the review team must emphasize that an emergency response plan alone does not directly protect the public and the environment. The plan is only a detailed blueprint of an emergency response program designed for a facility or community, with the purpose of protecting the environment and the public. Emergency response programs are the comprehensive approach to protecting the public.

In addition to complete, updated and coordinated emergency response plans, jurisdictions and industries must have the required resources, equipment and trained personnel, to be fully prepared to implement the plans and respond to accidents resulting from man-made hazards as well as natural disasters. Finally, the authorities responsible for the emergency response programs must be assured at all times that the programs are workable. They need feedback through the results of scheduled periodic exercises.

1 Introduction

1.1 Purpose

This report presents a review and evaluation of emergency response capabilities for Hawai'i County and Puna Geothermal Venture (PGV). The purpose of this review was to provide an independent evaluation of emergency response plans, with the long-term objective of preventing chemical accidents and improving emergency response capabilities. The U. S. Environmental Protection Agency (EPA) assembled an independent team of experienced individuals and tasked them to conduct the review. The Review Team functioned in an advisory role. Although all recommendations are based on laws, regulations or good management practices, this report is not an enforcement document.

1.2 Scope

The scope of the independent review was to:

1. Provide a desk review and evaluation of the emergency response plans for the County of Hawai'i, Puna Geothermal Venture (PGV) and local responders and provide constructive comments;

2. Meet with representatives of state agencies to discuss issues of concern regarding geothermal in Hawai'i;

3. Meet with Hawai'i County Civil Defense, the Hawai'i County Fire Department and other local agencies to evaluate the capability of Hawai'i County, PGV and local responders to carry out the emergency response plans;

4. Review the roles and responsibilities of these agencies in protecting the public and the environment from hazardous material releases, particularly in populated areas near PGV;

5. Visit the PGV facility and meet with the facility management to learn of its plans for prevention of hazardous material releases; further review the facility's emergency response plan, concept of operations, organization, incident command system, protective actions, and supporting systems required to carry out the plan;

6. Evaluate chemical hazards associated with substances handled and stored in the PGV facility and learn what the management of the facility recognizes as the hazards posing acute health effects;

7. Meet with public officials in Hawai'i County and residents in the Puna area to learn their concerns about chemical hazards, risks, and chemical accident preparedness;

8. Attend public meetings conducted by EPA to hear public concerns and questions about the emergency response plans.

1.3 Community Concerns

EPA held public meetings in Pahoa and Hilo, Hawai'i on August 7 and 8, 1996. During the meetings community residents raised concerns about hazards that could have acute or chronic health effects. Acute health effects can result from exposure to high concentrations of hazardous substances. Long term exposure to lower concentrations of hazardous substances can cause chronic health effects. The focus of the Emergency Response Review was acute health effects resulting from accidental releases, and the Review Team did not look at chronic effects. Table 2 at the end of this section summarizes specific comments and questions community residents asked during the public meetings.

1.4 Legal Authorities

Multiple legal authorities govern the releases of hazardous substances. The Review Team worked under the authorities of the following laws:

! Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. §§ 9601 - 9675 (1995). Sections 9604(b) and 9604(e) authorize EPA to enter a facility and gather information when illness or complaints of illness may be attributable to exposure to a hazardous substance. This is the legal authority that EPA used to enter PGV and seek information during the Review Team's site visit;

! Emergency Planning and Community Right–to–Know Act (EPCRA), 42 U.S.C. §§ 11001 – 11050 (1995). EPCRA requires local emergency planning committees (LEPCs) to develop emergency response plans to prepare for and respond to potential chemical accidents. Sections 11001–11003 address emergency planning and require community and facility emergency coordinators, who make determinations necessary to implement the plan. Section 11001 requires LEPCs to establish rules by which they function, that include provisions for public access to committee activities and emergency response plans. LEPCs are also required to establish procedures for receiving and processing requests for information from the public, and emergency plans, chemical inventory reports and emergency notification reports are available to the public. Section 11003 also requires LEPCs to gather appropriate information to develop and update their emergency response plans, and facilities to provide information to LEPCs. Section 11004 requires emergency release notification.

Sections 11011–11012 cover reporting requirements, including requesting and obtaining EPCRA information from a facility when a request for such information is made by the public. Section 11013 specifies toxic release inventory ("TRI") reporting, and EPA is the agency responsible for enforcing this law. Section 11044 requires LEPCs to publish as a legal notice in a newspaper an annual notice of public availability of EPCRA

reporting information.

! Clean Air Act, Prevention of Accidental Releases, 42 U.S.C. § 7412(r) (1995), and 40 CFR Part 68 Chemical Accident Prevention: Regulated Substances for Accidental Release Prevention and Risk Management Plan Requirements. Under the general duty clause in § 7412(r)(1), each industrial owner or operator has a general duty to design and maintain a safe facility, taking such steps as are necessary to prevent releases. They also have a duty to minimize the consequences of accidental releases which do occur. EPA is the agency responsible for enforcing this law.

In addition, the Review Team was aware of State laws pertaining to emergency planning.

! 1994 Supplement to the Hawai'i Revised Statutes, Volume 3, Chapter 128D Environmental Response Laws and Chapter 128 E Hawai'i Emergency Planning and Community Right–to–Know Act;

! Paragraph 128E–5, in Chapter 128E of the Hawai'i Emergency Planning and Community Right–to–Know Act describes the establishment and function of LEPCs. At least one local emergency planning committee has to be established in each county. The committee is subject to the requirements of both Chapter 128E and section 11003 of the Emergency Planning and Community Right–to–Know Act described above.

1.5 Background

In 1991 two incidents occurred at the PGV facility during the drilling of geothermal wells KS-7 and KS-8. On February 21, 1991 a steam kick occurred at well KS-7; this incident is described in Table 1 at the end of this section. On June 12, 1991 a blowout at well KS-8 resulted in a 31-hour release of steam and approximately 2,247 pounds of hydrogen sulfide (H_2S), and the County evacuated nearby homes. A characteristic of a well blowout is a sudden, very forceful, uncontrolled release to the atmosphere. This high pressure release transported large volumes of brine, steam, and gases from the deep geothermal reservoir through the well. When a release contains hazardous materials such as H_2S, and if at sufficiently high concentration levels, it can pose an immediate danger to the facility employees, the public, and the environment.

In 1992 three releases occurred at PGV during well drilling, testing, and plant startup; the following year several releases occurred as well. Although most of these releases of H_2S have been small and below the reportable concentration of 25 ppb, the concentrations have been measurable and have occurred throughout the years since 1991. PGV has reported many H_2S releases, neighbors to the facility have measured or sensed some releases, and local newspapers have reported others. These smaller releases are a continuing cause of concern among some residents adjacent to the PGV facility. As noted in the summary of public comments in Table 2, some residents have expressed a distrust of the safety aspects of well drilling and the operation of PGV's geothermal facility overall.

Through all of this, the affected public did not receive first hand, detailed knowledge of what caused the releases or what could be done to prevent them. Some community residents expressed a lack of confidence in the facility operators to control releases of hazardous materials and in State and County authorities to provide a proven workable emergency response plan. Thus, the EPA assembled an independent team of experienced individuals, the "Review Team," and tasked them to review the emergency response plans for Hawai'i County and Puna Geothermal Venture.

Table 1. Summary of Hydrogen Sulfide (H_2S) Releases. From 1991 to 1996, several releases of hydrogen sulfide occurred at PGV during well drilling, testing, and plant startup. Information about these releases, summarized below in Table 1, is provided as background information and to clarify the causes, duration, emissions and sources of information of each release.

Release and Date	Cause and Duration	H_2S Emissions	Source of Information
Steam kick of short duration occurred at the KS-7 injection well being drilled by PGV. February 21, 1991	"Well KS-7 was drilled through an intensely mineralized zone, had minor mud flow returns during connections below 1500', and blew out at 1678', injuring a right hand. The driller quickly closed the annular preventer and vented fluid out a 3-inch diverter, before closing the diverter and securing the well. At the time of the incident, the annular preventer, which was secured to 13-3/8 inch casing cemented at 1020', served as the sole BOPE. The well was subsequently plugged and suspended. According to PGV's proposal, flow into the hole was not anticipated to occur at this relatively shallow depth."	Not stated	*Independent Technical Investigation of the Puna Geothermal Venture Unplanned Steam Release June 12 and 13, 1991*. Report prepared by Richard Thomas, Dick Whiting, James Moore and Duey Milner for The Honorable Lorraine R. Inouye, Mayor, County of Hawai'i, and The Honorable William W. Paty, Chairperson, Board of Land and Natural Resources, July 1991.

Release and Date	Cause and Duration	H_2S Emissions	Source of Information
Blowout of well KS-8 June 12, 1991	"The blowout caused an unabated release of steam for a period of 31 hours before PGV succeeded in closing in the well. The report finds that the blowout occurred because of inadequacies in PGV's drilling plan and procedures and not as a result of unusual or unmanageable subsurface geologic or hydrologic conditions." "Not only did PGV fail to modify its drilling program following the KS-7 blowout, but they also failed to heed numerous "red flags" (warning signals) in the five days preceding the KS-8 blowout, which included a continuous 1-inch flow of drilling mud out of the wellbore, gains in mud volume while pulling stands, and gas entries while circulating mud bottom up, in addition to lost circulation, that had occurred earlier below the shoe of the 13-3/8-inch casing." "PGV personnel took appropriate steps to control the well following the kick. However, there were certain inadequacies in PGV's drilling operations and blowout prevention equipment. The mud cooler being used was inefficient. Monitoring equipment was not strategically placed. A sufficient supply of cold water was not available to pump into the wellbore to properly kill the well in the event of a blowout. The choke line was not of sufficient diameter to handle the volume of fluid that had to be vented, and there was no silencer on the end of the choke manifold line to reduce noise."	Approximately 2,247 pounds of H_2S were released during the period June 12 through June 14, 1991.	*Independent Technical Investigation of the Puna Geothermal Venture Unplanned Steam Release June 12 and 13, 1991*. Report prepared by Richard Thomas, Dick Whiting, James Moore and Duey Milner for The Honorable Lorraine R. Inouye, Mayor, County of Hawai'i, and The Honorable William W. Paty, Chairperson, Board of Land and Natural Resources, July 1991. Puna Geothermal Venture Compliance Investigation, NEIC report dated March 1996 (for emission data).

