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ACCIDENT INVESTIGATION OF
THE ELECTRICAL SHOCK INCIDENT
AT THE PG&E PVUSA SITE
DAVIS, CALIFORNIA

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L. Jacobson, P. D. Moskowitz, J. O. Garrett, and R. Tyler

February 1992

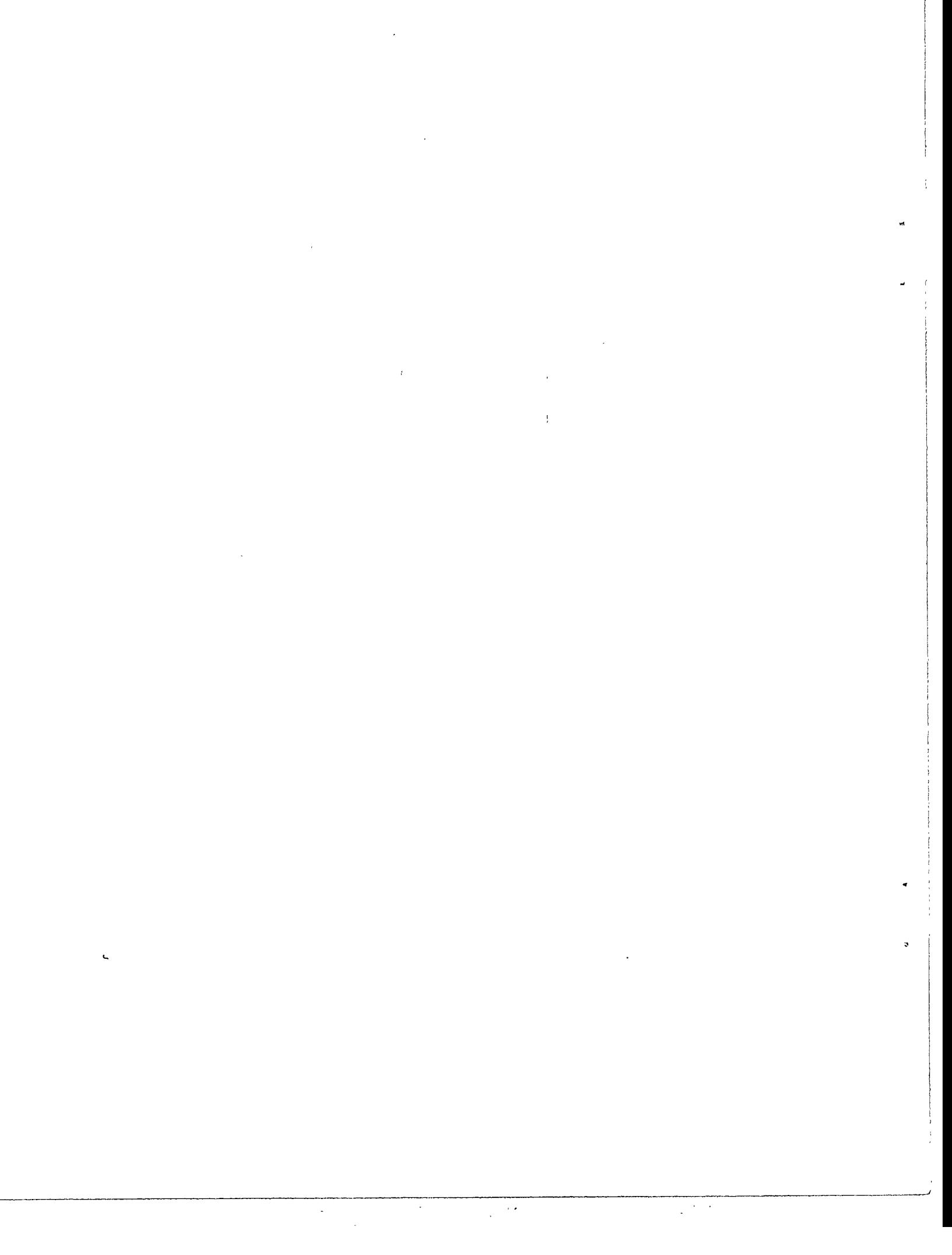
BIOMEDICAL AND ENVIRONMENTAL
ASSESSMENT GROUP

ANALYTICAL SCIENCES DIVISION
DEPARTMENT OF APPLIED SCIENCE

BROOKHAVEN NATIONAL LABORATORY
UPTON, LONG ISLAND, NEW YORK 11973

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L. Jacobson, P. D. Moskowitz, J. O. Garrett, and R. Tyler

February 3, 1992

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ANALYTICAL SCIENCES DIVISION
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BROOKHAVEN NATIONAL LABORATORY
ASSOCIATED UNIVERSITIES, INC.

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1. EXECUTIVE SUMMARY

This report summarizes the findings of the Accident Investigation Team (Team) assembled in response to a request from Pacific Gas and Electric Company (PG&E) to the U.S. Department of Energy (DOE) to understand the events surrounding the electric shock of a worker at the PVUSA site in Davis, California and to provide recommendations to prevent such events from recurring. The Team was co-directed by Lew Jacobson and Paul D. Moskowitz from Brookhaven National Laboratory. Other members of the Team included James O. Garrett (Reynolds Electrical and Engineering Co.), Rick Tyler (California Energy Commission) and Donald Gillies (Electrical Safety Consultant). The investigation began in November with a request to PG&E for documents surrounding the incident. This was followed with a site visit on December 11, and further discussions on December 12-13, 1991. Interviews were held with all prime and secondary subcontractor personnel involved in the incident. The report gives complete details on the sequence of events surrounding the accident and identifies 27 facts related to accident itself. Four technical deficiencies in the electrical systems which require further investigation were identified. The Team believes that the root cause of this accident was related to the absence of a proactive organizational entity responsible for overall health and safety on the site. Two contributing factors were identified. First, the prototype nature and associated operational difficulties of the electrical inverter resulted in large maintenance demands. Second, several of the injured employee's co-workers noted that he occasionally failed to use appropriate personal protective equipment, but they never reported this practice to management. The direct cause of this accident was the failure of the injured employee to wear appropriate personal protective equipment (i.e., rubber gloves). Based on the review of the facts established in this investigation, five recommendations are presented to the funding agencies to reduce the possibility of future accidents at the PVUSA site. They include: 1. Establish written rules and guidelines for safety programs; 2. Establish a single entity to communicate, audit, and enforce safety rules and regulations at the site; 3. Review the structural and electrical configuration of the inverter (and other new equipment) prior to purchase and installation to insure that there are no inherent design defects; 4. Encourage PG&E and Bechtel efforts started after the accident to improve operational safety at the PVUSA site; and, 5. Request PG&E to develop and document safety policies and procedures that could be used at other utility photovoltaic sites. Development of these procedures and documents should reduce the probability of occurrence of other electrical accidents at the site, while providing model health and safety documentation for other utility photovoltaic applications.

2. SCOPE OF INVESTIGATION

This is the report of the Accident Investigation Team (Team) assembled in response to a request from Pacific Gas and Electric Company (PG&E) to the U.S. Department of Energy (DOE). The Team was charged by DOE to understand the events surrounding the electric shock of a worker at the PVUSA site in Davis, California and to provide recommendations to prevent such events from recurring.

PVUSA is a joint venture funded principally by PG&E, DOE, the Electric Power Research Institute (EPRI), and the California Energy Commission (CEC). The prime contractor for this project is PG&E, San Francisco, California. Bechtel Construction Company as the prime subcontractor to PG&E is responsible for construction, verification and acceptance testing of all systems installed at the PVUSA site. There are numerous other subcontractors who are frequently on site. They include Endecon, Collins Electric, Siemens Solar Industries, and Bluepoint Associates. The individual involved in the incident was an employee of Siemens Solar working under contract to Bechtel. At the time of the incident, he was assisting the owner of Bluepoint Associates in the testing of a Bluepoint supplied inverter. Bluepoint Associates was a subcontractor to Siemens Solar.

The Team was co-directed by Lew Jacobson (Safety Coordinator, Brookhaven National Laboratory, Upton, NY) and Paul D. Moskowitz (Environmental Health Scientist, Brookhaven National Laboratory, Upton, NY). Other members of the Team included James O. Garrett (CSP, Electrical Safety Engineer, Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV), and Rick Tyler (Health and Safety Program Specialist, California Energy Commission, Sacramento, CA). Donald Gillies (Electrical Safety Consultant, Rhododendron, OR) served as an ex-officio member of the Team, and provided independent review of documents provided by PG&E, and comments developed by the Team.

The investigation began in November with a request for documents surrounding the incident. This was followed by a visit to the Davis site on December 11 and further discussion on December 12-13 at the PG&E Research and Development facility in San Ramon. The investigation was centered around facts developed from the following:

- * Physical inspection of the site.
- * Review of incident reports.
- * Review of safety procedures.
- * Review of training documentation.
- * Interviews with personnel (victim was not available for interview).
- * Review of safety supervision and management practices.

3. SEQUENCE OF EVENTS

On August 7, 1991, a Project Engineer for Siemens Solar, received injuries resulting from an electrical shock. Siemens Solar is subcontractor to Bechtel who had been contracted by PG&E for construction of the PVUSA project in Davis, CA.

The project engineer was taking meter readings in a DC enclosure when he received an electrical shock. He was observed falling from the device after shock, colliding with a metal chair and falling to the ground. A co-worker came to his aid, and transported him to a local hospital emergency room. The emergency room doctors who examined him, suggested that he be admitted and remain overnight for observation.

More specific details include:

July 10

Transducer calibration checked OK

August 7

- <1720 hrs Project Engineer and co-worker complete tests for fake alarms on a series of simulated ground faults.
- 1720 hrs Project Engineer said he was going to check the transducers located in the inverter "B" enclosure.
- 1728 hrs Co-worker observed Project Engineer at inverter B. Co-worker was 100 ft away at IJB-11 location and could not observe what Project Engineer was doing within the enclosure.
- 1730 hrs Project Engineer received shock.
Mechanism used to support overhead door in the open position (temporary wooden dowel) failed causing the door to DC inverter to unexpectedly close.
Co-worker runs to assist Project Engineer.
Co-worker performs preliminary examination.
Project Engineer placed in a sitting position on chair.
Co-worker brings Project Engineer's car to the accident scene.

Project Engineer placed in passenger side of car's front seat.

1735 hrs After receiving directions from an Endecon R&D engineer working in the control room, co-worker proceeded to hospital and became lost in route. This resulted in a delayed arrival at the hospital of approximately 5-10 minutes.

1742 hrs Endecon R&D Engineer arrives at hospital.
Project Engineer and co-worker arrive at hospital.
R&D Engineer notifies PG&E, Bechtel and Siemens Solar officials of incident.

1830 hrs Project Engineer had been examined twice by doctors at the emergency room - they found him to be in "relatively good shape" - but recommended he stay overnight for observation.

1840 hrs Siemens Solar official calls hospital and talks to co-worker.

1845 hrs Project Engineer admitted to hospital and placed in semi-private room.

August 8

0800 hrs Co-worker returns to hospital to see Project Engineer.

0800 hrs Accident reported to Siemens Solar Safety Department and Project Engineers Supervisor.

0845 hrs Co-worker returns to PVUSA site for meeting.

August 9

Co-worker gives verbal accident report to PG&E and Siemens Solar officials.

August 10

Co-worker gives verbal accident report to Bechtel Construction Official.

August 13

Siemens Solar Project Manager issues "Personnel Accident Investigation" report.

August 14

Co-workers complete their written reports on the incident.

Present

Work and health status of injured employee is not known.

4. FACTS

1. The Investigating Committee was greatly impressed with the *Esprit de Corps* demonstrated by all personnel for the project goals of developing and demonstrating the photovoltaic technologies.
2. The programs implemented by PG&E and Bechtel following the incident demonstrate a genuine concern for health and safety, and a renewed commitment to increase the operational safety of the PVUSA site.
3. There is currently an uneven balance between technical objectives and safety needs.
4. The injured Siemens Solar employee was not wearing protective gloves at the time of the accident and had been observed several times previously working "hot" in this manner.
5. Injured employee was performing electrical test on energized high voltage equipment.
6. Injured employee made contact with an energized circuit; it cannot be determined what was the actual point of contact. In the box, high voltage DC circuits are present.
7. Employee suffered electric shock injuries requiring hospitalization and lost workdays. These injuries included disorientation and electrical burns to the right index finger. It cannot be determined whether this was an entrance or exit wound.
8. The circuit that the injured employee was thought to be testing just prior to the accident was energized at 330 volts DC; this exceeds the OSHA standard of 50 volts for working "hot" without personal protective equipment.
9. Mechanical access to the panel, through the hinged overhead door with temporary door support (only one in use at the time of the accident), presented a hazard to the employee and an impediment to safe work.
10. There was no means for the field personnel to communicate with the control room. The distance from the field site to the control room is about 350 yards.