Release and Date	Cause and Duration	H_2S Emissions	Source of Information
Release at well KS-9 February 8, 1993	"Thirty minute clean out caused excessive emissions from the cyclonic muffler over two to four minute period. Inadequate mixing with NaOH in the flow line."	"SE station 23 ppb hourly average. Mobile H_2S concentration 250 ppb spike."	*Puna Geothermal Venture Compliance Investigation, NEIC report dated March 1996.*
Release at Brine Booster pump October 4, 1996 -- Note that this release occurred after the Review Team visited PGV.	An abnormal condition occurred due to a separator level control valve malfunction causing a loss of lubricant to the Brine Booster pump mechanical seal. This upset condition resulted in an inadvertent discharge of injectate and steam.	Monitor Station A recorded an emission peak of 301.7 ppb and an hourly average of 46.9 ppb.	*PGV Incident Report #961004 submitted to Nolan S. Hirai, State of Hawai'i Department of Health, Clean Air Branch, by Darren Hunt, PGV Environmental/Safety Coordinator on 10/9/96.*

Table 2. Summary of Public Comments. EPA received the following comments during public meetings held August 7, 1996 at the Pahoa Community Center and August 8, 1996 at the University of Hawai'i, Hilo Campus Center. The purpose of these public meetings was to allow members of the Review Team to hear community comments, including existing emergency response capabilities and plans and other general comments. The comments made during the two meetings are grouped under general categories of concerns pertinent to the elements in the PGV Emergency Response Plan as required by the Geothermal Resource Permit Condition #26 and the Emergency Planning and Community Right-to-Know Act.

General Comments	Specific Questions and Comments
Facility Description with Potential Hazards	1. What is coming out of the geothermal wells, and is it toxic to humans? What is the well constituency? 2. What is in the brine (geothermal constituency)? What is the composition of geothermal fluids? 3. How does geothermal "soup" act? 4. What is pentane? Where does it go? No one has accounted for the amounts. 5. What are the health effects of pentane? 6. What records are required for pentane and caustic soda and where are they maintained? 7. Is PGV required to report amounts used? Are the reviewers looking at safe storage and use? 8. Are lead or other chemicals going into water catchment? 9. Emergency response to what? 10. We cannot limit the emergency response plan to hydrogen sulfide. 11. Concerned about particulate matter (PM_{10}) and sulfa treat.

Potential Emergencies	1. Concerned about respiratory problems. 2. Smell odd chemical smell. 3. How would one know of exposure to pentane? 4. The community is suffering from many symptoms. 5. Smell hydrogen sulfide strongly. 6. Concerned about the health effects of noise. 7. Concerned about the low level exposure to chemicals (chronic effects). 8. Compare people (health impacts) in Upper and Lower Puna. 9. We have sensitive populations -- from infants to senior citizens. 10. They did not provide reference documents to the public. 11. School children are within a four-mile radius of the facility (PGV). 12. We should be considered a sensitive community at risk. 13. Affected on hourly basis. 14. Ten percent of school children have asthma and respirators. 15. An emergency exists now. 16. We need complete information. A hazards analysis should be based on complete geochemical data. 17. People have a right to know what “they” are being poisoned with, especially regarding organic farming and effect on crops. 18. Problems with data information especially about leaks (from DOH, for example).

Natural Hazards and Potential Emergencies	1. What is the nature of the geology? 2. Unique geographical area — lava fields. The island of Hawai'i is on the East Rift Zone with the most active volcano in the world — look into the geology of the island. 3. Concerned about geothermal / seismic activity. 4. Will the Review Team meet with the U. S. Geological Survey to discuss the relationship with PGV and natural factors (geologic issues)? 5. Please assess volcanic hazards and corroborate with experts. 6. Talk with local geologists. 7. Study the history of PGV/problems — bulldozes over well. 8. Concerned about the blowout of 1991. 9. Do not know how to cap wells. 10. Concerned about emergency steam release from the facility (PGV). 11. Concerned about problems with well casings and casing embrittlement.

Emergency Communication With Residents, Potential Emergencies and Response Measures	1. PGV has not installed any lead or radon monitors. 2. Are air monitors in proper areas? We need one in Pahoa? 3. How are they monitoring other chemicals? (Other than hydrogen sulfide?) 4. We need a reality check on monitors. 5. They need data to do air modeling / scenarios properly. 6. Stationary monitors all run by electricity (then no data available). 7. Public agencies need an answering service. We have had delays in getting information from stationary monitors (this is especially bad on weekends and at night). 8. Timely access to monitoring data should be available to families so they can decide what their emergency response should be – even without a major incident.
Coordination with Outside Parties and Emergency Communication with Residents	1. People most affected by PGV are requesting the Emergency Response Plan. They should be the focus of the plan. 2. Who is left "holding the bag" for the costs of the Emergency Response Plan? 3. What will be necessary to bring the facility into compliance? 4. Confidential business information re: the emergency response plan is an issue. 5. How can they promulgate the plan without addressing geothermal resource issues? 6. PGV should make its emergency response plan available to the public they alert (violating the permit). 7. How does the plan deal with peoples' culture?

Emergency Communications with Public Agencies and Residents	1.	Public is not aware of County Emergency Operations Plan or PGV Emergency Response Plan / denied process.
	2.	PGV version 6.0 (older) is available in the library.
	3.	How will we know about releases of reportable quantities of other chemicals (refer to page 34 of the NEIC report)?
	4.	They do not provide information.
	5.	One commenter was not in the loop for documents.
Warning Systems	1.	Releases into the neighborhood. Air monitors reported spikes of 1,000 parts per billion (ppb), and they notified no one.
	2.	We cannot hear the siren; we have no coverage in our area.
	3.	Who will notify neighbors in Kehena Beach?
	4.	They cannot get people out in emergencies.
	5.	How will they notify schools?
	6.	Does County Civil Defense think they can make notification?
	7.	Have toxicologists review a draft report.
	8.	Company decides if an emergency exists.
	9.	Will they notify National Response Center?
	10.	Who is in charge of deciding there is an emergency?
	11.	No warning, no alert given for 1992 incident (bulldozers on I-beams on well) — do not know current condition of that well. We at least need a "warning system."

Evacuation Plans	1. What is the radius for evacuations from a hydrogen sulfide release? 2. What roads will we use for evacuations? 3. Who will call and they will call who for evacuations? 4. Buses take two loads of children — in evacuations. 5. How can we evacuate the area in a worst-case scenario? 6. How do authorities plan to evacuate most of the population of Puna? 7. Lightening strikes can hit transmission lines. 8. We need a contingency to handle the flow when an emergency is occurring. 9. Do people know evacuation routes? 10. Alternate evacuation routes are nonexistent. 11. Concern over only (!) road and ability to evacuate large number of people.
Chain of Command	1. Is this plan implementable? 2. Sign-off on PGV's Emergency Response Plan should be by County Civil Defense — not the mayor.
Response Equipment	1. We do not have enough ambulances and fire equipment/supplies. 2. How will the Review Team determine if workers can properly use safety equipment?

Fiscal Concerns	1. What are the costs of the Review Team for travel and services? Is the EPA paying these costs with our tax dollars? Who invited the Review Team? 2. What is the complete accounting of what a blow out cost the county? How much has it cost Hawai'i County to deal with geothermal? 3. PGV should be required to carry insurance to cover all damages caused by accidents. 4. Does the EPA have the authority to look at economic impacts as part of the ER plan? 5. How do we balance impacts on nearby community and larger community?

Emergency Response Plan Review Process	1. Do review completely and analytically. 2. Need the complete story to know what impacts would be. 3. What will happen if they do not adopt recommendations? What will happen if PGV is not in compliance? 4. Confer with Dr. Wilson Goddard. Nothing has been done with Dr. Goddard's recommendations. 5. When will PGV supply additional info? 6. Dr. Rifferstein (?), Sulfide Institute, Alberta, Canada. Talk to him. 7. Fact finding vs. inspection. These are ERP reviews. 8. Has the EPA received all data from wells? 9. Where else in the last few years has EPA Region 9 reviewed ERPs for other geothermal facilities? 10. What authority does the EPA have to conduct such a review? 11. What sanctions are there? 12. What are the specific questions the Review Team will be asking the workers?

Other Concerns	1. Political issues get overlooked. 2. This is not a new or static situation. 3. Kittens are dying. 4. Why is there a plant in a neighborhood — no SARA involvement? Why not? 5. DOH deficiencies for managing environmental programs. 6. OSHA documentation is a concern. 7. OSHA criteria are not applicable to the surrounding community. 8. Air modeling for various chemicals (twelve scenarios) in light of new info.

2 The Review Team

The Review Team comprised the following persons who brought considerable experience in chemical accident prevention, chemical safety reviews, and emergency and risk management planning. Team members also had experience working in the private sector and local, state, and federal governmental departments and agencies.

Paul Hill, Ph.D., in 1996 was the Executive Director of the National Institute for Chemical Studies, in Charleston, West Virginia. Since the site visit, the Congress has funded Dr. Hill to serve on the Chemical Safety and Hazard Investigation Board in Washington, D.C.

Randy Sawyer, Manager of the Risk Management and Prevention Program, in Contra Costa County, California, has worked in the private and public sectors in emergency management, accident prevention and community notification systems.

Mark Zusy, Supervisor of the Chemical Accident Prevention Program for the State of Nevada, is a chemical engineer and a licensed mechanical engineer. His experience ranges from process and mechanical design to operating procedure development, operator training and startup coordination.

The following people worked with the review team to complete this project:

Mike Ardito, EPA Region 9, Superfund State Project Officer Chemical Emergency Prevention and Preparedness (CEPP) Coordinator for Hawai'i, has worked in emergency management programs for FEMA and EPA since 1987.