11. There were no formal procedures for emergency response to such an accident.
12. There were no formal and systematic process for safety auditing by any of the principals or most of the subcontractors on site.
13. The established site safety rules at the site were incomplete.
14. There were no effective lines of communication between management, contractors or individual employees regarding safety.
15. There was no formal onsite training for electrical safety, first aid for electric shock injuries, or performing "hot" work.
16. The written Standard Operating Procedures (SOPs) could use more detail on safety and trouble shooting procedures.
17. Substantial engineering changes took place between the time of factory testing of the Bluepoint Associates inverter and the time of the accident. Project development continued on the inverter after delivery to the jobsite.
18. The site had no formal safety orientation program for new employees or contractors.
19. There were many operational problems with the Bluepoint Associates power inverter. This resulted in frequent need for maintenance by the subcontractors and increased the frequency of "hot" work.
20. The safety policies of almost all parent companies are substantially different and more exhaustive for other sites than those at the Davis site.
21. There is no single, central organization responsible for safety, and coordination is lacking among site contractors to implement effective safety policies or work practices.
22. Because of the small number of resident personnel, they are required to perform multiple tasks including safety management. However, some employees responsible for safety lacked expertise, experience and training to support their qualifications for safety management.

23. The safety action plans for all contractors, except for Collins Electric, are duplicates of each other and have not been effectively implemented.
24. The program for Collins Electric was the single most important exception to these findings.
25. Employees do not have an effective mechanism for anonymously reporting safety violations. Furthermore, to whom they should report such incidents to is not clear.
26. Several employees were aware of the unsafe work practices used by the injured employee that contributed to the event. Nearly all of these observations went unreported and the employees direct supervisor was unaware of this ongoing practice.
27. None of the funding agencies (PG&E, EPRI, DOE or CEC) have provided proactive guidance to the PVUSA Project in the areas of environment, health and safety.

5. TECHNICAL ISSUES

The following items represent technical items of concern either discovered by the Team members or addressed by personnel or organizations located at the PVUSA site.

1. Emergency disconnects to the Bluepoint Associates inverter will disconnect both the neutral and hotlines.
2. During the interviews, the Team discovered that the primary neutral of the 12.5kv wye power system was not carried to the 12.5kv transformers in the site. The primary wye system must be grounded to the primary neutral to ensure circuit protection under fault conditions. The grounding of the wye connection to a ground rod and not the primary neutral, would result in fault clearing dependent on the earth path back to the wye system.
3. The Team observed that the 480 volt and 12.5kv enclosures were marked with "High Voltage" warnings, but were without indication of the voltage of the enclosed equipment. An uninformed person working on this system could be injured from incompletely labeled high voltage circuits.
4. The security and integrity of the PVUSA site is jeopardized when entry gates not under observation, are open and/or unlocked. Open, unattended gates present the hazard of unauthorized entry by the public and possible contact with energized parts of the photovoltaic systems.
5. Workmanship of the Bluepoint Associates inverter electrical connections was not in compliance with accepted practices (e.g., grommets missing, crimped wires, unprotected 'hot' terminals, and newly installed door supports that appear to be of insufficient strength and are loosely secured to the cabinet wall). We recognize that this is still a prototype, but the potential for injury to uniformed workers is high.

6. ANALYSIS

In this section, the root causes, contributing factors, and direct causes of the incident are identified.

6.1 Root Cause

The basic underlying reason for a transient to occur is called the root cause. Root causes may relate to failures in administrative procedures, engineering devices, or in personal protective equipment. Root cause is defined as, "the most basic cause(s) of an event that, when eliminated or compensated for, will prevent accident recurrence." A root cause is identified by systematically reviewing the facts obtained during an investigation and sorting through these facts to identify the common denominator. The intent of a root cause analysis is not to place blame, but to determine how to classify responsibilities and reduce errors. Collateral purposes of an investigation are to determine the nature and extent of the event and its overall impact; to assist in the improvement of policies, standards, and regulations; and, to improve safety performance.

In this accident, the root cause is related to the fragmented management structure at the site due to its numerous sub-contractors; and an absence of a proactive central organization responsible for overall health and safety management at the site. Each of the principal organizations involved in the PVUSA Project have refused to accept overall responsibility for contractors and employees working on the site. There is numerous evidence to support this conclusion which includes, but is not limited to, lack of written formal safety procedures for electrical safety and "hot" work, no established training guidelines, no established inspection or audit schedules, lack of enforcement of basic safety procedures, and prevalence of an attitude that safety was being or should be managed by someone else.

6.2 Contributing Factors

Contributing factors are defined to include those factors that did not necessarily directly result in the incident, but presented an environment for an incident to occur. In this incident, the contributing causes are related to two key factors. First, the prototype nature and associated operational difficulties of the Bluepoint Associates inverter resulted in large maintenance demands with frequent need for hot work. Furthermore, the structural design and packaging of the inverter housing was not adequate. The use of temporary wooden supports to hold the overhead door in an open configuration was unstable and the height of the door over

the access opening was not sufficient for a 95% man to work comfortably on the unit. It is important to note that the door support had failed at some point during the accident. Second, several of the injured employee's co-workers noted that he occasionally failed to use appropriate personal protective equipment. This practice was never reported to management or his immediate supervisor. Thus, corrective action was not taken.

6.3 Direct Cause

The direct cause arises from the failure of the final protective barrier which isolates the worker from the biologically or physically harmful agent. In this accident, the direct cause was the failure of the injured employee to wear appropriate personal protective equipment (i.e., gloves) or possible failure of the overhead door support causing the injured employee to fall into the energized equipment. In either case, had the employee been wearing Type 0 rubber gloves, the electric shock might have been prevented. Such an accident would also be less likely if proper door support was present. Type 2 gloves, that can be used with voltages up to 17 kV, were available. It is possible that the injured employee failed to use these gloves because of their bulkiness, but this is speculative. This type of glove, however, is not convenient for many tasks and produces an incentive for unsafe work practices. The Type 2 gloves were not intended for the type of work being conducted, but more for work at much higher voltages.

7. RECOMMENDATIONS

Based on the review of the facts established in this investigation, the following recommendations are offered to reduce the possibility of future accidents at the PVUSA site, the funding agencies should require the prime contractor to:

1. Establish a single entity to define, communicate, audit, and enforce safety rules and regulations at the site. We recommend that this authority be vested with PG&E because they are the prime contractor for this project. Because virtually all of the work at the PVUSA site is conducted by contractors, special attention should focus on contractor safety programs and implementation.
2. Establish written rules and guidelines for safety programs. This should include, but not be limited to; electrical safety and "hot" work, general safety, emergency response, training, personal protective equipment, orientation for new employees, and operational readiness reviews.
3. Require review of the structural and electrical configuration of Bluepoint Associates inverter (and other new equipment) prior to purchase and installation to insure that there are no inherent design defects producing increased risk of electrical shock.
4. Support PG&E and Bechtel efforts started after the accident to improve operational safety at the PVUSA site through funding and direct participation in development of safety procedures.
5. Request PG&E to develop and document safety policies and procedures that could be used at other utility photovoltaic sites.

8. SIGNATURES

Lew Jacobson
Lew Jacobson, Co-leader

Paul D. Moskowitz
Paul D. Moskowitz, Co-leader

James O. Garrett
James O. Garrett, Member 2/1

Rick Tyler, Member

APPENDICES

- A. Letter Appointing Investigation Team
- B. Letter Dated August 28, 1991 to Mr. Carl J. Weinberg from Mr. J. Michael Davis
- C. Letter Dated September 27, 1991 to Mr. J. Michael Davis from Mr. Carl J. Weinberg
- D. Personnel Interviewed
- E. Siemens Solar Industries Personnel Accident Investigation Report
- F. Report of Accident at PVUSA Site on 8/7/91
- G. Excerpts from Safety Manuals
Pacific Gas and Electric
Bechtel Construction Company
Siemens Solar Industries

Appendix A
Letter Appointing Investigation Team



Department of Energy
Washington, DC 20585

October 24, 1991

Dr. Paul Moskowitz
Biomedical and Environmental Assessment Group
Building - 475
Brookhaven National Laboratory
Upton, New York 11973

Reference: October 21, 1991 Letter from Stephen Hester, PVUSA
Project Manager, to Alec Bulawka, DOE/PV

Dear Paul:

With regard to Reference, of which you have a copy, I hereby task you to put together a team of pertinent experts for the purpose of visiting the PVUSA-Davis site to review, analyze and upgrade their Health and Environmental Safety (E,H&S) practices for consistency with our programmatic requirements. Let's plan our visit sometime in the December 1991 time-frame.

Alec Bulawka,
Project Manager
Photovoltaic Technology Division

cc: Stephen L. Hester (PVUSA-Davis, Project Manager)
P.G.&E. Research Development
3400 Canyon Road
San Ramon, CA 94583

Jim Rannels, (DOE)

Appendix B

Letter Dated August 28, 1991 to Mr. Carl J. Weinberg from Mr. J. Michael Davis

Department of Energy
Washington, DC 20585

August 28, 1991

Sk "Please send to Michael Davis R&D SW"
GWB
MLB
DAC
RWH
ACTION
COMMENT
F/U
INFO
REPLY
ROUTE
PREPLY
TPM
JWI
JMR
FILE

SEP 9 1991
9125

Mr. Carl J. Weinberg
Director, Research Division
Pacific Gas & Electric Co.
3400 Crow Canyon Road
San Ramon, CA 50583

Dear Carl:

I have just learned of the accident that took place on August 7, 1991, at the PVUSA site in Davis, CA. I hope that Mr. Lamar of Siemens who received the electrical shock will suffer no permanent damage or other ill effects. Please extend to him my best wishes for his speedy recovery.

I would also like to take this opportunity to stress the importance that my office places on safety and environmental protection in carrying out our program activities. This accident prompts me to recommend that the PVUSA Steering Committee review the project's safety plan and environmental protection plan, and the project's actual practices in these areas, to assess their adequacy in both content and implementation. Particular emphasis should be placed on the adequacy of safety training for all types of personnel involved with the project, including on-site personnel, vendors working occasionally on-site, and the numerous visitors to the site.

Please advise me of your response to my recommendation and keep me informed of Mr. Lamar's progress. Thank you for your attention to this matter.

Sincerely,

Michael Davis
Michael Davis, P.E.
Assistant Secretary
Conservation and Renewable Energy

Appendix C

Letter Dated September 27, 1991 to Mr. J. Michael Davis from Mr. Carl J. Weinberg

September 27, 1991



Mr. J. Michael Davis, P.E.
Assistant Secretary for Conservation
and Renewable Energy
U.S. Department of Energy, 6C-016
1000 Independence Avenue, S.W.
Washington, DC 20585

Dear Mike:

In response to your letter dated August 28, 1991, we share your concern regarding safety at the PVUSA site. We have been in regular contact with Siemens Solar Industries (SSI) since Paul Lamar's accident. SSI has informed us in a recent letter that, "He has not yet returned to work pending the results of a complete and ongoing medical evaluation. He seems to be progressing well. The physicians have not provided any written reports to us, and we have not been informed of any serious or long-term problems," and SSI has also just informed us that Mr. Lamar will return to work on October 10, 1991.

According to accident reports filed immediately after the incident, events may be summarized as follows:

At 5:30 p.m. on Wednesday, August 7, Paul Lamar (SSI) and Art Dickerson of Bluepoint Associates Ltd. (SSI subcontractor) were taking measurements inside the Siemens US-1 inverter. Apparently, Mr. Lamar's hand slipped while taking electrical measurements with a hand-held multimeter and his right index finger came into contact with a 380-volt dc conductor. Disoriented but not unconscious, Mr. Lamar was rushed to the hospital by Art Dickerson and Tim Townsend (PVUSA site staff). Mr. Lamar spent the night in the hospital under observation.

Unfortunately, Paul Lamar was not wearing safety gloves at the time of the accident as required by PVUSA and OSHA safety procedures. We have now instituted even more safety meetings with subcontractors' staffs and are monitoring subcontractor activities more closely in order to insure that a similar occurrence will not happen again.

Although there were substantial safety procedures in place at the time of the accident, we are undertaking a comprehensive review of all project safety requirements, procedures, and training. Our safety plans, which must be adhered to by all contractors and subcontractors working at the site, have the following features:

- o All project personnel working at the site are required to undergo periodic CPR and safety training.
- o Weekly field safety meetings are required for all contractors and subcontractors working on site.

- o Field safety boxes containing safety equipment such as fire extinguishers, gloves, hot sticks, and first aid supplies are permanently located in the array field on site at all times.
- o A buddy system is in effect when personnel are working on energized equipment and requires the presence of a second, trained person as a safety observer.
- o As part of our normal visitor orientation, we brief visitors on appropriate safety conduct while in the field.
- o We continually focus on safety at the site and have ongoing reviews of our procedures and training.

The project has an environmental protection policy in effect including:

- o Storing, handling and disposal of toxic substances (chemicals, fuels, lubes, transformer oil, etc.)
- o Fugitive dust control
- o Burning of weeds
- o Solid waste disposal
- o Sanitary waste system
- o Water well (casing sealed to prevent surface contamination entering aquifer)
- o Controlling array testing and washing solutions
- o All site runoff is controlled and no direct releases are made to waterways off site.

The project Steering Committee has on its agenda for the next meeting a full review of project safety and environmental procedures and practices.

In all projects involving PG&E or Bechtel, safety is a primary importance in field operations, and both companies enjoy excellent safety records.

Sincerely,

Carl Weinberg/RWS

cc: Jim Rannels (DOE)

Appendix D
Personnel Interviewed

John Ostrom	Bechtel
Ron Delucchi	PG&E
John Seltzer	Bechtel
Dan Shipman	Bechtel
Steve Hester	PG&E
Ron Lux	Collins Electric
Ingun Littorin	Siemens Solar
Raju Jenamandra	Siemens Solar
Larry Schlueter	Siemens Solar
Art Dickensen	Bluepoint Associates
Tim Townsend	Endecon

Appendix E
Siemens Solar Industries Personnel Accident Investigation Report

Siemens Solar Industries

Personnel Accident Investigation Report

Injured Employee

Paul Lamar *Siemens Employee*

Employee Number

64

Employee's Job Title

Senior Product Engineer

Job During Injury

Construction Mgr, PVUSA US-1

Immediate Supervisor

Larry Schlueter

Department

3301

Date and Time Injured

8/7/91 5:30 am pm

Date and Time Reported to Supervisor

8/8/91 8:00 am pm

Date and Time Reported to Safety Department

8/8/91 8:00 am pm

First-Aid Administered

Art Dickerson, Bluepoint Associates, (805) 7060

First-Aid Administered at the Scene of Injury

Employee placed in a reclining position.

E.R.T.

First-Aid Administered By
□ Yes No Art Dickerson, Bluepoint Associates, (805) 7060 543-530 am pm

Disposition

 First-Aid per Company Nurse

Was employee unable to work on any day

□ Returned to Job

 Sent for Medical Exam

after injury?

What was the Employee doing when injured? Where?

(Please be specific. Identify tools, equipment or material the employee was using.)

Employee was making electrical measurements with a hand held meter
in an electrical cabinet containing high voltage DC terminals.

How did the Accident or Exposure Occur?

(Please describe fully the events that resulted in injury or occupational disease. Tell what happened and how it happened.)

While making electrical measurements, his finger slipped and came into contact with a high voltage DC terminal.

Object or Substance that Directly Injured Employee.

(E.G., The machine employee struck against or which struck him; the vapor or poison inhaled or swallowed; the chemical that irritated his skin; in cases of strains, the thing he was lifting, pulling, etc.)

Electrical current

Describe Unsafe Act(s) and Contributing Factors

not wearing electrical safety gloves

Nature of Injury and Part(s) of Body Affected

Electric shock, hand and arm

Invention's Building of Invention Used for Siemens US-1
System
Art Dickerson, Bluepoint Assoc.
(805) 543-7060

Prepared By

Larry Schlueter

Date

8/13/91

SIE-23 (7-90)

Distribution: White - Safety Center Notebook Canary - Safety Department
Pink - Department Director Goldenrod - PersonnelSiemens Project Manager
for PVUSA Project

Appendix F
Report of Accident at PVUSA Site on 8/7/91

REPORT OF ACCIDENT AT PVUSA SITE ON 8/7/91

RECEIVED
AUG 15 1991

At 1730 hours on 8/7/91 Paul Lamar and Art Dickerson were taking data on the east array of the Siemens US-1 installation at the PVUSA station on Poleline Road at Davis, CA. Paul contacted a DC main inside the DC contactor enclosure at the inverter B location. Art was at the IJB-11 location, approximately 100 feet west of inverter B, and was watching Paul (partly obscured by inverter B). Paul was seen to move abruptly backwards away from the inverter and collide with a metal chair which was behind him. He fell to the ground, railing to his left. A shout (or loud grunt) was heard along with the sound of the chair overturning and the door of the DC contactor enclosure closing. Art ran to the inverter location and found Paul on the ground about four feet northeast of the inverter. He was on his knees and hands, facing east, with his head slumped down onto his chest. The wooden prop for the enclosure door was on the ground, between Paul and the inverter. The metal chair was upset and approximately three feet to the east of Paul.

KW
DAWNTW

His
Boss

Paul was not unconscious, as he was supporting his upper body on his hands, but he was severely disoriented. He called for "Kelly" and while Art was doing a preliminary examination, he called for "Rahju". He did not recognize Art until roughly 20 minutes after the accident. The preliminary examination showed that Paul was breathing, had no airway obstruction and showed no evidence of broken bones. An attempt to obtain a pulse at both the carotid artery and the wrist was not successful, but his color was good and his hands were warm and dry, so the pulse attempt was abandoned. There was no communication means available and the nearest personnel were about 300 yards away. It was not deemed wise to leave Paul unattended in his disoriented condition. Accordingly, he was lifted to a sitting position in the metal chair with a second metal chair in front of him, supporting his arms and upper body. His car keys were recovered and his car driven to the inverter B location from the IJB-11 location. Paul was lifted from the chair and assisted to the front right seat of his car. The car was driven to the main building at the PVUSA site, where Tim Townsend was notified and directions requested to the hospital. At this point about five minutes had elapsed from the time of the accident.

Paul was driven to the emergency room of the Sutter Davis Hospital at Road 99 outside of Davis. This hospital was hard to locate as it is a single-story structure surrounded by trees and 1.5 miles outside of Davis in the surrounding farmland. A road sign 1.0 miles from road 99 was labeled road 99 and this caused some confusion. Art returned to the edge of Davis and asked directions again. During this period, Paul was upright, but with his head slumped on his chest. He complained of chest pains, nausea and extreme overheating. His requests for water were denied, though it was available in the car. His disorientation continued. The hospital was reached at 1742 hours by Art's watch. Paul was admitted and placed on an EKG monitor. At this time, he complained of numbness in his left arm and left leg, and

soreness across the chest, nausea and overheating. His color was good, blood pressure was 118/75 with a pulse of 66. An entrance wound was found on his right index finger about 1.5 inches from the end, opposite the thumb. He was now oriented to the extent that he recognized Art, knew where he was and what day it was.

TM Townsend had driven to the hospital from the site and requested Paul Hutchenson (at the site) to contact Siemens Solar Industries at Camarillo. Through a guard at Camarillo, Jackie Fraser was reached and called the hospital about 1830 hours. Art spoke with her and gave a summary of the events. By this time Paul had been twice examined by doctors at the emergency room and the comment was that he seemed in relatively good shape, but should be observed overnight. Arrangements were made for his admission and at approximately 1945 hours he was placed in a semi-private room. At this time he was still nauseous, but alert enough to joke about his boots. A tic, or jerking action was noted on his right arm. He seemed as comfortable as he was likely to be.

Art returned to the hospital at 0800 hours on 8/8/91. Paul reported that the numbness in his left arm and leg had subsided, but commented on the tic in his right arm and leg and a headache. His color was good and he seemed thoroughly oriented. Art returned to the site at 0845 hours for a meeting.

Art gave accident reports verbally to PG&E (Paul Hutchenson) and Siemens (Rahju and Schlueter) on 8/9/91 and to Bechtel (Clements) on 8/10/91.

SPECULATION ON THE SPECIFICS OF THE ACCIDENT

Paul and Art had completed the measurements necessary to secure the site and turn it over to Bechtel about 10 minutes before the accident. This consisted of a series of simulated ground faults in the east array and tests for false alarms on ground faults. In these tests, Paul would set up the conditions on the array and then Art would take readings at the IJB-ii location. In this, Paul was working directly with the array wiring, with Art watching him. When he finished, he would stand aside and Art would then read the IJB data.

When the ground fault data was complete, Paul said something like "I want to check the transducers" -- this was a little surprising as the transducer calibration had been checked on July 10 by PG&E in the presence of both Paul and Art and found to be OK. There was no reason to suspect the transducers from the ground fault data, although it is the transducer output that is used to establish the ground fault alarm. Paul walked from the IJB to inverter B and began to take measurements with a handheld Fluke DMM. The accident occurred about two minutes later.

It is speculated that Paul was measuring the output of the main current shunts, which appears at the left edge of the transducers terminal board 46 in that his hand (holding the

probe) slipped, causing his right index finger to ~~burn~~ his right index finger to ~~burn~~ the terminal which is at the mains voltage. The return path is unknown, but could be through his boots to ground, or his leg to a disconnect switch. Alternatively, he may have disturbed the wooden prop for the enclosure door, which fell on him and caused his hand to slip.

LESSONS LEARNED FROM THE ACCIDENT

- 1) Leather gloves should be worn when working with the DC mains.
- 2) The wooden prop for the enclosure door should be replaced by a secure-locking device. (material on order)
- 3) A communication means between the array field and the main building at PVUSA should be implemented.
- 4) A supply of blankets at the PVUSA site should be available for cases of shock syndrome or severe weather or where it might be necessary to hold the person in place until an ambulance arrives.



8/14/91

Arthur F. Dickerson

Appendix G.
Excerpts from Safety Manuals

Pacific Gas and Electric Company



STANDARD PRACTICE

STANDARD PRACTICE NO. 726-8

ISSUING DEPARTMENT SAFETY, HEALTH, AND CLAIMSPAGE NO. 1 (of) 9 EFFECTIVE 7/1/91CORPORATE OFFICER VICE PRESIDENT AND GENERAL COUNSELREPLACING ~~PRACTICE NO. 726-8~~ (all of) 11 (of) 11 EFFECTIVE 1/1/82

SUBJECT:

INJURY AND ILLNESS PREVENTION PROGRAM

PURPOSE: This Standard Practice establishes the requirements for the implementation of the Company's Injury and Illness Prevention Program. The Injury and Illness Prevention Program applies to all employees.

PRIOR REVISION: This revision replaces the one dated January 1, 1982.

POLICY: It is the Company's policy to manage its activities in a manner which protects and promotes the safety and health of its employees, and to maintain, as an integral part of its activities, an effective Injury and Illness Prevention Program which conforms to statutory and regulatory requirements.

PROGRAM ELEMENTS: 1. Code of Safe Work Practices:

CODE OF SAFE WORK PRACTICES -

"ACCIDENT PREVENTION RULE BOOK"

The Accident Prevention Rules (APR) Book, which applies to all employees, constitutes the Company's Code of Safe Work Practices. The APR Book shall be provided, at a minimum, to each supervisory employee, and shall be readily available to each employee.

2. Safety Committees:

a. The Central Safety Advisory Committee (CSAC), Accident Prevention Working Committee (APWC), and the Company-Union Health and Safety Committee shall meet as needed, but not less frequently than quarterly to discuss and address safety and occupational health issues.

b. Division/Department Safety Committees shall meet as often as necessary to ensure support for an effective Injury and Illness Prevention Program. The composition of the committees shall be at the discretion of the line officer or his/her designee(s).

c. Division/Department Safety Inspection Committees shall meet at least twice annually. Meeting minutes and attendance rosters shall be documented and maintained in accordance with the provisions of Paragraph 7, Recordkeeping.