Åke Jacobson (Senior Environmental Enrollee), a member of EPA Region 9's chemical accident prevention program, is a chemical engineer with experience as project engineer and project manager in engineering and construction of chemical process plants.

Dianna Young, EPA Region 9, Community Involvement Coordinator (for public meetings in Pahoa and Hilo).

Sandra Carroll, EPA Region 9, CEPP Coordinator for Nevada, was the Risk Management Program Manager for Region 9 at the time of the site visits. Currently a Ph.D. student at the University of Nevada, she wrote and edited this report.

Vicki Rosen, EPA Region 9, Community Involvement Coordinator, has written fact sheets and met with community members to discuss their concerns.

3 Planning and Operating Safely

3.1 Guidelines for Facility Emergency Response Planning

Before the Review Team could evaluate emergency response plans and capabilities for PGV, Team members first had to review the requirements that PGV followed to prepare its emergency response plan. In 1989, the Hawai'i County Planning Commission required PGV to prepare an emergency response plan, as Condition #26 of PGV's Geothermal Resource Permit. PGV wrote and submitted its emergency response plan to the Administrator of the Hawai'i County Civil Defense Agency, who then reviewed and approved it in August 1990. The emergency response planning requirements in Condition #26 are presented below in Table 3.

Table 3. Components of PGV's Emergency Response Plan. The Hawai'i County Planning Commission required that PGV's plan include but not be limited to the following elements. The Commission also required PGV to make its plan available to the public.

Planning Elements	Description
Geothermal Resource Permit Condition #26	
a. Facility Description ➤	A description of the project facilities and operations, with site plans identifying areas of potential hazards, such as high pressure piping and the presence, storage and transportation of flammable or hazardous materials, such as lubrication or fuel oil, pentane, hydrogen sulfide, and sodium hydroxide.
b. Local Responders ➤	A description of emergency services available off-site to respond to any emergency.
c. Chain of Command ➤	A description of the current onsite chain of command and responsibilities of project personnel in the event of an emergency.

d. Potential Emergencies and Response Measures ➤	A description of potential project emergency situations, such as loss of well control, chemical spills, hydrogen sulfide exposure, pipeline rupture, fires, contaminated solids, etc. identifying: (I) technical data on the nature of the hazard (for example, the concentrations of hydrogen sulfide in the various areas and the hazard associated with these concentrations, the corrosive characteristics of the abatement chemicals), or any data regarding the possible aerial extent of each potential emergency situation; (ii) the warning systems (such as hydrogen sulfide detectors) used to alert personnel of the hazard; (iii) the location and use of equipment used to control the hazard (such as fire protection equipment or isolation valves) or repair hazardous equipment (such as welding equipment or casing sleeves), and safety equipment for personnel (such as respiratory packs), including identification of the personnel trained in the use of that equipment; and (iv) provisions for the monitoring, detection, and inspection of wells and plant facilities for the prevention of emergency situations.
e. Natural Hazards ➤	Provisions to address natural hazards (such as lava flows, earthquakes, and storms) that identify warning systems, control options, steps for securing and shutting down the facility, personnel evacuation, and notification to appropriate agencies;
f. Medical Services ➤	The location and capabilities of available medical services and facilities and plans for treating and transporting injured persons;
g. Evacuation ➤	Evacuation plans, including meeting points, personnel rosters, and escape routes;

h. Training ➤	Training requirements for personnel, including procedures for emergency shutdown, handling of emergency equipment, spill prevention, first aid and rescue, fire fighting procedures, and evacuation training;
I. Drills ➤	Provisions for periodic emergency preparedness drills for personnel;
j. Coordination with Outside Parties ➤	Detailed procedures to be used to facilitate coordination with appropriate federal, state, and county officials during and after any emergency situation; and
k. Emergency Communication with Residents ➤	Procedures to be used to identify and inform all residents within applicable distances of the project of the possible emergency situations, warnings, and responses in advance of commencement of project operations and the methods by which all individuals affected by a given emergency will be notified and evacuated, as necessary.

3.2 Guidelines for County Emergency Response Planning

In reviewing the County of Hawai'i Emergency Operations Plan, the Review Team used the National Response Team's recommended criteria for reviewing emergency response plans. This guidance, Criteria for Review of Hazardous Materials Emergency Plans (NRT-1A), serves as a supplement to the National Response Teams's Hazardous Materials Emergency Planning Guide (NRT-1). The National Response Team developed NRT-1 and NRT-1A according to the Emergency Planning and Community Right-to-Know Act (EPCRA). NRT requirements are summarized below in Table 4.

Table 4. NRT Guidance for Preparing a Hazardous Materials Emergency Plan. Summarized in this table are the key components of a hazardous materials emergency plan for local governments. The National Response Team developed this guidance to clarify the requirements of the Emergency Planning and Community Right-to-Know Act (EPCRA).

Planning Elements	Description
Summary of "Hazardous Materials Emergency Planning Guide" (NRT-1)	
a. Introduction ➤	The introduction includes a summary of information on past incidents, a promulgation document, legal authority and responsibility for responding, table of contents, abbreviations and definitions, assumptions and planning factors, concept of operations with governing principles, organizational roles and responsibilities, and relationship with other plans. It also includes instructions on plan use with purpose and plan distribution, and a record of plan amendments. **EPCRA Requirements:** designation of a community emergency coordinator and facility emergency coordinators, who shall make determinations necessary to implement the plan; methods for determining the occurrence of a release.
b. Emergency Assistance Telephone Roster ➤	Contact names, addresses, phone numbers, and other pertinent information are included.

c. Response Functions ➤	Included are initial notification of response agencies, direction and control, communications among responders, warning systems and emergency public notification, public information and community relations, resource management, health and medical services, and response personnel safety. Also included are personal protection of citizens (indoor protection, evacuation procedures, and other public protection strategies), fire and rescue, law enforcement, ongoing incident assessment, human services, public works, and any other response functions that are specific to local conditions. **EPCRA Requirements:** methods and procedures to be followed by facility owners and operators and local emergency and medical personnel to respond to any releases of extremely hazardous substances; procedures providing reliable, effective, and timely notification by the facility emergency coordinators and the community emergency coordinator to persons designated in the emergency plan, and to the public, that a release has occurred. A description of emergency equipment and facilities in the community and at each facility in the community subject to EPCRA, and an identification of the persons responsible for such equipment and facilities. Evacuation plans, including provisions for a precautionary evacuation and alternative traffic routes.
d. Containment and Cleanup ➤	Techniques for spill containment and cleanup, and resources for cleanup and disposal are included.
e. Documentation and Investigative Follow-up ➤	Requirements, procedures and formats are included.
f. Procedures for Testing and Updating the Plan ➤	This includes exercises, incident review, training, keeping the plan up-to-date, internal and external review, and plan approval. **EPCRA Requirements:** Training programs, including schedules for training of local emergency response and medical personnel. Methods and schedules for exercising the emergency plan.

g. Hazards Analysis ➤	A summary of hazards identification, vulnerability analysis, risk analysis, and facility information are included. **EPCRA Requirements:** methods for determining the area or population likely to be affected by a release of extremely hazardous substances; identification of facilities subject to EPCRA that are within the emergency planning district; identification of routes likely to be used for the transportation of substances on the list of extremely hazardous substances; and identification of additional facilities contributing or subjected to additional risk due to their proximity to facilities, such as hospitals or natural gas facilities.
h. References ➤	Among the key references are laboratory, consultant, and other technical support resources, and a technical library with pertinent data bases.

3.3 Operating Safely

Both EPA and OSHA have recently adopted identical requirements for preventing accidental releases and improving safe work practices. They include the prevention requirements summarized below in Table 5. The prevention requirements also are included in the Integrated Contingency Plan guidance, known as “Oneplan,” adopted by the EPA, U. S. Department of Transportation, U. S. Department of the Interior, and U. S. Department of Labor. The “Oneplan” guidance is an optional format for facility emergency response planning. Both the prevention requirements and the “Oneplan” format are included in this report as Appendix J.

Table 5. Summary of Prevention Requirements. EPA and OSHA have published the complete text of their prevention requirements in the Code of Federal Regulation (CFR). The citation for EPA's prevention regulation is 40 CFR Part 68, and the citation for OSHA's prevention standard is 29 CFR 1910.119.

,	Process Safety Information ..	Identify and understand all process hazards.
,	Process Hazard Analysis ...	Evaluate the potential for accidental releases.
,	Operating Procedures	Provide workers with clear, written instructions.
,	Training	Teach both the hazards and safe work practices.
,	Mechanical Integrity	Use best engineering and management practices.
,	Management of Change	Understand the technical basis and effects of change.
,	Pre-startup Review	Confirm that construction followed the design.
,	Compliance Audits	Verify and certify compliance with standards.
,	Incident Investigation	Thoroughly analyze and resolve findings.
,	Employee Participation	Involve workers in safety management.
,	Hot Work Permit	Issue a permit for any electric or gas welding.
,	Contractor Safety	Carry out safe work practices with contractors.

4 How the Review Team Evaluated The Emergency Response Plans

4.1 General

The primary tasks of the Review Team were to provide an independent review and evaluation of the emergency response plans for Puna Geothermal Venture and Hawai'i County. Team members focused on the longer–term objective of preventing chemical accidents and improving emergency response capabilities.

4.2 Hawai'i County Emergency Operations Plan

The Review Team evaluated the 1989 version of the Hawai'i County Emergency Operations Plan. The State Civil Defense Division prepared this plan for the Hawai'i County Civil Defense Agency. The Review Team also evaluated a Geothermal Incident Standard Operating Procedure that the Administrator of the Hawai'i County Civil Defense Agency gave to the Team. This standard operating procedure does not show which department or agency is responsible for its development or when it was issued, except a penciled-in date of July 30, 1992. The Review Team also evaluated a two-page plan for an emergency response at PGV prepared by Hawai'i County Fire Department.

4.3 Criteria for Review of the Hawai'i County Emergency Operations Plan

As stated earlier in Section 3.2, the Review Team used, in part, the National Response Team's recommended criteria for reviewing emergency response plans. This guidance, Criteria for Review of Hazardous Materials Emergency Plans NRT-1A, serves as a supplement to the National Response Teams's Hazardous Materials Emergency Planning Guide NRT-1.

4.4 Puna Geothermal Venture Emergency Response Plan

The Review Team reviewed version 6.3 of the Puna Geothermal Venture Emergency Response Plan dated January 30, 1996, and the Puna Geothermal Venture Emergency Action Plan revised February 23, 1996. Review Team members also reviewed the HAZWOPER/Emergency Response Guidelines and Training Program, revised February 23, 1996.

4.5 Criteria for Review of the PGV Emergency Response Plan

The Review Team evaluated the PGV Emergency Response Plan following EPA Chemical Safety Audit Guidelines and OSHA Process Safety Management and Hazardous Waste Operations HAZWOPER Standards. Audit teams use Chemical Safety Audit Guidelines in conducting safety reviews of facilities producing and handling

hazardous chemicals. The Chemical Safety Audit Program, as directed by the Chemical Emergency Preparedness and Prevention Office of EPA, is part of its Chemical Accident Prevention Program. The EPA has structured the Chemical Safety Audit Guidelines to address each of the major elements of chemical process safety management at the facility being audited. While no statute links the Chemical Safety Audit and EPCRA programs, similar goals between the two programs include:

- Increased preparedness for responding to accidental releases both at a facility and in a community;

- Increased awareness and understanding of chemical hazards; and

- Increased levels of safety practices related to producing, treating, handling, disposing, and transporting of hazardous substances at a facility.

5 County of Hawai i Emergency Operations Plan

5.1 General

This section covers the Review Team's assessment of the Hawai'i County Emergency Operations Plan, from now on called the "Plan." The Review Team presents findings and recommendations for the Plan, including the Basic Plan and Annexes.

The Plan is a multiple hazards plan that "is designed to provide guidance to emergency managers to cope with every possible type of hazard—natural, technological and war." A primary focus of the Plan is preparedness and emergency response to floods, volcanic activity, earthquakes, tsunami, drought, and fire. It also integrates emergency response capabilities along functional lines.

The Plan covers transportation and industrial accidents, utility failures, and pollution including marine oil spills and accidents involving oil and hazardous substances. It also covers health, including epidemics and infestations, and major public disorder and unrest. All of these are called "human-caused" disasters. Annexes to the Plan present more detail on emergency response procedures for utility failures, oil and hazardous substance accidents, and health hazards. The Plan lists the other human-caused disasters for reference only. It states that such disasters could occur more frequently if the urbanization, tourism and economy of the County continue to expand.

The Plan covers human-caused spills and releases of hazardous substances as disasters if the destructive event is great in size and scope. This would justify carrying out as much of the organization and response portion of the Plan as the County determines is necessary. The Plan presents an "Oil and Hazardous Substances Response Plan" in Annex M. Specifically, Annex M addresses emergency response to spills and releases of hazardous substances.

The Plan provides a basis for emergency managers of government agencies and private organizations to develop internal preparedness and response procedures. Each county agency is responsible for developing and maintaining disaster response plans, Standard Operating Procedures (SOPs), or checklists in support and conformance with the Plan.

The State Civil Defense Division prepared the Plan for the Hawai'i County Civil Defense Agency. The Hawai'i State Director of Civil Defense and the Mayor of Hawai'i County, also serving as a State Deputy Director of Civil Defense, signed the Plan on March 8, 1990. Hawai'i County distributed copies of the Plan to all cooperating agencies and offices in local, state, and federal government. Notably, they included the Federal Emergency Management Agency Region IX - San Francisco in the distribution list. As of August 1996, the State and County had made no revisions to the Plan from the date of

approval, as recorded on the page provided for this purpose.

5.2 Basic Plan

Hawai'i County Emergency Operations Plan includes a Plan for Emergency Preparedness. This Basic Plan defines the purpose, scope, authority, and organization for a governmental or private sector response in the County. Section III of the Basic Plan also defines the responsibilities and functions of the County, State and Federal departments, agencies, and offices, and other supporting organizations.

Section IV of the Basic Plan describes emergency procedures during disasters and coordinating instructions. Included is a description of response plans that each County department, agency and office, and State district and branch office will develop, including an annual update. Each agency will ensure that Standard Operating Procedures (SOPs) or checklists include complete, understandable instructions for carrying out and coordinating activities under emergency conditions. Appendix I to the Basic Plan contains a sample of the disaster response checklist.

Section V "Direction and Control" includes paragraphs that describe the organizational structure and role of the County Civil Defense Agency. This agency and its administrator are responsible for promptly and efficiently carrying out the County Emergency Operations Plan. This includes the review and coordination of supporting plans developed by governmental and private agencies in the County. Section V also describes the responsibilities of the head of each County and State department, agency, and office. This section covers warning and evacuation, access to disaster areas, communications, reports and reporting, damage assessment, public information, training tests and drills, no-fault coverage and effective date.

Section VI "Readiness Evaluation" describes a State and County Civil Defense assistance program for reviewing response plans (including operating procedures, checklists, and agreements). This program aids County departments and agencies, State district and branch offices, and private organizations in identifying and correcting deficiencies. Also, the assistance program helps to conduct emergency training exercises and critiques, participate in post disaster critiques and evaluations, and program and budget for operating requirements and improvements. If a County department or agency was not complying with provisions of the Basic Plan, the County Civil Defense Administrator would prepare a disaster readiness evaluation. The Administrator would cite the agency as delinquent in the evaluation and include these findings in a periodic report to the State Deputy Director of Civil Defense.

5.3 Annexes

5.3.1 Annex A: County of Hawai'i Disaster Response Organization

The organization chart in Annex A identifies the Hawai'i County Civil Defense Agency as the lead agency in a disaster. During a disaster response, this agency has command and control responsibility for the activities of the police and fire departments. The chart also defines the organizational responsibilities and relationships between county and state departments, agencies and offices in providing support to the Hawai'i County Civil Defense Agency. The chart does not show a role for a site incident commander or on-scene coordinator. In the role of State Deputy Director of Civil Defense, the Hawai'i County Mayor is ultimately responsible for disaster response preparedness and the performance of the Hawai'i County Civil Defense Agency.

5.3.2 Annex B: Hazards Analysis

In Annex B, Hazards Analysis, the authors of the Plan recognize that a thorough analysis of all hazards is fundamental to all effective disaster preparedness and response plans. Annex B includes accidental release of hazardous substances as human-caused hazards. Accordingly, an industrial accident like a release of H_2S at Puna Geothermal Venture is a human-caused emergency when it seriously threatens the loss of life or damage to property. Annex B, Section II, "Types of Hazards," lists human-caused hazards separately from natural disasters. The authors make this distinction because human-caused hazards can occur more frequently and develop suddenly and unexpectedly. They require a prompt, effective and coordinated response to protect lives and property.

While Annex B includes accidental releases of hazardous substances as human–made hazards, it does not address such releases as a threat to the public and the environment. The authors have not listed this category in Section III "Vulnerability."

5.3.3 Annex C: Warning and Evacuation

Annex C describes the County disaster warning system and the responsibilities and functions of the Hawai'i Civil Defense Agency in coordinating a disaster warning. The County Civil Defense Administrator may direct an agency to sound an Attention/Alert siren when a local disaster threatens the immediate welfare of the County. An announcement over the radio and television will accompany the Attention/Alert signal using the local Emergency Broadcast System.

Section III A of Annex C describes the actions citizens should take when they hear an Attention/Alert siren. The actions include tuning a radio to any local station, listening for emergency information and instructions, and taking

necessary protective actions as directed. Information in Appendix 4 "Hazards" is inconsistent with "Warning Time" information in Section III, based on discussions with Mr. Harry Kim. According to Appendix 4, the County will notify the 'community' at risk. Section III describes the Emergency Siren Signal system that provides warnings throughout the county.

While this warning system is set up to alert the public of natural hazards that have warning time, they recognize that some hazards will occur with no warning. Appendix 3 to Annex C lists such hazards: local tsunamis, flash floods, water spout tornados, and earthquakes. In an urgent local tsunami warning, the Central Police Dispatch (County Warning Point) in Hilo has the authority to sound the Attention/Alert signal immediately.

Notably, the list of hazards also includes human-induced events that could be catastrophic to the community. Any of these hazards could result in a sudden unexpected effect with little time for official warning: explosions, fires, and transportation or industrial accidents. Appendix C does not specify whether the County has extended an urgent alerting authority to the Central Police Dispatch for other hazards that may occur with little warning time.

5.3.4 Annex D: Civil Defense

Annex D clearly describes the County of Hawai'i Civil Defense Agency and the organizational structure of its Emergency Operating Center. Appendix 1 to Annex D is a guide to the disaster communications capability of the organization. This guide lists the participating agencies and how a basic radio communication system links them. The guide also includes a list of commercial radio stations that would broadcast emergency bulletins from the Civil Defense Agency. The organizational structure does not include a list of people the County would notify by telephone.

5.3.5 Annex M: Oil and Hazardous Substances Response Plan

Annex M "Oil and Hazardous Substances Response Plan" states the following --

> "Proper handling of a hazardous material emergency requires that certain information pertaining to the released material be obtained before any personnel or public are exposed during a subsequent effort to mitigate the emergency. The listing of these materials and information is attached to each individual facility appendix of this Annex."

However, the Review Team found no such appendices attached to Annex M. Annex M does not contain a list or any information about hazardous substances in the PGV facility. Also, it does not describe any public or environmental threats that could result from a serious release of hazardous substances.

5.4 Geothermal Incident Standard Operating Procedure

The Basic Plan requires police, fire and other emergency support organizations to include Standard Operating Procedures (SOP) for warning and evacuating residents. Emergency response organizations have prepared a Geothermal Incident SOP for a major H_2S release from the PGV facility. The SOP is a checklist of tasks and responsibilities the emergency managers use when Hawai'i County opens its Emergency Operations Center. Police, Fire, Health, and Public Works departments, and the Red Cross use their SOP for notifying the public of any threat from a geothermal hazard.