EXHIBIT A

*Paragraph Revised (Portions Underlined)

**Paragraph Added



STANDARD PRACTICE

STANDARD PRACTICE NO. 726-8

ISSUING DEPARTMENT SAFETY, HEALTH, AND CLAIMSPAGE NO 2 (or) 9 EFFECTIVE 7/1/91CORPORATE OFFICER VICE PRESIDENT AND GENERAL COUNSELREPLACING ~~PRACTICE NO. 726-8~~ (or) 11 EFFECTIVE 1/1/82

SUBJECT:

INJURY AND ILLNESS PREVENTION PROGRAM

EXHIBITS
B AND C

3. Safety Meetings:

- a. Business Unit and Corporate Services departments shall hold periodic employee safety meetings for the discussion of safety problems and accidents that have occurred. There shall be a minimum of six (6) hours of safety meetings each calendar year for physical and semi-physical employees and a minimum of two (2) hours each calendar year for office workers. Meeting minutes and attendance rosters shall be documented and maintained in accordance with the provisions of Paragraph 7, Recordkeeping.
- b. Construction supervisory employees shall conduct "tailboard" safety meetings to emphasize safety. Tailboard meetings shall be conducted as needed, but not less frequently than once every ten (10) working days.

EXHIBIT D

4. Safety Training:

EXHIBIT E

- a. Business Unit and Corporate Services departments shall have a safety orientation program for all new or newly assigned employees.
- b. Specific training shall be provided to supervisors to familiarize them with the safety and health hazards to which employees under their immediate direction and control may be exposed.

EXHIBIT F

- c. Additional safety training shall be provided to all affected employees whenever (1) new substances, processes, procedures or equipment are introduced to the workplace which represent a new occupational safety and health hazard or (2) whenever the Company has been notified of a new or previously unrecognized hazard.
- d. Subsequent training for all employees shall be provided to ensure maintenance of needed injury and illness prevention skills.

*Paragraph Revised (Portions Underlined)

**Paragraph Added

Pacific Gas and Electric Company



STANDARD PRACTICE

STANDARD PRACTICE NO. 726-8

ISSUING DEPARTMENT SAFETY, HEALTH, AND CLAIMSPAGE NO 3 (e) 9 EFFECTIVE 7/1/91CORPORATE OFFICER VICE PRESIDENT AND GENERAL COUNSELREPLACING ~~726-8-1~~ (e) 1 EFFECTIVE 1/1/82

SUBJECT:

INJURY AND ILLNESS PREVENTION PROGRAM

Six (6) hours of first aid instruction shall be given annually to all field and/or physical employees including meter readers, collectors, estimators, construction field clerks, surveyors, and General Office employees who do regular field work. In addition, specialized first aid training will be given to selected employees in all offices.

- e. All training required by this Standard Practice shall be documented and maintained in accordance with the provisions of Paragraph 7, Recordkeeping.

5. Inspections:

- a. Periodic inspections shall be scheduled regularly and performed by the appropriate department/committee having jurisdiction (see "Responsibilities") to (1) ensure employee compliance with safe work practices and (2) identify work place hazards and unsafe work practices and conditions.

Inspections also shall be scheduled whenever new substances, processes, procedures, or equipment are introduced that represent a new occupational safety and health hazard, or whenever the Company is made aware of a new or previously unrecognized hazard. Records of inspections shall be maintained in accordance with the provisions of Paragraph 7, Recordkeeping.

- b. Results of inspections shall be documented and communicated to affected employees. Results may be communicated through written media such as safety newsletters or bulletins or verbally in safety meetings as appropriate.
- c. Appropriate corrective action shall be taken by local management with respect to identified hazards, deficiencies, and unsafe work practices.

EXHIBITS F,
G AND H

*Paragraph Revised (Portions Underlined)
**Paragraph Added

Pacific Gas and Electric Company



STANDARD PRACTICE

STANDARD PRACTICE NO. 726-8

ISSUING DEPARTMENT SAFETY, HEALTH, AND CLAIMSPAGE NO 4 (or) 9 EFFECTIVE 7/1/91CORPORATE OFFICER VICE PRESIDENT AND GENERAL COUNSELREPLACING ~~PAGE NO. 11 (or)~~ EFFECTIVE 1/1/82

SUBJECT:

INJURY AND ILLNESS PREVENTION PROGRAM

EXHIBIT F

- Corrective action taken shall be documented, and records maintained in accordance with the provisions of Paragraph 7, Recordkeeping.
- d. When an imminent hazard exists which cannot be corrected immediately without endangering employee(s) and/or property, all employees exposed to the hazard shall be removed from the area except those necessary to correct the condition. Employees necessary to correct the condition shall be provided the required safeguards.
- e. When a serious concealed danger is suspected to exist, the Safety, Health, and Claims Department shall be contacted immediately (Director of OSHA Compliance: 223-3163 or Director of Safety Engineering: 223-3168) to determine if Cal/OSHA and affected employees must be informed in writing. A serious concealed danger is one which (1) results from normal Company operations, (2) poses a substantial probability of death or great bodily harm, and (3) is not readily apparent to the individual who is likely to be exposed.

6. Investigations:

EXHIBIT I

- a. All occupational injuries, illness or exposures to hazardous substances shall be investigated as appropriate by the department/committee having jurisdiction (see "Responsibilities") and documented.
- b. Investigation records shall be maintained in accordance with the provisions of Paragraph 7, Recordkeeping.

7. Recordkeeping:

EXHIBIT I

- a. Documentation of training shall, as a minimum, include the employee's name, instructor's name, training dates, and type(s) of training received.

*Paragraph Revised (Portions Underlined)

**Paragraph Added

Pacific Gas and Electric Company



STANDARD PRACTICE

STANDARD PRACTICE NO. 726-8

ISSUING DEPARTMENT SAFETY, HEALTH, AND CLAIMSPAGE NO 5 (or) 9 EFFECTIVE 7/1/91CORPORATE OFFICER VICE PRESIDENT AND GENERAL COUNSELREPLACING PAGE NO 5 (or) 11 EFFECTIVE 1/1/82

SUBJECT:

INJURY AND ILLNESS PREVENTION PROGRAM

EXHIBITS F,
G AND H

- b. Documentation of inspections and investigations shall, as a minimum, include the name of the person(s) conducting the inspection or investigation, the hazards, deficiencies, or unsafe work practices identified, and the corrective actions(s) taken.
- c. All meeting minutes, training records, inspection and investigation records, and documentation of actions taken to correct identified hazards, deficiencies, and unsafe work practices shall be retained by local offices for at least three (3) years.

8. Compliance:

Methods to ensure employee compliance will include, but not be limited to, training and education, prompt action on issues discovered by audits, inspections, investigations, and evaluations, and use of approved Company disciplinary procedures where appropriate.

9. Contractual Relationships:

As part of its obligations to the Company, prior to commencing any work, all contractors and subcontractors shall certify that each has an effective Injury and Illness Prevention Program which meets the requirements of all applicable laws, including but not limited to Section 6401.7 of the California Labor Code.

Such certification shall be made by the person with the authority and responsibility for implementing and administering that company's Injury and Illness Prevention Program.

IMPLEMENTATION: Each officer is responsible for the implementation of the Injury and Illness Prevention Program within the operations and business activities for which he or she is responsible.

*Paragraph Revised (Portions Underlined)

**Paragraph Added

Pacific Gas and Electric Company



STANDARD PRACTICE

ISSUING DEPARTMENT SAFETY, HEALTH, AND CLAIMSSTANDARD PRACTICE NO. 726-8CORPORATE OFFICER VICE PRESIDENT AND GENERAL COUNSELPAGE NO 6 (or) 9 EFFECTIVE 7/1/91REPLACING ~~PAGE NO 8-11 (or)~~ EFFECTIVE 1/1/82

SUBJECT:

* INJURY AND ILLNESS PREVENTION PROGRAM

RESPONSIBILITIES: President:

The President approves standards, procedures, and injury and illness prevention rules to protect and promote the safety and health of Company employees, customers, and the public at large.

Vice-President and General Counsel:

The Vice-President and General Counsel is responsible for issuing, updating, and monitoring compliance with the Company's Injury and Illness Prevention Program. The Vice-President and General Counsel also monitors compliance with occupational health and safety laws and regulations, and advises Business Unit General Managers and other senior officers, as appropriate, of serious deficiencies.

Business Unit General Managers:

Business Unit General Managers take appropriate action to correct significant deficiencies noted as a result of any investigation, inspection, evaluation, or audit, and advise the Safety, Health, and Claims Department and the Vice-President and General Counsel of the actions taken.

Officers:

Each officer ensures that the operations and business activities for which he or she is responsible are conducted in accordance with the Company's safety and health standards, procedures, and accident prevention rules. Each officer also ensures that all employees are periodically informed of the Company's safety and health standards, procedures, and accident prevention rules.

Employees:

Each employee fully supports, participates in, and complies with the Company's Injury and Illness Prevention Program.

*Paragraph Revised (Portions Underlined)

**Paragraph Added

Pacific Gas and Electric Company



STANDARD PRACTICE

STANDARD PRACTICE NO. 726-8

ISSUING DEPARTMENT SAFETY, HEALTH, AND CLAIMSPAGE NO 7 (of) 9 EFFECTIVE 7/1/91CORPORATE OFFICER VICE PRESIDENT AND GENERAL COUNSELREPLACING ~~RELEASING all on~~ EFFECTIVE 1/1/82

SUBJECT:

INJURY AND ILLNESS PREVENTION PROGRAM

Central Safety Advisory Committee (CSAC):

The Central Safety Advisory Committee reviews industrial accidents and safety issues, and recommends new or revised safety and health standards, procedures, and accident prevention rules for approval by the President.

Accident Prevention Working Committee (APWC):

The Accident Prevention Working Committee functions as staff to the CSAC. In this role it studies, coordinates, and prepares subjects presented to the CSAC. The APWC makes recommendations to the CSAC that include input from affected organizations.

Company-Union Health and Safety Committee:

This committee of Company and Union members promotes safe working conditions and safety awareness on the part of both supervisors and other employees, and performs other functions as outlined in Section 105.3 of the Agreement between PG&E and IBEW Local 1245. It also provides an additional avenue for employee input on health and safety issues.

Safety, Health, and Claims (SH&C):

The Safety, Health, and Claims Department provides staff consultation support to division/department management and safety committees to enhance their ability to implement effective Injury and Illness Prevention Programs. This support includes, but is not limited to, providing inspections on request, providing safety communication devices, maintaining and publishing the Accident Prevention Rules Book, and providing professional advice and counsel.

SH&C also provides support services to assist the CSAC to analyze the requirements of safety and health laws and regulations, and to develop appropriate standards, guidelines and accident prevention rules in consultation with affected business units and corporate services.

*Paragraph Revised (Portions Underlined)

**Paragraph Added

Pacific Gas and Electric Company



STANDARD PRACTICE

STANDARD PRACTICE NO. 726-8

ISSUING DEPARTMENT SAFETY, HEALTH, AND CLAIMSPAGE NO 8 (or) 9 EFFECTIVE 7/1/91CORPORATE OFFICER VICE PRESIDENT AND GENERAL COUNSELREPLACING ~~REB-726-8~~ all (or) 11 EFFECTIVE 1/1/82

SUBJECT:

INJURY AND ILLNESS PREVENTION PROGRAM

In addition, SH&C supports the Vice-President and General Counsel's responsibility for monitoring compliance by initiating and conducting regularly scheduled audits, inspections, evaluations and investigations, and making specific recommendations to management. SH&C advises the appropriate officer and Vice-President and General Counsel of any significant deficiencies noted as a result of any investigation, inspection, evaluation or audit.

Division/Department Safety Committees:

These committees recommend and coordinate education and training programs, evaluate local injury trends, review investigations of accidents or occupational hazards, perform safety inspections and/or coordinate inspections by Division/Department Safety Inspection Committees. Based on analysis of trends, investigation reviews, and inspection results, the committees recommend to division/department management courses of action to ensure an effective Injury and Illness Prevention Program. In addition, these committees provide a communication link between systemwide safety committees, division/ department management, and other employees. Each committee member makes himself/herself available for input from employees on safety and health issues. To fulfill their roles, the committees are supported by the CSAC and SH&C.