The Geothermal Incident SOP dated July 30, 1992 does not describe how to do the tasks, nor does it provide clear definitions of responsibilities and duties. For example, the SOP shows that a task of the Emergency Operations Center is to direct the response operations and to establish an On-Scene Coordinator. The main tasks of the On-Scene Coordinator are to (1) establish communications with the Emergency Operations Center, responding agencies, and the community, (2) prepare a hazard assessment, and (3) coordinate the response, including warning and notification, evacuation, and securement. The SOP splits the management functions of directing and coordinating between the Emergency Operations Center and the On-Scene Coordinator, leaving uncertainties about who is in full command. We note that the On-Scene Coordinator described above should not be confused with a predesignated federal official. The federal official coordinates federal activities at a hazardous material incident and monitors the incident for compliance with federal pollution control laws.

The Geothermal Incident SOP does not describe any likely geothermal incidents for which the plan is directed. The SOP identifies PGV as a location of direct impact and includes a table with H_2S release scenarios that have the PGV facility as a source. The SOP does not describe any response actions the County and local responders would take in the PGV facility. It does not mention coordinated preparedness among the County, local responders and PGV.

5.5 Findings and Recommendations

5.5.1 Finding:

The *Basic Plan* clearly states its purpose to achieve effective governmental and private sector preparedness for prompt, fully coordinated, flexible response and assistance when natural, human-caused disaster or acts of war threaten or occur anywhere in the County of Hawai'i. As reflected in this statement and throughout the plan, little recognition or attention to "chemical" or "industrial" issues occurs. Annex M, the Oil and Hazardous Substances Response Plan, is underdeveloped considering the island's continuing economic growth.

Recommendation:

The County Department of Civil Defense should review and revise the Hawai'i Emergency Operations Plan to update and replace the 1989 Plan. They should update the Plan in cooperation with all County agencies, local code enforcement and emergency response departments and other interested parties. The basic Oil and Hazardous Substances Response Plan, as described in Annex M, is not a plan for field operations. The Plan should describe the relationship between Federal, State and local response plans for hazardous materials. This document should contain three parts: basic plan, local jurisdiction information, and pertinent source material.

Part I- the basic Oil and Hazardous Substances Response Plan (Annex M) should provide the framework to bring together, in one place, information describing the elements of hazardous materials incident planning and response in the County of Hawai'i including:

a. Establishing roles and responsibilities for government agency actions required to protect life, the environment and property from the effects of any hazardous materials release or threatened release that impacts any part of the County of Hawai'i;

b. Identifying procedures Hawai'i County will use to coordinate the management of hazardous materials emergency response;

c. Meeting the requirements for the County that also carry out the requirements for the State of Hawai'i;

d. Substantially addressing each element listed in the SARA Title III and in the Hazardous Materials Emergency Planning Guide (NRT–1) issued by the National Emergency Response Team. Objectives include the following:

1. Providing guidance to those required to provide services in case of a hazardous materials incident;

2. Describing pre–emergency preparations, concept of operations, organization, incident command, protective actions, and supporting systems required to carry out the plan;

3. Defining responsibilities and functions of each participating organization, public or private; and

4. Establishing lines of authority and coordination.

Part II- Each lead agency with planning and response roles should provide local jurisdiction information. Local jurisdictions should provide information for the following:

a. An information sheet with contacts;

b. A narrative report describing local capabilities and resources; and

c. Supplemental information showing assigned responsibilities.

Part III- Appendices should include, at a minimum, references to all source documents that provide the foundation for the basic Oil and Hazardous Substances Response Plan (Annex M) including:

a. County and Operational Plan;

b. Local Police and Fire Service;

c. County Central Fire Protection District Hazardous Materials Operations Guide; and

d. PGV Emergency Response Plan.

5.5.2 Finding:

While the *Basic Plan* mentions 'private sector' assistance, this is not well defined for the role of facilities that may experience hazardous materials accidents. Many organizational graphics (see Annex D-1) do not include assistance from the private sector.

Recommendation:

Planners should address and define the role of facility personnel if facility chemical emergencies are to be coordinated with the county plan. They should also specify how, when, and under what conditions facility (private sector) personnel would interface with other authorities. Concerning the Oil and Hazardous Substances Response Plan (Annex M), EPCRA laws require the designation of a community emergency coordinator and facility emergency coordinators who will make determinations necessary to implement the plan.

5.5.3 Finding:

Annex C, Section III, Civil Defense Siren Signals and Appendix 4, Hazards with Warning Time are inconsistent based on discussions with Mr. Harry Kim. While the Emergency Siren System described in Section III provides warnings throughout the county, Appendix 4 says they will notify the 'community' at risk.

Recommendation:

Emergency managers have found many ways to alert and notify the community when a human-made disaster affects only the area local to the source. Below are some ways that Hawai'i County working with PGV could improve their alerting and notifying:

! Both Hawai'i County and PGV should explore the technical and economic feasibility of upgrading the system. The upgrade should include the capability to provide alerts within a single community (such as Pahoa or Hilo) without unnecessarily alerting the entire island. This would allow them to use the system as Annex C, Appendix 4 intends — the notification of a specific community at risk;

! Install tone-alert radios that a Radio Broadcast Data System (RBDS) signal could activate in the homes surrounding PGV or where sensitive population centers exist (e.g., schools, hospitals, day care centers);

! Use a telephone call-down system, which can make many telephone calls simultaneously, to get emergency information to the community;

! When sirens are sounded, in response to an accidental release of a hazardous material, use the existing connections with the television and radio stations to notify the public what is occurring and protective actions they should to take; and

! Educate the public on how to "shelter-in-place" and turn on their radios or televisions to receive instructions on the appropriate protective action, when a they hear a siren. With some modifications to the Hawai'i County systems, they could provide an excellent means of alerting and notifying the community surrounding the PGV facility. The County could also instruct the public about what actions they should take during an emergency.

5.5.4 Finding:

Some hazards will occur with almost no warning time. Appendix 3 to Annex C lists local tsunami, flash floods, water spout tornado, and earthquake as such hazards. Notably, the list of hazards also includes human-induced events that could be catastrophic to the community. Any of these hazards could result in a sudden unexpected effect with little time for official warning: explosions, fires, and transportation or industrial accidents. In an urgent local tsunami warning, the Central Police Dispatch (County Warning Point) in Hilo has the authority to sound the Attention/Alert signal immediately. Appendix C does not specify whether the County has extended an urgent alerting authority to the Central Police Dispatch for other hazards that may occur with little warning.

Recommendation:

The Plan should include a procedure allowing the Pahoa Substation of the Hawai'i County Fire Department to make emergency decisions, such as sounding sirens. The Pahoa Substation could then manage the emergency until personnel from Hawai'i County Civil Defense have time to arrive and take command. This could shorten the time needed to alert and notify the public after a release.

Hawai'i County Civil Defense, the Pahoa Substation, PGV, and representatives of the community should work together and determine how they will manage an accidental release. This could include setting up different levels of incidents. This group could also determine the appropriate response for each level of incident and when to notify Civil Defense, the Pahoa Substation, and the community.

5.5.5 Finding:

Annex M, Section I "Overview" does not address public or environmental threats caused by a serious release of hazardous substances from a facility. The appendix listing hazardous materials for individual facilities is also missing.

Recommendation:

Puna Geothermal Venture and other facilities in Hawai'i County that handle hazardous materials should submit information on all hazardous substances as required by EPCRA. In addition, each facility should prepare a hazards analysis including a worst-case scenario and off-site consequence analysis. If the hazards analysis shows a serious threat to the public and the environment, the County should list it in Annex B, Hazards Analysis, Section III - Vulnerability. The County also should address it in Annex M "Oil and Hazardous Substances Response Plan."

In September 1998, Hawai'i County Civil Defense Agency informed EPA that each individual facility appendix is available on the Hawai'i County Fire Department computer. A paper copy is also located at the Civil Defense emergency operations center, but it should be updated. These appendices are commonly referred to as the "individual facility profiles for SARA Title III."

5.5.6 Finding:

Annex M, Section III, Concept of Operations (Step C) states that "the Chief of the Hawai'i Fire Department, or his designee, assumes the role of Incident Commander until relieved by the Hawai'i County Civil Defense Agency upon activation of County of Hawai'i Emergency Operations Plan." However, the emergency response plans for Puna Geothermal Venture designate facility personnel to fill the role of incident commander. Thus, the county and facility plans are inconsistent.

Recommendation:

PGV and County personnel should jointly assess the emergency and the necessary response activities. PGV personnel will better understand the response level required within the plant boundaries. However, the County agencies should also assess the emergency, as PGV may call them to provide backup for personnel rescue, medical assistance and fire fighting within the plant boundaries. Additionally, the County agencies should decide the need for offsite evacuations. Refer to the recommendations in Section 4.2.4.

5.5.7 Finding:

In *Annex M, Section VII, Warning and Evacuation*, the County determines the evacuation area based on information from the computer program CAMEO (Computer Aided Management of Emergency Operations). They do not define the parties responsible for modeling in the procedure. Additionally, they do not define procedures for obtaining necessary input variables to run the computer program. Variables include industrial process and meteorological information that should be available quickly.

For planning purposes, PGV has prepared advanced modeling of anticipated worst case release scenarios for H_2S and effects from pentane fires. This information is presented in the Plan. The models show no life threatening effects at the nearest residential location, which is approximately 2,000 feet. However, the public is concerned about model accuracy. One local resident stated that during a blowout, concentrations of 30 parts per million (ppm) were present at the resident's home, but the PGV models predicted only 1.1 ppm. The EPA has not confirmed the PGV model accuracy or the resident's statement.

Recommendation:

a. Identify a responder responsible for CAMEO modeling and identify where to obtain meteorological input data. Identify a PGV source to provide release information. This procedural information may be better placed in the Hawai'i County Fire Department plan for Emergency Response to Puna Geothermal Venture. The County Emergency Operations Plan is more general in nature.

b. Hawai'i County (with support from EPA) should confirm PGV model accuracy, determining if PGV's input is appropriate and if the model results are reasonable. Additionally, Hawai'i County and PGV should evaluate other hazard scenarios. One example of a hazard scenario is the failure of caustic injection at the Emergency Steam Release Facility when this facility experiences maximum flow. Another example is the effect of discharges from pressure relief valves on the pentane, steam, and process sides of the operation. The "process" at PGV, as defined by Process Safety Management (29 CFR 1910.119), includes the pentane, steam, and condensate systems, as they are all interconnected by pipeline.

5.5.8 Finding:

Annex M, Section VII, Warning and Evacuation says that each facility appendix lists individual evacuation plans. The Review Team did not see a facility appendix for PGV. Additionally, the public has raised several concerns related to evacuation:

a. They do not know where to evacuate.

b. They do not know how the County will notify them of an evacuation.

c. Residents southwest of PGV are concerned that their only evacuation route is toward the facility, and that electric power transmission lines run along this road. For example, the power lines could fall onto the road during a major earthquake, and this same earthquake could also cause a major accidental release from PGV. If the release required an evacuation, and the only evacuation route was impassable, residents would be at risk of injury.

d. They are concerned about housing for evacuees.

e. They state that too few (only two) buses are available for evacuating children from school in Pahoa. They do not know how the County will notify the school of an evacuation.

f. They are concerned about the County Civil Defense's ability to notify the residents in the adjacent housing if they need to evacuate quickly.

Recommendation:

a. Initially, the local responders and PGV should resolve all coordination issues identified previously in these findings and recommendations.

b. After Hawai'i County, with EPA support, confirms release scenario models, local responders should define public evacuation routes and safe congregation areas. Although maps show releases as circles concentric to the release point, the actual release will take the shape of a plume. Consequently, local responders should define alternate evacuation routes considering different wind directions.

c. A plan to evacuate the schools at the Pahoa K-12 complex should be in place. If too few buses are available, perhaps the County should consider using private vehicles. Local responders should also work with the schools to develop an emergency plan which includes shelter–in–place procedures.

d. Local responders should develop a plan to ensure the public follows proper evacuation routes and that they reduce traffic congestion.

e. The County should publish additional information in the individual facility appendix of Annex M addressing -- (1) indoor protection and (2) the evacuation procedures detailed in Function 9, Page 56 of the NRT–1 guidance. Evacuation procedures should address housing for evacuees.

f. The local responders should review the evacuation plan with the public and consider public participation to the plan.

5.5.9 Finding:

Annex M, Section X –Training provides little information beyond the County's intent to provide training.

Recommendation:

Annex M, Section X –The County should develop training for hazardous materials response to include both frequency of delivery (a schedule) and emphasis on joint activities with private sector facility personnel. Joint training is vital for addressing and exercising the interface mechanisms (cited above) which

avoid confusion in real-world events.

5.5.10 Finding

The State Department of Civil Defense prepared the Hawai'i County Emergency Operations Plan for the County of Hawai'i. On March 8, 1990, the Mayor of the County (who is also the State Deputy Director of Civil Defense) and the Director of Hawai'i State Civil Defense signed the Plan. The document as signed was incomplete. However, they have made no revisions to the Plan since the date of acceptance. The Emergency Planning and Community Right-to-Know Act, 42 U. S. C. § 11003 (1995), states that each local emergency planning committee (LEPC) "shall review such plan once a year, or more frequently as changed circumstances in the community or at any facility may require."

Recommendation:

Hawai'i County should review, update, and complete the Plan, including SOPs. The Review Team suggests that the County refer to the Hazardous Materials Emergency Planning Guide, document NRT-1, and the Criteria for Review of Hazardous Materials Emergency Plans, document NRT-1A. The National Response Team prepared both documents as guides for reviewing and updating emergency response plans.

6 Puna Geothermal Venture Emergency Response Plan

6.1 General

The PGV Emergency Response Plan and other facility documents describe some pertinent types of incidents and who will be contacted during an incident. The Emergency Response Plan describes who will be the Incident Commander during certain times. The only person specified as the Incident Commander is the Site Manager or the Operations and Maintenance Manager "if pre-qualified." The Emergency Response Plan designates the Incident Commander as the person responsible for confirming that PGV notifies all agencies and others quickly.

The Emergency Response Plan includes several different release scenarios. Some of these scenarios involve hydrogen sulfide, diesel fuel, pentane, brine and steam. OSHA Process Safety Management (PSM), 20 CFR 1910.119, requires regulated facilities to take steps to prevent or minimize the consequences of catastrophic releases of toxic, reactive, flammable or explosive chemicals. PGV is subject to this regulation because it handles pentane, which is a flammable substance. Among the requirements of PSM are emergency planning and response.

PGV addresses emergency response in the following several documents: the Emergency Response Plan, Version 6.3, dated February 1, 1996 and referenced as *ERP* below; the HAZWOPER/Emergency Response Guidelines and Training Program, revised February 23, 1996 and referenced as *HAZWOPER* below; and the PGV Emergency Action Plan and Notification Guidelines, revised February 23, 1996 and referenced as *EAP* below. Under federal requirements for hazardous waste operations and emergency response (HAZWOPER) 29 CFR 1910.120, the emergency response plan is required to address, "Pre-emergency planning and coordination with outside parties." All emergency response plans list County Civil Defense and other non-PGV responders on the external call list.

The Review Team noted that these plans appeared to lack several emergency response requirements as mandated by OSHA. Although EPA is not asserting responsibility for enforcing OSHA requirements, these findings and recommendations for correcting the deficiencies include specific regulatory references.

6.2 Employee Emergency Plans and Fire Prevention Plans — 29 CFR 1910.38

6.2.1 Finding:

Under 1910.38(a)(2)(ii), the plan is required to include, "Procedures to be followed by employees who remain to operate critical plant operations before they evacuate." PGV notes equipment removal activities in case of a natural hazard in Table 5-1 of the *ERP*. Due to time constraints, the Review Team scanned the procedures in the emergency response documents. The Operations and Maintenance Manual table of contents did not state clearly whether emergency shutdown procedures do exist.

Recommendation:

PGV should have emergency shutdown procedures. If these procedures exist already, PGV should cross-reference the procedures for an emergency shutdown with its emergency response procedures. *[Please note: the Review Team was not given the opportunity to review the PGV Operations Manual, and EPA did not receive a copy for review. HIOSH informed EPA during a teleconference November 3, 1999, that HIOSH is satisfied with the written emergency shut down procedures in PGV's emergency response plan.]*

6.2.2 Finding:

Under 1910.38(a)(2)(iv), the plan is required to include, "Rescue and medical duties for those employees who are to perform them." The *ERP* states that at least three people with first aid training will work on every shift. At the time of the review, it was not clear in any emergency response document how the facility identified individuals with first aid training during an emergency or what their role was on the response team. PGV has since indicated to EPA that all PGV employees are certified for first aid and cardiopulmonary resuscitation or CPR.

Recommendation:

The emergency response procedures should clarify the role of first aid responders to ensure they are available to administer first aid when required.

6.3 Hazardous Waste Operations and Emergency Response — 29 CFR 1910.120

6.3.1 Finding:

Under 29 CFR 1910.120(q)(2)(I), the emergency response plan is required to address, "pre-emergency planning and coordination with outside parties." From discussions with County Civil Defense and local responders, the Review Team found that coordination with outside parties is practically nonexistent. The emergency response plans do not address responders' roles or coordination of response activities with local responders. At the time of this review, PGV's stated position was that it will handle all incidents internally in its facility, except fire incidents. Insufficient coordination with outside parties is the primary cause of concern over PGV's need to improve its emergency response capability. Some of the specific concerns are described below, in paragraphs 6.3.2 through 6.3.6.

Recommendation:

PGV should improve its emergency response capability by --

1. Clarifying in writing the local responder responsibilities and

2. Communicating with outside parties during pre-emergency planning.

PGV responders may need backup from the Hawai'i County Fire Department and its HAZMAT, hazardous materials, or EMT, emergency medical technician, teams. A facility emergency could include a fire, explosion, hazardous substance release, or all three at the same time, in which case PGV could become overwhelmed. Given a very serious emergency, local responders may need to rescue PGV responders.

6.3.2 Finding:

The Hawai'i County Fire Department and its HAZMAT team members said they were uncertain what their role would be in an emergency response at PGV. The assistant fire chief also stated that he would not send County responders beyond the plant boundary without understanding the facility and the County's role in the response. PGV personnel noted that they do not expect the fire department to respond to releases of hazardous substances in their facility. However, PGV would call Hawai'i County Fire Department for assistance if it had a fire in its facility. For example, if the pentane cycle or any component of the entirely closed cycle caught fire, PGV would call the fire department.

Recommendation:

PGV should work with the Hawai'i County Fire Department to refine the Fire Department's procedure entitled, "Emergency Response to Puna Geothermal Venture." The Fire Department should incorporate the response of its newly formed HAZMAT team. Also, PGV should work with the Fire Department to clearly define the possible response scenarios, both inside and outside the plant boundaries. Some of these scenarios involve hydrogen sulfide, caustic soda, diesel fuel, pentane, brine and steam. If other hazardous chemicals are present in the steam from geothermal wells, the Emergency Response Plan should include them as well. EPA notes that specific conditions render chemicals hazardous rather than their presence alone. Defining these scenarios and the anticipated level of backup from the Fire Department and the HAZMAT team will require PGV participation.

PGV should work with Hawai'i County Civil Defense Agency and Fire Department, Pahoa Substation, to establish how and whom PGV will notify during an incident. For example, a situation could arise in which PGV personnel are injured during an emergency response, and PGV would need to call County Fire for rescue or backup. PGV and the County should address emergencies involving both hazardous materials and fire in the facility.

6.3.3 Finding:

Version 6.3 of the Emergency Response Plan states that the County "Civil Defense Agency has the responsibility of providing the warning to, and to effect the implementation of, the evacuation of any residents or other members of the public from the appropriate hazard area surrounding the site, as necessary." However, this plan does not clearly state the order in which PGV personnel should notify County responders. The lack of clarity may cause a delay in County response, such as evacuation, that could have serious consequences. PGV does not address pre-emergency response planning activities with outside parties, e.g. the community, in any planning document.