Division/Department Safety Inspection Committees:

These committees are comprised of employees as determined by Section 105.8 of the Agreement between PG&E and IBEW Local 1245. They conduct safety inspections and make recommendations to division/department management on courses of action to ensure an effective Injury and Illness Prevention Program. Each committee member makes himself/herself available for employee input in safety and health issues.

EXHIBIT A

*Paragraph Revised (Portions Underlined)

**Paragraph Added

Pacific Gas and Electric Company



STANDARD PRACTICE

STANDARD PRACTICE NO. 726-8

ISSUING DEPARTMENT SAFETY, HEALTH, AND CLAIMSPAGE NO 9 (of) 9 EFFECTIVE 7/1/91CORPORATE OFFICER VICE PRESIDENT AND GENERAL COUNSELREPLACING ~~PAGE 726-8~~ all (of) 1 EFFECTIVE 1/1/82

SUBJECT:

INJURY AND ILLNESS PREVENTION PROGRAM

REFERENCES:

Accident Prevention Rules Book
 Supervisors' Handbook
 Corporate Policy Manual, Section E3.6, Safety and Health
 Company - Union Agreement Between PG&E and Local 1245 of
 the IBEW.

ISSUED BY:

Etta G. Herbach
 Etta G. Herbach
 Manager
 Safety, Health, and Claims Department

APPROVED BY:

Howard V. Golub
 Howard V. Golub
 Vice-President and General Counsel

DISTRIBUTION:

Officers
 Division Managers
 Department Heads

Additional copies of this Standard Practice may be obtained from the Safety, Health, and Claims Department, Company extension 223-5254.

*Paragraph Revised (Portions Underlined)

**Paragraph Added

Bechtel Construction Inc.

Job No. 19271

Pacific Gas & Electric

PV-USA Project

OSHA

Davis, California

Safety Action Plan

This Safety Action Plan provides guidelines for the implementation of an Accident Prevention Program on the PV-USA Project. The plan incorporates provisions for achieving compliance with the statutory requirements of the Occupational Safety and Health Act (OSHA), Bechtel Construction, Inc. (Construction Manager) safety requirements, and PV-USA rules and regulations. It is designed to create a safe and healthful work environment and to minimize the cause of accidents and damage to equipment property.

1.0 RESPONSIBILITIES

1.1 Pacific Gas & Electric

Acknowledges its support and grants Construction Manager the authority to implement and enforce an effective project safety program.

1.2 Bechtel Construction, Inc. (Construction Manager)

1.2.1 Implement and enforce the Project Safety Program

1.3 Contractor/Subcontractor

1.3.1 Establish responsibilities and accountabilities for the implementation of this Project Safety Action Plan.

1.3.2 Monitor and record the safety activities of their employees.

1.3.3 Effectively minimize the potential for losses by approved accident prevention methods.

2.0 SAFETY ORIENTATION FOR NEW HIRES

Each new hire or transferee shall promptly receive a safety orientation which is intended to provide the employee with basic information regarding the Project Safety Action Plan. A copy of the contractor's/subcontractor's safety rules will be given to each employee.

3.0 WEEKLY TOOL BOX SAFETY MEETINGS

Conducting Weekly Tool Box Safety Meetings is the responsibility of the Contractor/Subcontractor. The meeting shall be conducted every Monday morning at the start of shift. Documentation will be maintained by the Contractor/Subcontractor for review by Construction Manager.

If no work is performed on this project on any given Monday, then the Weekly Tool Box Safety Meeting shall be conducted on the next scheduled working day.

The meeting shall provide employees with the opportunity to ask questions regarding safety.

The actual meeting time should not exceed fifteen (15) minutes.

Each person who conducts a Weekly Tool Box Safety Meeting shall have all in attendance sign the Weekly Tool Box Safety Meeting Report during the meeting.

4.0 SAFE WORK AREAS

The Contractor/Subcontractor shall be expected to be familiar with the conditions in each area of the project where personnel are assigned. Unsafe conditions that exist in the work area shall be corrected prior to commencement of work when possible; otherwise, the problem shall be brought to the attention of Construction Manager.

5.0 SAFE WORK PRACTICES

When making work assignments, the Contractor/Subcontractor shall inform personnel of safe practices, work methods, and personal protective equipment required. The Contractor/Subcontractor is responsible for insuring that personnel uses the proper protective equipment and suitable tools for the job.

The following specific areas should be continually monitored by the Contractor/Subcontractor:

- o In the following the progress of the work assigned, the Contractor/Subcontractor shall constantly review the safety procedures and practices by personnel and shall initiate corrective action when necessary.
- o In all operations, especially those that are not routine, make sure that safety precautions are determined and followed.
- o Instruct personnel on how to work safely, using all types of personal protective equipment.
- o Instruct personnel in the proper handling of hazardous material.
- o Keep all personnel informed of the jobsite safety policy.

6.0 EMERGENCY PROCEDURES

The Contractor/Subcontractor shall develop and implement procedures which detail reasonable response to all types of project emergencies.

7.0 ACCIDENT INVESTIGATIONS

The Contractor/Subcontractor is required to participate actively in the investigation of any accident that occurs in their area that results in:

- o Personal injury to employees under their direction.
- o Equipment or property damage in their area of responsibility.
- o Near misses that had a potential for serious injury or loss. The investigation should be aimed at determining facts, not fault, so that recurrences can be prevented.

The Contractor/Subcontractor shall insure that all employees under their supervision are aware of their obligation to immediately report all injuries, however minor, to the Contractor/Subcontractor.

8.0 INCIDENT REPORTING

The Contractor/Subcontractor shall cooperate with the Owner and Construction Manager in investigating any major safety-related incidents. Additionally, the Contractor/Subcontractor shall immediately investigate and submit to Construction Manager written reports of all accidents wherein disabling injuries or fatalities occur or which result in damage to property or fire loss. These reports shall be submitted within twenty-four hours of the occurrence.

9.0 RECORDKEEPING

The Contractor/Subcontractor shall complete and maintain OSHA 200 Form for all safety-related incidents. The form shall be made available for inspection and review by Construction Manager. The Contractor/Subcontractor shall complete injury forms as required after an occupation injury or illness.

10.0 SAFETY INSPECTION

The Contractor/Subcontractor shall participate, through a Contractor/Subcontractor Designated Safety Representative acceptable to Construction Manager, in periodic general safety inspection tours conducted by a member or members of the Construction Manager Safety Department and Construction Manager's contract coordinator assigned to the Contractor's/Subcontractor's. During these inspections, the Contractor's/Subcontractor's Designated Safety Representatives shall identify and record safety violations, and list such items for action and immediate correction by the Contractor/Subcontractor. If the Contractor/Subcontractor has any subcontractors, a representative of each subcontractor may accompany the inspection. The Contractor/Subcontractor shall provide Construction Manager with a list of items designated for correction.

11.0 SPECIFIC PROJECT SAFETY PROGRAMS AND PROCEDURES

The following programs and procedures will be implemented as required to complement the Project Safety Program.

11.1 Fire Protection and Prevention Program

Each Contractor/Subcontractor is expected to maintain a constant awareness of the fire potential in his area of responsibility. The Contractor's/Subcontractor's operations shall be conducted in such a manner as to: (1) not create any fire hazards, and (2) comply with fire protection/prevention and suppression requirements.

The Contractor/Subcontractor shall provide fire suppression equipment that is adequate for potential hazards that may be encountered during its operations and shall instruct its employees in the proper use and handling of such equipment.

If a fire is noted, the supervisor shall immediately notify the Construction Manager's Site Manager. Notification will be made to the local fire department for assistance.

12.0 ENFORCEMENT POLICY

The Contractor/Subcontractor shall advise each employee that any employee who jeopardizes his health and safety and/or the health and safety of others will be subject to disciplinary action.

13.0 FIRST AID

The Contractor/Subcontractor shall establish a procedure for providing medical treatment and emergency transportation for all injured employees. The requirements of this procedure shall comply with OSHA First Aid/ Medical Regulations.

14.0 OCCUPATIONAL HEALTH

The Contractor/Subcontractor shall take all reasonable steps and precautions to protect the health and minimize danger from all hazards to life and property. The Contractor/Subcontractor shall conduct occupational health monitoring and/or sampling as required or requested by Construction Manager to determine the levels of exposure of its employees to hazardous or toxic substances or environmental conditions.

15.0 OTHER SAFETY PROGRAMS

Other safety programs will be developed as needed; i.e., scaffold tagging, confined space, respiratory protection, hearing conservation, hot work, tag and lock out, etc.

16.0 CONTRACTOR/SUBCONTRACTOR REQUIREMENTS

As a contractual agreement, each Contractor/Subcontractor shall prepare and submit for review a safety program within seven (7) working days after contract start which the Contractor/Subcontractor develops to provide a safe and healthful work environment for their employees.

Before work begins on an awarded contract, a preconstruction meeting is arranged with Construction Manager and the Contractor's/Subcontractor's management. The project safety policy, the work safety regulations, and the safety procedures will be presented to the Contractor/Subcontractor. The safety policies and OSHA standards will be reviewed and coordinated to conform with the Contractor's/Subcontractor's safety requirements and the Project Safety Program.

The Contractor/Subcontractor shall submit the name of their designated safety representative within five (5) days of mobilization. This designated safety representative shall be vested with authority so corrective action of safety related problems can be completed in a timely manner.

- The Contractor's/Subcontractor's designated safety representative will attend periodic Project Safety Meetings conducted by Construction Manager's Site Manager to assist in the resolution of safety issues and implement corrective action as required. Owner representatives will attend when areas of concern are relative to their operations.

17.0 CONCLUSION

This Safety Action Plan governs and controls the Project Safety Policy and the safety procedures which have been developed and initiated for this project. Each document meets or exceeds the minimum requirements of OSHA regulations. Together, they are an effective instrument in reducing the injury/illness potential.

SUPPLEMENT TO PARAGRAPH 15.0 OF THE
PVUSA SAFETY ACTION PLAN

15.1 CLEARANCES, PROPER USE OF TAGS, AND RECORD KEEPING

The site shall implement Pacific Gas and Electric company standard practices for clearances, tagging, and recordkeeping. The site shall have at least two bound copies of the following updated procedures:

- 15.1.1 PG&E standard practice 403-3, proper use of tags and control handle barricades: man-on-line, non-test, caution and approved tag holders.
- 15.1.2 PG&E electric general operating instructions.
- 15.1.3 PG&E general operating orders, revision 12.

15.2 REQUIREMENTS FOR WORKING WITH ENERGIZED DC VOLTAGES IN EXCESS OF 25 VOLTS DC.

All personnel working in or around exposed dc voltages in excess of 25 volts dc must abide by the following safety rules:

- 15.2.1 PRIOR to working on energized dc circuits the site manager or his designee must be contacted and briefed on the work to be performed.
- 15.2.2 All personnel working on energized dc circuits must wear safety glasses and approved lineman's rubber insulating gloves and leather protectors. The rubber gloves must meet the requirements of ASTM D 120 class 0 or better.
- 15.2.3 All personnel working on energized dc circuits must be accompanied by a second individual while performing the task. The second individual is responsible for watching the worker and providing emergency assistance when needed.
- 15.2.3.1 Either a portable radio or cellular phone will be checked out to the second individual at the time of task briefing with the Site Manager. The radio or phone is for emergency communications only.

DATE: August 15, 1990

SUBJECT: Safety at Siemens Solar Industries, L.P.

FROM: Charles F. Gay, President

TO: All Employees

A COMMITMENT TO SAFETY

Safety forms the foundation for the manner in which we treat each other, our customers and the communities around the world where we have plants and offices. Safety is a key ingredient of business success.

The basic principle of safety is that ALL personal injuries are avoidable. Safety must precede every other work consideration. Personal safety depends on a sincere and continuous effort to exercise good judgment in conducting our daily activities.

The Company's position on standards of employee behavior were established at the beginning in October of 1977. A company's conduct depends, first, on a clear line of direction from senior management, and then on the good faith and judgment of every employee in carrying out that policy. Let me, therefore, make it unmistakably clear that our policy--a policy for which every employee is to be held accountable--is to maintain Siemens Solar Industries honorable reputation as a company of the highest standards of responsibility and accountability. To accomplish this simple but sometimes difficult objective, we rely not on a book of detailed rules but on the character and judgment of every employee. Moreover, I have full faith that Siemens Solar Industries employees at all levels will continue to conduct themselves so that their actions will never embarrass or disgrace themselves or the company.

Safety requires that we think of people as people, both in groups and individuals. At Siemens Solar Industries we do not have lists of detailed "do's" and "don't's" but rely on the Golden Rule to assure that every employee is individually responsible and fully accountable for his or her actions or lack of action to ensure the safety and health of each of us.

Safety requires constant attention. It is no more automatic than cost control or quality assurance. Safety requires concentration. A safe individual sees what he or she is looking at, instead of looking over or through it. This kind of attention not only makes us work more safely but more intelligently. Everyone in every job must be involved in this process. There are no exceptions and can be no exemptions. If you have any suggestions for improving the safety performance of our operations, please let me know. The lines of communication are open and available to everybody.



SAFETY AND HEALTH POLICY

Management has an obligation to protect the integrity of the Company's human, physical, and financial resources. We recognize our responsibility to manage our business in such a way that these resources are conserved and utilized effectively. Accordingly, our policy is to:

1. Furnish work places free from recognized hazards which are likely to cause death, injury or illness.
2. Comply fully with laws regulating employee safety and health.
3. Recognize the priority of safety and health factors where there is competition with economic factors.
4. Provide a professional staff to support safety and health programs.
5. Hold each supervisor accountable for the safety performance of their activity and regularly measure their achievement in controlling accidents and losses.
6. Train employees in safe procedures and require compliance with safety regulations and procedures.
7. Develop and use better methods for reducing human and economic cost of accidents and other losses.
8. Monitor progress toward a safer and healthier work place environment on a regular basis.

SAFETY RULES

Because safety violations can cause serious injury, we abide by rules that are designed to ensure employees' safety. The following are the safety rules for Siemens Solar Industries.

1. All injuries, no matter how slight, must be reported to the supervisor immediately.
2. Only trained and authorized personnel with proper safety equipment may use welding and machine shop equipment, drive forklifts, or work with or dispose chemicals.
3. Smoking, eating, or drinking is allowed only in designated areas.
4. Safety equipment must be worn in all designated areas.
 - a. Eye protection and safety shoes must be worn in all designated areas and operations.
 - b. Work with hazardous chemicals requires safety glasses, a face shield, chemical resistant aprons and sleeves or chemical resistant coveralls.
 - c. Eye protection, gloves, and lab coats must be worn while handling chemicals.
5. Proper attire must be worn in production areas.
 - a. Where safety shoes are not required, shoes must be low heeled and completely enclosed.
 - b. Loose clothing, dangling jewelry and rings must not be worn, and long hair must be tied back while operating equipment with moving parts. Shorts and tank tops are not allowed in the production area.
 - c. Neckties must be tucked inside shirts while in the operating areas.

ORGANIZATIONS AND RESPONSIBILITIES

I. MANAGEMENT

Management has the ultimate responsibility for safety and health programs at Siemens Solar Industries.

II. SAFETY, HEALTH, AND ENVIRONMENTAL DEPARTMENT

This department is a consultant to management in the areas of safety, health, and environmental issues. The department has the responsibility to keep management abreast of codes, regulations, and current trends. The department also measures the effectiveness of safety and health programs by the use of statistics and trend analysis. Effectiveness is continually monitored by the use of audits and statistics.

III. DEPARTMENT MANAGEMENT

Department management is responsible for carrying out the recommendations of upper management. It is also responsible for the day-to-day enforcement of safety rules and practices.

IV. EXECUTIVE SAFETY COMMITTEE

The Executive Safety Committee consists of management personnel and meets periodically as a method to meet its responsibilities in the areas of safety and health. The Committee considers information and recommendations from staff and other committees, evaluates options, and reports findings to upper management.

VI. EQUIPMENT SAFETY REVIEW COMMITTEE

All proposals for new, modified, or relocated equipment or processes must be reviewed and approved by the Equipment Safety Review Committee (ESRC) prior to start-up or operation. This includes approving operations, maintenance, and shutdown procedures; conducting hazard analysis for all new or modified equipment, facilities, or materials; auditing incorporation of fail-safe systems; developing backup plans for system failures; and acting on inquiries from personnel regarding concerns for potential hazards.

The responsible engineer will request a meeting of the ESRC with the ESRC Chairperson. The engineer is responsible for providing necessary documentation as specified in Manufacturing Procedure, Equipment Safety Review Committee Overview, No. 40-013, two days prior to the meeting.

The ESRC Chairperson's name may be obtained from the Safety, Health, and Environmental Department.

E. ELECTRICAL LOCKOUT PROCEDURES

A lockout device must not be tampered with - only the initiator can remove the device. If that person is not available, then his/her supervisor may remove the tag. Anyone tampering with or removing a lockout device without permission from the initiator will be released from employment with Siemens Solar Industries.

This procedure must be followed to ensure protection for personnel working on applicable equipment.

1. Requirements for Use of Lockouts and Tags

- a. Work on electrical equipment or systems shall be performed by qualified personnel only, and appropriate procedures as specified in "Lockout Procedures For Working on Electrical Equipment," Number 40-002, Rev. B must be followed.
- b. A piece of electrical equipment is considered locked out if power is removed and it is physically locked and a danger tag is attached.

2. Lockout and Tag Uses

Only qualified personnel shall work on electrical equipment, and they are authorized to use the following padlocks, lockouts, devices, and tags for personal protection and to warn of potential danger.

Padlock. An approved padlock must be used to secure main electrical disconnect switches.

Multiple Lockout. A multiple lockout device must be used to secure main electrical disconnect switches if more than one person is working on a piece of equipment.

Distribution Panel Lockout. The distribution panel lockout must be used to secure a distribution panel circuit breaker.

Danger Tag. A danger tag must be used in conjunction with a padlock or multiple lockout.

Notice Tag. A notice tag must be used when written instructions are attached to the equipment.

6. Work Procedure on Tagged or Locked Out Equipment

Prior to performing work on a piece of equipment that has been locked out, check to ensure that other personnel are safe and clear of the equipment, and only then attempt to start the equipment to ensure that it will not operate. Check that all sources of danger have been properly inactivated and tagged.

7. Lockout and Tag Removal

- a. Lockout devices can only be removed by the person who installed them. If the person is not available after the job is completed, that person's supervisor should be notified immediately. The supervisor will then assume the responsibility of verifying that the lockout can be safely removed and the equipment safely operated. The supervisor may remove the lockout.
- b. Equipment with lockout devices installed must not be started or operated until each lockout has been removed.
- c. Personnel replaced or exchanged on a job during a shift must ensure that the lockouts of their replacement are substituted for their own lockout before leaving the job.
- d. Lockout devices shall be left on the equipment at the end of a shift if the job has not been completed and checked.

F. WORKING WITH ENERGIZED CIRCUITS

1. The following definitions are used in this procedure:

HIGH VOLTAGE: Any electrical circuitry that is operating at or more than 50 volts and is capable of a current flow of greater than 0.005 amperes.

"HOT WORK": Any work performed on or close to exposed high voltage.

CURRENT LIMITING: Any circuitry that has the inherent capability of limiting the current flow in the circuit regardless of the voltage applied to the resistance involved.

2. Protective Devices

- a. High voltage electrical equipment must be equipped with protective devices such as interlocks or other similar means that will assure that the main electrical power supply will be cut off when one of the panels is removed, so that high voltage components are not exposed. Except as provided in other parts of this procedure, no work will be performed on electrical circuits unless the power is off and secured in such a way as to prevent accidental or unauthorized activation.
- b. Exception: Equipment with current limiting devices that restrict current flow to 0.005 amperes or less may be worked with exposed circuits energized regardless of voltage. Figure 1 presents the basis for this criteria.

N.E.C. Section 210-8

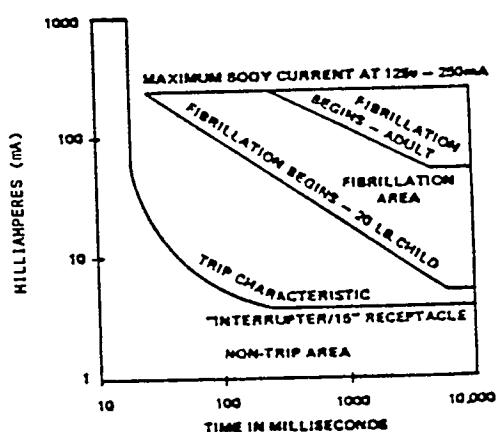


Fig. 1. FATAL FIBRILLATION OF THE HEART CAN OCCUR AFTER EXPOSURE TO AS LITTLE AS SIXTY 1/1000 AMPERE (60 milliamperes).

G. SAFETY REQUIREMENTS FOR ON-SITE WORK BY OUTSIDE CONTRACTORS

1. The SSI employee responsible for hiring contractors must brief them on safety rules and procedures, including:
 - A. Evacuation procedures and location for headcount.
 - B. Personal protective equipment, namely safety glasses, safety shoes, hard hats, respiratory protection, chemical, and other protective gear as required for the job. Safety glasses are required in all laboratory areas, safety glasses and safety shoes are required in all production areas.
 - C. Appropriate sign-in and sign-out procedure. All contractors must sign in and out with the Security Guard or the Receptionist.
 - D. Plant rules and regulations as provided in purchase order attachment "CR-1": **PLANT RULES AND REGULATIONS FOR CONSTRUCTION CONTRACTORS**. CR-1 is available from the Purchasing Department or the Safety, Health & Environmental Department.
2. The SSI employee responsible for hiring contractors is referred to as the "Project Coordinator" in the CR-2 purchase order attachment. As such, the Project Coordinator is responsible to:
 - A. Ensure that the contractors follow the SSI plant rules and regulations.
 - B. Account for all contractor personnel in the event of an evacuation.
 - C. Designate an alternate Project Coordinator should the need arise to leave the premises.
 - D. Review any particular hazards specific to the task at hand with the contractor before the contractor begins the work.
 - E. Ensure that the Safety, Health & Environmental Department (S,H,&E) approves the hazardous materials a contractor proposes to use.

I. HOUSEKEEPING

Housekeeping is one of the most important factors in accident prevention. Employees can trip over objects on floors, stairs, and platforms; be struck by articles falling from overhead; slip on greasy, wet, or dirty floors; walk against projecting, poorly stacked, or poorly placed material; be struck by improperly supported material; or be cut by projecting sharp objects.

Industrial housekeeping provides for an orderly arrangement of operations, tools, equipment, storage facilities, supplies, and waste material. Clean working conditions are essential to the safety of all employees and should be maintained at all times in both plant and office areas. Good housekeeping is evidenced by floors free from grease and oil spillage, properly marked aisles with unobstructed access and exit, neat and orderly machinery and equipment, well-nested hoses and cables, properly stored materials, removal of excessive material waste or debris from the working area, and adequate lighting. Orderliness and good housekeeping are fundamentals of good management. Where these conditions are found, there is usually a low accident and injury rate.

1. Procedures

Some examples of the basic safe housekeeping practices essential to a well-managed facility are provided below:

- Adequate aisles and passageways must be provided in all shop, warehouse, and office areas. All aisles, passageways, and stairways must be kept clear of tools, materials, liquids, grease, and debris, including welding rod tips, wood, bolts, nuts, paper, and similar materials.
- Air, gas, and oxygen hoses and electrical conductors must be elevated over all walkways, working surfaces, ladders, and stairs or be covered by housings or otherwise nested where they will not create a tripping hazard.
- All work areas must be kept free of debris. Material must be stored so that it will not fall on employees.

Subject : R&D Safety Manual Supplement

To : CIS R&D Group

From : Chris Eberspacher

Chris

ce31:safsup

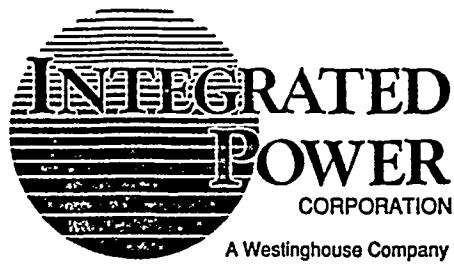
This R&D Safety Manual Supplement provides safety information specific to CIS/R&D activities. It is intended to supplement the Company policies contained in the Safety Manual with additional information on R&D teams, resources, and procedures.