Version 6.3 of PGV's Plan states that "PGV anticipates no project-created situation which would not provide sufficient time for the Civil Defense Agency to warn or evacuate the public, as appropriate." PGV's release history does not support this statement. In the past, incidents have occurred quickly and without sufficient warning to notify or evacuate the public before they were exposed to hazardous substances. According to the County Civil Defense Administrator, incidents also have occurred in which neighbors to PGV phoned-in complaints of H_2S releases, and PGV did not report these same releases. Copies of letters between EPA and PGV regarding one such release in January, 2000 are appended to the final report.

Recommendation:

With PGV's assistance, Hawai'i County Fire Department personnel should evaluate and determine if release or fire situations require outside response. The State of Hawai'i has adopted the 1988 edition of the Uniform Fire Code by reference into its State Model Fire Code. The Uniform Fire Code section 10.101 authorizes the County Fire Department to direct an operation as necessary at the scene of a fire or other emergency involving the protection of life or property. Section 10.101 also empowers the County Fire Department to perform any rescue operation or take any other action necessary in the reasonable performance of its duty. Both PGV and Hawai'i County Fire Department have emergency response capabilities and responsibilities. PGV should improve its coordination with outside parties and its outreach activities. PGV should involve both local responders and the community in its pre-emergency planning.

6.3.4 Finding:

This finding pertains only to hazardous materials releases. By not incorporating the ranking outside responder into the Incident Command System (ICS) for hazmat response, PGV is directly or indirectly making decisions that affect outside emergency response personnel and the public. For example, PGV will define the severity of an accidental release scenario or the potential severity of the release. Then the outside responders will base their action on the PGV assessment.

Recommendation:

PGV and Hawai'i County should modify the PGV Emergency Response Plan and the Hawai'i County Emergency Operations Plan to coordinate a joint incident command system. Both a PGV official and the ranking outside responder should share the responsibility for incident command. The PGV Emergency Response Plan should clarify that the PGV control room operator will serve as the Incident Commander during every shift, including off-hours, until relieved by the Operations and Maintenance Manager or Site Manager.

6.3.5 Finding:

The Review Team was not able to review and determine if PGV had conducted a thorough process hazards analysis (*PHA*), such as a hazard and operability study, for the entire PGV facility. As of August 1996, PGV had not reviewed its *PHA* on well blowouts and pentane fires with outside responders. Thus, they may not have identified emergencies beyond well blowouts and pentane fires that could require outside emergency response. EPA takes notice of PGV's more recent efforts to work with response agencies and its willingness to share process hazards analyses.

Recommendation:

PGV should continue to review the results of its PHAs with outside responders to identify the hazards that may require outside emergency response.

6.3.6 Finding:

Under 1910.120(q)(2)(viii), the emergency response plan should address, "Emergency medical treatment and first aid." The *ERP* discusses first aid but does not clarify the coordination with outside responders to provide emergency medical treatment.

Recommendation:

PGV should address medical treatment beyond first aid, such as acute exposure to H_2S and severe burns. PGV also should identify offsite responders and the hospital in Hilo that can handle such emergencies. EPA has discussed this issue with HIOSH and takes note that PGV has made improvements since the Review Team's site visit in 1996.

6.3.7 Finding:

Under 1910.120(q)(2)(iii), the emergency response plan is required to address, "Emergency Recognition and Prevention." The *ERP* discusses recognition of an H_2S emergency. However, it does not discuss recognition of combustible gas leaks and fires in any of the emergency response procedures. The *ERP* references pentane leak rupture and fire in the Operations and Maintenance Procedures, but PGV did not make these procedures accessible to the Review Team. Thus, the Review Team cannot comment on the content. The Operations Manager advised the Review Team that as of August 1996, PGV was developing the emergency procedure for fire.

Recommendation:

If PGV addresses combustible gas leaks and fires somewhere, then it should either incorporate them into the emergency response procedures or cross-reference them. If PGV has not addressed gas leaks and fires, it should incorporate them into the *ERP* or *EAP*.

6.3.8 Finding:

Under 1910.120(q)(3)(I), "The senior emergency response official responding to an emergency shall become the individual in charge of a site-specific Incident Command System (ICS)."

Recommendation:

PGV and the local Fire Department's HAZMAT Team should consider the Joint Incident Command System for a coordinated emergency response. Both parties should formalize the joint command structure so everyone will know who is responsible for all tasks.

6.3.9 Finding:

Under 1910.120(q)(3)(v), "The individual in charge of the ICS shall limit the number of emergency response personnel at the emergency site, in those areas of potential or actual exposure to incident or site hazards, to those who are actively performing emergency operations. However, operations in hazardous areas shall be performed using the buddy system in groups of two or more." *HAZWOPER* discusses control zones, but at the time of this review in August 1996, none of the emergency response plans addressed control of the number of personnel or use of the buddy system.

Recommendation:

In its *ERP* or *EAP*, PGV should include a discussion of using the buddy system and controlling the number of response personnel. This should also be included in PGV's Annual Safety Training Program which is in Section 6 of the *ERP*.

6.3.10 Finding:

Under 1910.120(q)(3)(viii), "When activities are judged by the safety official to be an Immediately Dangerous to Life and Health (IDLH) condition and/or involve an imminent danger condition, the safety official shall have the authority to alter, suspend, or terminate those activities." The PGV emergency response plan does not give this authority to the safety officer.

Recommendation:

PGV should provide this authority to the safety officer or provide some type of check support to the incident commander's authority. PGV should add a clear statement of authority or check support to its *ERP*. The term "check support" means a system of checks and balances on the authority of the incident commander.

6.3.11 Finding:

Under 1910.120(q)(4), "temporary employees who are needed to perform work on an emergency basis, such as operating cranes or earth moving equipment, are not

required to be trained in the emergency response plans, but should be briefed in the hazards, proper Personal Protective Equipment (PPE) to be used and the duties to be performed." This issue is not addressed in the emergency response plans.

Recommendation:

PGV should amend the *ERP* to satisfy this requirement.

6.3.12 Finding:

Under 1910.120(q)(10), "chemical protective clothing used for emergency response shall meet the requirements of 1910.120(g)(3-5)." Personnel protective equipment (PPE) and clothing available for emergency response are listed in *HAZWOPER* and the *EAP*. PGV's plans do not discuss what type of clothing and PPE its personnel will use for different types of emergency response.

Recommendation:

PGV should clarify what appropriate clothing and protective equipment its personnel will use for different response activities.

7 Overarching Issues

7.1 General

Although the focus of this review was evaluating the emergency response capabilities of Hawai'i County and PGV, the Review Team did discover some issues and concerns that related to emergency response but were outside the reviewers' fields of expertise. Review Team members also learned about other important emergency planning issues of overlapping responsibility among PGV, Hawai'i County, and the State of Hawai'i. These overarching issues are presented in this final section of the report because the issues are important and relevant to emergency planning and response. The Review Team suggests that all parties work together to resolve each issue.

7.2 Findings and Recommendations

7.2.1 Finding:

In 1991, the State of Hawai'i Department of Health (HDOH) identified levels of hydrogen sulfide (H_2S) that emergency managers could use for alert, warning, and emergency levels of H_2S in the air. The alert level is 10 ppb H_2S averaged over a 24-hour period, the warning level is 100 ppb averaged over a one-hour period, and the emergency level is 1,000 ppb averaged over a one-hour period.

Emergency managers at Hawai'i County and PGV also have identified H_2S levels. Hawai'i County has identified the 1,000 ppb level averaged over a one-hour period as an evacuation trigger. In its *ERP*, PGV has listed a watch level of 25 ppb averaged over a one-hour period and a warning level of 1,000 ppb averaged over a one-hour period.

The Review Team found that the stationary H_2S air monitoring network around PGV's perimeter is currently not set to measure ambient H_2S levels greater than 500 ppb. HDOH and PGV operate stationary monitors around the PGV perimeter, which are set to monitor from 0 to 500 ppb[1]. The monitors are capable of measuring different ranges, up to 20 ppm or 20,000 ppb, if recalibrated. Because the monitors are currently set to measure from 0 to 500 ppb, the stationary H_2S air monitoring network around PGV cannot adequately measure the data necessary to make evacuation decisions if ambient H_2S concentrations exceed 500 ppb[2].

---

[1] The monitors are currently set to a range of 0 to 500 ppb to ensure that the H_2S ambient requirements in the HDOH air operating permit can be adequately enforced. However, monitors with a wider dynamic range, from five to 1000 ppb, are now available, and monitoring equipment is fundable under EPA's Clean Air Act Section 105 grant to HDOH.

[2] The Review Team recognizes that PGV and HDOH currently have portable monitors that are available to measure ambient H_2S levels greater than 500 ppb.

Recommendation:

The Review Team recommends that stationary air monitors around the facility perimeter should measure continuously the higher H_2S concentrations, greater than 500 ppb. This is to ensure that local authorities can alert, warn, or evacuate the public quickly. PGV should share its real-time air monitoring data with the Pahoa Substation, so the local responders will know exactly what is occurring at PGV during an emergency.

The Review Team also recommends that the County form a technical work group to evaluate evacuation needs, resources, and procedures. The technical work group could begin by reviewing H_2S trigger levels, types of incidents, and the air monitoring network around PGV. The technical work group also may want to consider if stationary monitors should have alarms set to notify the County Civil Defense Agency and Fire Department automatically when H_2S concentrations reach the alert, warning, or emergency levels.

Technical work group members should include representatives from the County Civil Defense Agency and Fire Department, HDOH, the University of Hawai'i, and EPA. Work group members should confer with PGV technical staff on the details of facility operations. Technical issues under evaluation are extremely important and will require a great deal of thought, research, and professional judgement.

Public participation should be included when setting new evacuation trigger levels. Based on comments EPA received regarding the draft report, EPA suggests that at least one member of the technical workgroup could represent the community-at-large.