The basic priorities for the CIS/R&D Group are safety and health, quality of work, and achievement of performance goals, in that order. The application of these basic priorities to the real workplace requires a combination of cooperative pragmatism and attentive responsibility. Safety and R&D progress are never to be traded-off one against the other. There is always a safe way to achieve timely progress, and no unsafe compromises are ever appropriate. Progress is achieved by a reasoned, pragmatic application of safe practices to the job at hand. Cooperation between individuals and groups is essential in identifying safe alternatives and agreeing on workable solutions. The responsibility for both safety and progress is shared by each individual. Each person is responsible and accountable both for his/her personal safety and health and for the safety and health of others. Individuals must be attentive, assertive and active in fulfilling their safety and health responsibilities. Management is accountable for providing the resources, training and supervision necessary for individuals to fulfill their responsibilities. Management is also responsible for providing direction and discipline as necessary to assure complete compliance with all safety policies.

The personal responsibility held by each individual is matched by the direct authority given to each individual. Each person in the Group is explicitly authorized to raise safety and health concerns, initiate safety improvements, activate emergency warning systems, and obtain emergency aid for himself or others. Every individual should be clear on how to do his/her job safely, and on how to properly respond to emergencies. Any questions should be immediately directed to your supervisor.

If you have any questions about R&D's safety and health policies or suggestions on improving the safety of the workplace and the health of the workforce, then please come speak with me. I am committed to working with you to assure a safe and healthful workplace.

Please file this R&D Safety Manual Supplement in your Safety Manual under Specific Department Practices.



INTEGRATED POWER CORPORATION

SAFETY ACTION PLAN FOR PVUSA PROJECT DAVIS, CA

This Safety Action Plan provides guidelines for the implementation of an Accident Prevention Program on the PVUSA Project. The plan incorporates provisions for achieving compliance with the statutory requirements of the Occupational Safety and Health Act (OSHA), Bechtel Construction, Inc. (Construction Manager) safety requirements, and PVUSA rules and regulations. It is designed to create a safe and healthful work environment and to minimize the cause of accidents and damage to equipment property.

1.0 RESPONSIBILITIES

- 1.1 Bechtel Construction, Inc. (Construction Manager)
 - 1.1.1 Implement and enforce the Project Safety Program
- 1.2 Integrated Power Corporation (IPC)
 - 1.2.1 Establish responsibilities and accountabilities for the implementation of this Project Safety Action Plan.
 - 1.2.2 Monitor and record the safety activities of employees and subcontractors.
 - 1.2.3 Effectively minimize the potential for losses by approved accident prevention methods.

2.0 SAFETY ORIENTATION FOR NEW HIRES

Each new hire or transferee shall promptly receive a safety orientation which is intended to provide the employee with basic information regarding the Project Safety Action Plan.

3.0 WEEKLY TOOL BOX SAFETY MEETINGS

Conducting Weekly Tool Box Safety Meetings is the responsibility of IPC. The meeting shall be conducted every Monday morning at the start of shift.

If no work is performed on this project on any given Monday, then the Weekly Tool Box Safety Meeting shall be conducted on the next scheduled working day.

The meeting shall provide employees with the opportunity to ask questions regarding safety.

The actual meeting time should not exceed fifteen (15) minutes.

4.0 SAFE WORK AREAS

IPC shall be expected to be familiar with the conditions in each area of the project where personnel are assigned. Unsafe conditions that exist in the work area shall be corrected prior to commencement of work when possible; otherwise, the problem shall be brought to the attention of the Construction Manager.

5.0 SAFE WORK PRACTICES

When making work assignments, IPC shall inform personnel of safe practices, work methods, and personal protective equipment required. IPC is responsible for insuring that personnel use the proper protective equipment and suitable tools for the job.

The following specific areas shall be continually monitored by IPC:

- In following the progress of the work assigned, IPC shall constantly review the safety procedures and practices by personnel and shall initiate corrective action when necessary.
- In all operations, especially those that are not routine, make sure that safety precautions are determined and followed.
- Instruct personnel on how to work safely, using all types of personal protective equipment.
- Instruct personnel in the proper handling of hazardous material.
- Keep all personnel informed of the jobsite safety policy.

6.0 EMERGENCY PROCEDURES

IPC shall implement procedures which detail reasonable response to all types of project emergencies.

7.0 ACCIDENT INVESTIGATION

IPC shall participate actively in the investigation of any accident that occurs in their area that results in:

- Personal injury to employees under their direction.
- Equipment or property damage in their area of responsibility.
- Near misses that had a potential for serious injury or loss. The investigation should be aimed at determining facts, not fault, so that recurrences can be prevented.

IPC shall insure that all employees under their supervision are aware of their obligation to immediately report all injuries, however minor, to the IPC site representative.

8.0 INCIDENT REPORTING

IPC shall cooperate with the Owner and Construction Manager in investigating any major safety-related incidents. Additionally, IPC shall immediately investigate and submit to the Construction Manager written reports of all accidents wherein disabling injuries or fatalities occur or which result in damage to property or fire loss. These reports shall be submitted within twenty-four hours of the occurrence.

9.0 RECORDKEEPING

IPC shall complete and maintain forms for all safety-related incidents. The form shall be made available for inspection and review by Construction Manager. IPC shall complete injury forms as required after an occupation injury or illness.

10.0 SAFETY INSPECTION

IPC shall participate, through an IPC Designated Safety Representative acceptable to Construction Manager, in periodic general safety inspection tours conducted by a member or members of the Construction Manager Safety Department and Construction Manager's contract coordinator assigned to IPC. During these inspections, the

Designated Safety Representative shall record safety violations, and list such items for action and immediate correction by IPC. If IPC has any subcontractors, a representative of each subcontractor may accompany the inspection.

11.0 SPECIFIC PROJECT SAFETY PROGRAMS AND PROCEDURES

The following programs and procedures will be implemented as required to complement the Project Safety Program.

11.1 FIRE PROTECTION AND PREVENTION PROGRAM

IPC shall maintain a constant awareness of the fire potential, in our area of responsibility. IPC's operations shall be conducted in such a manner as to: (1) not create any fire hazards, and (2) comply with fire protection/prevention and suppression requirements.

If a fire is noted, the supervisor shall immediately notify the Construction Manager's Site Manager. Notification will be made to the local fire department for assistance.

12.0 ENFORCEMENT POLICY

IPC shall advise each employee that any employee who jeopardizes his health and safety and/or the health and safety of others will be subject to disciplinary action.

13.0 FIRST AID

IPC shall establish a procedure for providing medical treatment and emergency transportation for all injured employees. The requirements of this procedure shall comply with OSHA First Aid/Medical Regulations.

14.0 OCCUPATIONAL HEALTH

IPC shall take all reasonable steps and precautions to protect the health and minimize danger from all hazards to life and property.

15.0 OTHER SAFETY PROGRAMS

Other safety programs will be developed as needed; i.e., scaffold tagging, confined space, respiratory protection, hearing conservation, hot work, tag and lock out, etc.

16.0 IPC REQUIREMENTS

IPC shall prepare and submit for review a safety program after contract start which provides and maintains a safe and healthful work environment for their employees.

IPC shall submit the name of their designated safety representative within five (5) days of mobilization. This designated safety representative shall be vested with authority so corrective action of safety related problems can be completed in a timely manner.

IPC's designated safety representative will attend periodic Project Safety Meetings conducted by Construction Manager's Site Manager to assist in the resolution of safety issues and implement corrective action as required. Owner representatives will attend when areas of concern are relative to their operations.

17.0 CONCLUSION

This Safety Action Plan governs and controls the Project Safety Policy and the safety procedures which have been developed and initiated for this project. Each document meets or exceeds the minimum requirements of OSHA regulations. Together, they are an effective instrument in reducing the injury/illness potential.



collins electrical company inc.

Electrical Contractors

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COLLINS ELECTRICAL COMPANY, INC.

WRITTEN INJURY AND ILLNESS PREVENTION PROGRAM

JULY 1, 1991



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COLLINS ELECTRICAL COMPANY, INC.

SAFETY POLICY STATEMENT

Collins Electrical Company, Inc. has a fundamental responsibility to protect the health and safety of each employee; therefore, it is our policy to provide a work environment that promotes safe working conditions and sound operating practices.

It is the intent of Collins Electrical Company, Inc. to comply with the requirements of the California Code of Regulations, Title 8 and to be in compliance with Senate Bill 198 (Labor Code 6401.7 CCR Section 3203) regarding the implementation of an Injury and Illness Prevention Program in accordance with Cal/OSHA regulations.

Accident Prevention is an important part of the normal, routine operating responsibilities of our Foremen and Field Supervision. We recognize that the success of our accident prevention effort is contingent upon the cooperation and active support of these employees.

As a condition of employment, all employees are expected to participate in the program and will be instructed regarding the Code of Safe Working Practices and any other requirements therein. Employees must conduct themselves in a way that enhances their personal safety and that of their fellow workers. The Company has established a Safety Standard that requires employees to wear Hard Hats and Safety Glasses at all times. There will be disciplinary measures taken in cases where employees willfully choose to violate company safety standards. In addition, employees will be trained to recognize and report workplace hazards and help correct them.

The continued success of the Company depends on the safety and well-being of its employees. Therefore, management at all levels is committed to providing an "accident free environment." This valuable objective can only be achieved with the commitment and complete support of every employee.



Eugene C. Gini, President

JULY 1, 1991



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SAFETY PROGRAM: GOALS AND OBJECTIVES

1. To establish and maintain an effective Injury and Illness Prevention Program.
2. To comply with all applicable local, state and government regulations as mandated by CAL-OSHA and the State of California, Senate Bill 198 regarding the establishment of an "effective written injury prevention program."
3. To minimize workplace hazards so as to decrease the risk and financial loss incurred as a result of workplace injuries and accidents.
4. To implement a program that protects the health and safety of every employee.
5. To establish an effective safety and health training program so that employees will be instructed in general safe work practices and be able to identify workplace hazards.
6. To have regular jobsite safety inspections performed by the Foremen for the purpose of identifying unsafe working practices and conditions.
7. To report and investigate all accidents promptly and thoroughly in order to determine the cause and appropriate corrective action to be taken so that the accident or hazardous situation does not occur again.

8. To set up an effective recordkeeping and documentation system for all required procedures.
9. To set up a system of discipline and recognition/award for outstanding safety service/performance.
10. To identify person(s) responsible for implementing and evaluating the Program.
11. To establish an effective system for communicating with employees on occupational, safety and health matters; the Safety Committee will be an active part of this system, as well as training, orientation, reorientation, posting, and written communications.

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RESPONSIBILITIES AND ACCOUNTABILITIES

The achievement of the goals and objectives of Collins Electrical Company, Inc.'s Injury and Illness Prevention Program depend upon the fulfillment of each employees assigned responsibilities. Each employee understands what they are required to do and will be held accountable for their performance.

Maureen Fraga has been assigned the position of Safety Coordinator and will be in charge of the overall implementation and maintenance of the Injury and Illness Prevention Program.

Employees found performing work in an unsafe manner that would endanger the employee or another employee shall receive a verbal warning from their Foreman or Superintendent. If the violation continues, a written warning will be issued. If the employee continues to be in violation after the written warning, it is grounds for dismissal.

The general responsibilities for all employees are divided as follows:

MANAGEMENT

Management must demonstrate their commitment to lead the organization in the achievement of program goals and objectives for a successful Injury and Illness Prevention Program. Further, they will enforce safety policies, audit and evaluate program performance, and correct identified deficiencies. A member of management will be an active member of the established Safety Committee.

SUPERVISION

Both Superintendents and Foremen are responsible for developing proper attitudes toward safety and health on the jobsite. They must ensure that all operations are performed with regard to the safety of those involved and themselves.