7.2.2 Finding:

The perimeter H_2S air monitors are on an interruptible power supply. Circumstances causing power disruptions also may cause accidental H_2S releases from the PGV facility. PGV personnel can monitor ambient conditions with hand-held H_2S monitors.

Recommendation:

The Review Team suggests that PGV and HDOH install, for their respective monitors, an adequate backup power source for the stationary H_2S monitors. HDOH and PGV should maintain stationary H_2S monitoring during power disruptions.

7.2.3 Finding:

Hawai'i County Fire Department personnel noted that not all shifts from the Pahoa Substation have received site tours to familiarize them with the PGV facility or training in the hazards unique to PGV. This was a discussion item during the combined meeting with firefighters at the Pahoa Substation on August 8, 1996. The meeting included Hawai'i County Fire Department personnel, the EPA Review Team, and members of PGV management.

Recommendation:

The Review Team suggests that PGV provide site familiarization and training for all shifts of fire and HAZMAT response personnel from the local fire department, including:

1. An overview of plant operations and process hazards,

2. H_2S and any other hazards unique to PGV,

3. Safe handling practices of H_2S and any other hazards unique to PGV,

4. Facility procedures, information, and personnel responsibilities for emergency response; this should include the locations of all water hydrants, hydrocarbon monitors, and point source monitors for H_2S.

EPA notes that for the purposes of the PGV plan the hydrogen sulfide (H_2S) monitors should measure air quality in the "breathing zone" of approximately six feet. There are no federal regulations which prescribe the requirements of siting hydrogen sulfide monitors. EPA monitoring regulations [40 CFR Part 58] address the monitoring of "criteria" pollutants, i.e. ozone, particulate matter, carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), and lead. In general, EPA, State and local agencies collect data on these pollutants for use in regulatory programs mandated by the Clean Air Act. EPA monitoring regulations contain specific siting criteria for monitors that measure these pollutants. In order for the data collected to be valid for regulatory use, the criteria pollutant monitors must meet all relevant siting criteria, including probe height. However, since H_2S is not a criteria pollutant, these regulations can be used as simply a guide to siting the samplers, not a requirement.

Minimum probe heights for collecting ozone, CO, SO_2 and NO_2 data are three meters (about 10 feet). For particulate matter and lead monitoring, the minimum probe height is two meters (about 6.5 feet). The reason the minimum probe heights are set where they are is to obtain the most representative sample of ambient air in order to measure concentrations of a particular air criteria pollutant. If the probe is too close to the ground, the air sampled may be influenced by the effect of ground turbulence or near ground sources (e.g. automobile exhaust).

Since the object of the monitoring of H_2S is to provide information to the community on H_2S levels they are exposed to, not to implement a regulatory program mandated by the Clean Air Act, it is absolutely appropriate to site the monitor probes at the breathing height level (six feet). The data collected will be used to indicate whether certain actions in the emergency response plan should be triggered. If there are concerns about where the H_2S is coming from (i.e. PGV, natural vents, automobiles, etc.) then supplementary monitors can be set up at different heights to try to assess contributions from different sources. The primary purpose of the H_2S monitoring is to protect the health of the community; therefore, the monitoring sites operated by the Hawai'i DOH should sample air at breathing height (six feet).

5. Where the outside agencies will meet, including alternate locations, when an incident occurs, and

6. The interface between the agencies and the facility and the different responsibilities of each; this should include coordinated drills for rescuing injured PGV employees.

Subsequent to the Review Team's visit, PGV stated that it has provided increased site familiarization for all shifts of fire and HAZMAT response personnel in Pahoa and Hilo.

7.2.4 Finding:

PGV's Emergency Response Plan *(ERP)* addresses magma intrusion. The *ERP* seems to imply that this event is controllable, but does not discuss the severity or likelihood of this event.

Recommendation:

Knowledge of this type of occurrence is outside the expertise of the review team. PGV should evaluate the likelihood of occurrence and the severity of a magma intrusion. PGV could draw upon the expertise of the University of Hawai'i, Center for the Study of Active Volcanoes and the U.S. Geological Survey's Hawai'ian Volcano Observatory. PGV should share the results of the evaluation with the public.

7.2.5 Finding:

The effects of an earthquake of magnitude seven or greater on the PGV facility, including pentane piping and tanks and underground well casings, are unknown to the emergency response agencies. Seismic activity and its effects on structures are outside the expertise of the Review Team.

Recommendation:

PGV should consult with a qualified and respected engineering firm to review and comment on the structural integrity of the facility, existing geothermal wells, and any new wells yet to be drilled. This engineering review should address whether the PGV facility would likely withstand earthquakes of magnitude seven or greater in the Puna locality.

7.2.6 Finding:

In Hawai'i, the Emergency Planning and Community Right-to-Know (EPCRA) Tier Two filing fees currently go directly to the State's Superfund environmental response revolving fund and not to the Local Emergency Planning Committees (LEPCs). The Review Team finds that these funds are not returning to local agencies for emergency responder training. A lack of funds may compromise the training of local response personnel.

In 1998, the Hawai'i County LEPC nominated two PGV employees to serve on its reactivated committee. The Hawai'i State Emergency Response Commission (SERC) confirmed their membership in August 1998.

Recommendation:

a. The LEPC should evaluate the training for local responders to decide if it is adequate and evaluate ways to improve training where appropriate.

b. The Review Team encourages participation of industry on the Hawai'i County LEPC. This will greatly improve communication between responders and facilities and help to improve the quality of individual emergency response plans.

c. The State of Hawai'i should channel some Tier Two filing fees to LEPCs for use in the training of HAZMAT response personnel.

7.2.7 Finding:

Hawai'i County has not recently conducted an exercise for hazardous materials response, and PGV has never participated in one. The last time the EPA co-sponsored a HAZMAT exercise for Hawai'i County was 1993. Then, the exercise planning team mentioned PGV as a possible focus of the exercise. However, the hazardous materials exercise scenario selected by the planning team was the Port of Hilo in an industrial part of the city.

On October 4, 1996, PGV had a release of H_2S that exceeded the limit under the state's air permit. The County and PGV should conduct a joint hazardous

materials response exercise to prepare for this type of release. FEMA's guidance for training exercises suggests a progression, from less difficult to more difficult exercises. First a jurisdiction should conduct a tabletop exercise, then a functional exercise, and finally a full-field exercise.

Recommendation:

The Review Team recommends that local and state agencies and PGV plan and conduct a multiple jurisdictional hazmat response exercise. Participants should include Hawai'i County Civil Defense, Hawai'i County Fire Department, Hawai'i County and Keeau Police Departments, Hawai'i Department of Health and other agencies. Before conducting an exercise, participants should resolve many coordination issues and update their emergency response plans.

Hawai'i County should conduct the complete series of exercises -- tabletop, functional and full-field, as recommended by FEMA. Additionally, exercise evaluators should critique each exercise and make this information available to the public.

PGV should initiate and actively participate in at least one of these exercises with Hawai'i County. A tabletop or functional exercise between PGV and Hawai'i County should have a target completion date no later than two years after the release of this report.

7.2.8 Finding:

Under 29 CFR 1910.120(q)(2)(I) and (ix), the emergency response plan should address "pre-emergency planning and coordination with outside parties" as well as "emergency alerting and response procedures." At the time of the review, the *EAP* did address internal alerting but did not clearly define the alerting of offsite emergency responders.

Recommendation:

In cooperation with the County of Hawai'i Civil Defense, both the Pahoa Substation and PGV should develop local emergency alert, warning and response procedures. Hawai'i County also should educate the public near the PGV facility regarding appropriate action that may be necessary.

Hawai'i County and/or PGV should equip the Pahoa Substation with a combustible gas monitor, H_2S detector, and UV/IR flame detector. PGV should work with the County to identify the appropriate equipment, train the Pahoa Substation personnel, and help maintain the equipment. PGV's *EAP* or *ERP* should describe what actions operators will take when they hear a high alarm from one of the point source monitors for hydrogen sulfide and hydrocarbons. This

information should be communicated to the Pahoa Substation for the use of its first responders.

7.2.9 Finding:

The Review Team found that public communications and access to chemical emergency planning information from PGV could improve. This is based on the EPA's experiences with community requests for information, such as requests under the Freedom of Information Act. Community residents also raised comments about the availability of information during the August 1996 public meetings. Public comments are summarized in Table 2 at the end of Section 1.

Recommendation:

The Review Team strongly recommends that PGV improve and expand a program for proactive community outreach. One objective is to increase the flow of information for chemical emergency planning. Another important objective is to further improve the working relationship between the community and PGV.[3]

[3] PGV has recently provided updated information to EPA regarding its public outreach program. PGV reports that an average of one hundred visitors per month have toured the plant. In addition, PGV personnel have participated as guest lecturers at local schools and business organizations. PGV is maintaining published telephone lines which allow the general public to speak to plant personnel, ask questions, obtain information on plant activity, and file complaints. Through the Hawai'i Department of Health, PGV provides 24-hour-a-day hydrogen sulfide tables and charts from each of its air monitoring stations. PGV is constructing an Internet web page to allow electronic interaction with the community. Completion of the web page is expected by the end of the first quarter of 1999. PGV also reports that it provides other services and contributions to the community. For example, during the recent drought, PGV provided fire fighting equipment and water to assist the local fire department respond to a fire in the nearby Leilani Subdivision.

The Review Team recommends that Hawai'i County agencies ensure that EPCRA Tier Two information from all applicable facilities is readily available for emergency planning and response.

In closing, the review team must emphasize that an emergency response plan alone does not directly protect the public and the environment. The plan is only a detailed blueprint of an emergency response program designed for a facility or community, with the purpose of protecting the environment and the public. Emergency response programs are the comprehensive approach to protecting the public.

In addition to complete, updated and coordinated emergency response plans, jurisdictions and industries must have the required resources, equipment and trained personnel, to be fully prepared to implement the plans and respond to accidents resulting from man-made hazards as well as natural disasters. Finally, the authorities responsible for the emergency response programs must be assured at all times that the programs are workable. They need feedback through the results of scheduled periodic exercises.