The responsibilities of the Foremen are:

1. To see that all tools and equipment are maintained in safe condition;
2. To make sure that Safety Glasses and Hard Hats are worn at all times and take disciplinary measures, when necessary, to enforce this policy;
3. To correct and control unsafe work practices and conditions in a timely manner, based on the severity of the hazard;

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4. To make pre-job and regular monthly jobsite inspections to identify unsafe conditions and work practices. When an immediate hazard exists that cannot be corrected without endangering employees and/or property, all exposed personnel must be removed from the hazardous area except those necessary to correct the condition;
5. To make additional inspections whenever new substances, processes or equipment are introduced and present a new safety/health hazard, and whenever a previously unrecognized hazard is brought to their attention;
6. To report and investigate all injuries, work-related illnesses, near-miss accidents, and/or over-exposure cases in the time prescribed by law;
7. To hold weekly safety meetings with employees to discuss recent accidents and corrective action needed, review safety issues and performance, and instruct them how to recognize hazards.

A. Superintendents from each branch will periodically attend weekly Safety Meetings.

EMPLOYEES

As a condition of employment, all employees are responsible for actively participating in the Injury and Illness Prevention Program.

1. All new employees will receive a "New Hire Orientation."
2. Employees will attend weekly Safety Meetings where they will be educated to work safely and to recognize unsafe conditions and work practices.
3. Employees will be given equal opportunity to provide input and feedback regarding program effectiveness without fear of reprisal. Employee Suggestion Forms will be available at weekly Safety Meetings and/or at their local branch.
4. Employees are expected to work safely and follow all posted Safe Working Practices and Safety Standards.

SAFETY COORDINATOR

It is the Safety Coordinator's responsibility to develop and promote an Injury and Illness Prevention Program. The Safety Coordinator will:

1. Serve as an organizational resource to assist in creating and maintaining accident-prevention procedures which satisfy program requirements and state/local codes and standards;
2. Be accountable for the quality and timeliness of the information, analysis, evaluation, and instruction provided;

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3. Maintain and establish a recordkeeping program of New Employee Orientation's, accidents, investigations, inspections, recommendations, and Safety Meeting reports;
4. Regularly evaluate Program effectiveness and identify any problem areas found;
5. See that all accidents are properly reported in the time prescribed by law and that the Supervisors' Accident Investigation Reports and First Report of Injury or Illness are properly completed for every accident;
6. Follow through on corrective action recommended by the Foreman or Superintendent as the result of each accident investigation;
7. Review recommendations submitted as the result of monthly jobsite inspections and follow through on corrective action taken;
8. Evaluate Worker's Compensation Claims and regularly log/update the OSHA 200 Log of Occupational Accidents and Injuries;
9. Act as coordinator of the Safety Committee.

SAFETY COMMITTEE

The Safety Committee will consist of one or more representatives from Management in each branch, Field Supervision, Foremen, Journeyman/Electrician(s), Apprentice/Electrician, and the Safety Coordinator who will act as coordinator of the Committee. The Committee will be selected at discretion of Management and will meet on a quarterly basis.

The responsibilities of the Safety Committee are to:

1. Audit and evaluate program requirements and effectiveness;
2. Review accident investigation findings and monthly worksite inspection reports;
3. Identify program deficiencies as well as assess the effectiveness of safety communication and instruction;
4. Recommend corrective action for identified hazards to both Foremen and Field Supervision;
5. Investigate any alleged hazardous situation brought to the attention of any Committee Member in order to determine possible causes, solutions and improvements;
6. Review Employee Suggestion Forms and submit recommendations for corrective action;
7. Make all written records of safety/health issues discussed during quarterly meetings available to all affected employees;
8. Discuss any proposed new policies, procedures or revisions to existing procedures that will strengthen the Program effectiveness.

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EDUCATION AND TRAINING

All Management, Field Supervision, and employees who have a responsibility in the fulfillment of the requirements of the Injury and Illness Prevention Program, will be educated about those requirements and trained to perform his/her role.

EDUCATION AND TRAINING GOALS

1. Management and Supervision will be continually educated in new principles and practices of job safety and program changes.
2. Foremen will ensure that employees comply with Company Safety Codes and Standards.
3. Foremen will be trained to familiarize employees, under their direction, with safety and health hazards they may be exposed to, how to recognize them and their effects, and rules and procedures for controlling exposure to them. Whenever Foremen are informed of a previously unrecognized hazard, they will make all affected employees aware.
4. All employees shall be instructed whenever new substances, processes, procedures or equipment are introduced to the workplace and represent a potential hazard.
5. Foremen will be trained and knowledgeable on how to report accidents in a timely manner, investigate them and take the appropriate corrective action to avoid recurrence. In addition, they will be informed of the correct recordkeeping and reporting procedures.
6. All new employees will receive "New Hire Orientation" from their Foremen before the commencement of work so that they are familiar with Company policies and safe work practices.

JULY 1, 1991





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TRAINING REQUIREMENTS

NEW HIRE ORIENTATION

1. Foremen are required to give all new employees a "New Hire Orientation" before they start work on the jobsite. If there is more than one new hire at a time, the Foremen may choose to do the orientation for all the new hires together. Also, if an employee is rehired, he/she is required to repeat the orientation.

The orientation will:

- A. Inform the employee of the Company's Injury and Illness Prevention Program and his/her responsibilities therein.
- B. Inform the employee of the Code of Safe Working Practices and personal protective equipment required (i.e. Hard Hats & Safety Glasses to be worn at all times).
- C. Inform the employee of common hazards he/she may be exposed to and to report any additional unsafe conditions he/she may encounter without fear of reprisal.
- D. Inform the employee of Accident Reporting Procedures.
- E. Inform employee that he/she is required to attend weekly Safety Meetings.

2. The Foreman is required to document all New Hire Orientations and forward them to the Safety Coordinator. In addition, all new employees will be required to sign the Orientation Form acknowledging that they have received the orientation and from who.

FOREMEN MEETINGS

1. Each Branch Manager and/or Superintendent will hold quarterly Foremen Meetings.

The purpose of the meetings will be to:

- A. Inform and familiarize the Foremen with new safety and health hazards that employees under their direction may be exposed to.
- B. Allow the Foremen to discuss any concerns and/or recommendations they may have regarding the Injury and Illness Prevention Program effectiveness.
- C. Discuss and review any workplace injuries/accidents.
- D. Instruct Foremen on new policies or procedures.

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WEEKLY SAFETY MEETINGS

1. Every Foreman will hold a weekly tool box meeting for 5-10 minutes where, among other issues, he/she will discuss safe methods of performing the job; as described in the weekly Safety Letter. Superintendents will periodically attend a weekly Safety Meeting.
2. Foremen will discuss any hazards found on the jobsite during jobsite investigations, and propose corrective action. Also, they will brief the employees on any nonroutine tasks or operational changes, new substances and/or equipment.
3. Foremen will discuss any worksite injuries, accidents, or near miss accidents and what can be done to avoid them in the future.
4. Foremen will document all Safety Meetings including the names of those in attendance, the date, and the topic(s) discussed. A copy of this documentation will be forwarded to the Safety Coordinator.
5. It is important to encourage discussion at the meetings so that the employees can inform the Foremen of unsafe conditions and/or hazards and offer recommendations or solutions without fear of reprisal.

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ACCIDENT INVESTIGATION PROCEDURE

The purpose of an Accident Investigation is to determine what condition was responsible for the accident. Then it is possible to determine what other losses may be attributed to the same cause, and what can be done to eliminate this cause. The Accident Investigation is a way of finding methods and procedures that can be used to get the job done efficiently.

1. Foremen will keep a record of and report all incidents, accidents and near-miss accidents to the Superintendent and/or Branch Manager.
 - A. When an employee has suffered an injury or illness that either results in lost time or requires medical treatment beyond first aid, the Foremen will have the injured employee fill out an "Employee Claim For Worker's Compensation Benefits" within 24 hours.
 - B. The Foreman must ensure that a "First Report of Occupational Injury or Illness" is filled out and forwarded to directly the Branch Manager or Superintendent within two calendar days. The Branch Manager or Superintendent must then report the injury/illness to the Worker's Compensation Carrier within two calendar days, for a total not to exceed five calendar days from the onset of injury.
 - C. Once the injury/illness has been reported to the Worker's Compensation carrier, a copy of the forms shall be forwarded to the Safety Coordinator at the main branch in Stockton.
 - D. The Foremen will fill out a "Supervisor's Accident Investigation Report" and conduct a complete investigation of the accident, the area it occurred in, and the possible cause(s) in order to determine corrective action.
 - E. The Foremen will, if possible, interview the injured victim as to reasons why the accident occurred. Any witnesses on the jobsite shall be questioned as well.

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- F. Action will be taken immediately, if possible, to correct any unsafe condition/hazard that may have contributed to the cause of the accident/incident. If it is not possible to act immediately, the Foremen will be given a period of one week to take the appropriate action. The Superintendent will be responsible to make sure that the situation has been corrected by the Foremen.
- G. The Safety Coordinator will further review the Accident Investigation Report to determine whether or not the appropriate corrective action has been taken and if a second investigation is necessary.

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COLLINS ELECTRICAL COMPANY, INC. LOCK OUT AND TAG OUT PROCEDURE

The purpose of this procedure is to make sure that precaution is taken for the protection of employees while they are repairing or servicing equipment and/or electrical systems.

1. Lockable equipment does not include push button switches or the local on/off switch, control valves or motor valves operated by pneumatic, electric, or hydraulic means.
2. If a tag is needed, it is used by those responsible for operating the equipment. It is a method for communicating the status of equipment whenever it is to be worked on, opened or entered for the protection of other workers on the jobsite.
3. The employee performing the work is responsible for making preparations so work can be performed in a safe manner.
4. The disconnect switch that isolates the equipment to be worked on must be placed in a safe position and locked and/or tagged. Before any repair work is begun, an attempt shall be made to start the piece of equipment to ensure that the proper circuit has been de-energized.
5. If work is interrupted (stopped), equipment and locks shall be rechecked before work resumes.
6. Repairmen from each craft must add his/her lock(s) and tag(s), unless he/she is working with another repairman of the same craft whose lock(s) and tag(s) are already in place. All tags shall be signed and dated.
7. Persons removing or bypassing locks or red tags by means not authorized in this standard are subject to immediate discharge.

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DOCUMENTATION AND RECORDKEEPING

1. Copies of all records will be kept at the main branch office in Stockton.
2. Records will be kept by the Foremen of monthly job inspections reporting unsafe conditions and work practices, they will also include the name of the person conducting the inspection, and the identified action(s) taken to correct them. These records will be forwarded monthly to the branch office and then to the Safety Coordinator at the main office and maintained for three (3) years.
3. Documentation of Safety Meetings and New Hire Orientation will be kept. They will include identification of employee attendance, the date of the meeting/orientation, subjects covered, and any comments or suggestions made. These records will be forwarded monthly to the main office and maintained for three (3) years.
4. Records of quarterly Safety Committee Meeting minutes will be kept and made available to all affected employees.
5. Records of Accident Investigation Reports will be kept by the Foremen and forwarded to the Safety Coordinator. These records will be maintained indefinitely.
6. All Foremen Meetings will be documented by each branch; information shall include those in attendance, subjects covered, and suggestions/recommendations made by the Foremen. These records will be forwarded to the main branch and kept for a period of three (3) years.
7. Records of hazardous substance exposure shall be kept indefinitely.
8. The OSHA Log of recordable Occupational Injuries and Illnesses for each branch will be regularly updated by the Safety Coordinator and annually posted during the month of February.

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AUDIT AND EVALUATION SYSTEM

In order to ensure compliance with program requirements and evaluate program effectiveness, there will be routine audits of program activity by the Safety Committee and Safety Coordinator.

1. Foremen will inspect their jobsites monthly and monitor the safe working habits of their employees in order to identify and control unsafe work practices and/or hazardous conditions. These inspections will be documented and sent to the Superintendent/Branch Manager and Safety Coordinator on a monthly basis to review inspection findings and hazard control activities.
2. Employees will be given opportunity at weekly Safety Meetings to audit the program by providing suggestions and giving feedback on program effectiveness. There will be Employee Suggestion Forms available for input. Their input will be documented and reviewed by the Foremen and then sent to the Safety Committee/Coordinator for a monthly review.
3. There will be a monthly review of accidents and accident investigation reports by the Safety Coordinator in order to assess causes and ensure that control measures have been taken and implemented.
4. The Safety Committee will meet quarterly to review program effectiveness and evaluate the accident rate and financial risk involved.
5. The Safety Coordinator will regularly review and maintain the overall program.

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