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(STMP0-964)

10-MWe SOLAR THERMAL CENTRAL RECEIVER PILOT PLANT

OPERATIONAL TEST MANAGEMENT PLAN


THREE YEAR POWER PRODUCTION PHASE

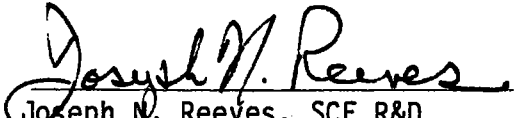
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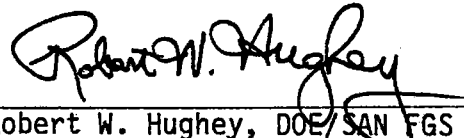
PREFACE

This Operational Test Management Plan represents the Project Management Plan for the three year power production phase for the Ten-Megawatt Central Receiver Solar Thermal Pilot Plant Project.

The previous issue of the Operational Test Management Plan, approved March 25, 1982, addressed primarily the first, two-year Experimental Testing and - Evaluation phase of the Operational Testing period; an update was issued in November, 1983, to reflect the current Project documentation flow diagram. The present Revision describes the goals, management structure, budgeting approach and documentation for the three-year Power Production phase of the Operational Testing Period, which extends from August 1, 1984 through July 31, 1987.


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1.0 Introduction

The Department of Energy (DOE) and the Associates (composed of Southern California Edison Company which acts as principal, the Los Angeles Department of Water and Power, and the California Energy Commission) have entered into a Cooperative Agreement to design, construct, and operate a central receiver power plant as a viable source of energy.

The Pilot Plant consists of a field of 1818 computer-controlled mirrors (heliostats) that reflect the sun's energy to a tower-mounted receiver. At the receiver, water is converted into superheated steam. The plant is designed to generate 10 MWe net for delivery to the Southern California Edison (SCE) electric power grid with steam directly from the receiver (1465 psia and 950 degrees F). When delivered through a thermal storage system, the steam is capable of driving the turbine-generator to produce 7 MWe net for a period of at least four hours.

The Cooperative Agreement between DOE and the Associates calls for a five-year Operational Testing period scheduled to begin in mid-1982. It is generally agreed by the parties that this test period will consist of a 2-year Experimental Testing and Evaluation phase followed by a three-year Power Production phase. The Experimental Testing and Evaluation phase will develop experience in all the Plant operating modes, measure plant performance, and establish stable, controlled operation of the Pilot Plant. This phase will be governed primarily by the needs of technology development rather than by a desire to optimize the plant solely for total power production. The subsequent Power Production phase will demonstrate the

operational capability of the Pilot Plant to supply electrical power under day-to-day utility management.

The legal terms and conditions defining the obligations and general responsibilities of the Associates and DOE are contained in Cooperative Agreement DE-FC03-77SF10501. Omissions of duties and responsibilities in this Operational Test Management Plan do not relieve the parties from fulfilling their respective obligations as specified in the Cooperative Agreement.

The Operational Test Management Plan describes the procedures and responsibilities for managing the Plant's operation during the five-year Operational Testing period. The Plan defines the management structure and specifies the responsibilities for developing test procedures and safe operating procedures, and for plant performance evaluation. Budgeting responsibilities and data generation and distribution procedures are also described. This Plan will be reviewed and updated periodically.

2.0 Objectives

The primary objectives of the project are to:

1. Establish the technical feasibility of a solar thermal power plant of the central receiver type and to identify areas where research and development may lead to significant performance improvements and increased capabilities.
2. Obtain development, production, operating, and maintenance cost data to (a) support private sector decisions to invest in solar central receiver energy systems, and (b) identify areas where research and development

may most effectively be applied to reduce cost and extend areas of application of such systems.

3. Determine the environmental impacts of the construction, operation, and maintenance of solar thermal central receiver plants.

These objectives will be met through the extensive collection and evaluation of technical and cost data (including data on production, operation, maintenance, environmental, and life-cycle costs). The data will be made available for use by electric utilities, industrial firms, and private sector groups. DOE's Solar Thermal Technology program as well as other federal, state and local entities will also have access to the information for defining long-term, high-risk, high-payoff research that should appropriately be supported by public funds.

3.0 Management Structure: Three-Year Power Production Phase

The Cooperative Agreement provides for a five year Pilot Plant Operational Testing program. As specified in the Cooperative Agreement, The last three years are dedicated to power production to evaluate the central receiver concept as to its potential as a viable commercial electrical power generation resource. During this three year period, SCE will operate the Pilot Plant, following utility practices, to maximize power production while effecting safe, reliable, and efficient operation in accordance with established operating and maintenance procedures. The management structure used during the two year Experimental Test and Evaluation phase was revised for the three year Power Production phase. The revised management structure defines organizational responsibilities appropriate to the power production program. The general management relationships are shown in Figure 1.

3.1 DOE Division of Solar Thermal Technology

As the sponsor for the Central Receiver Development program, the Division of Solar Thermal Technology (STT), DOE Headquarters (DOE/HQ), sets overall DOE policies with respect to funding and operation of the Pilot Plant project.

STT Responsibilities:

1. Acts as the prime interface for DOE/HQ-level communications and activities, and arranges allocations of funds and other resources for successful attainment of Pilot Plant objectives.
2. Approves SAN and SNLL Annual Operating Plans for the Pilot Plant.
3. Integrates and guides the products of other solar thermal research and development work with Pilot Plant activities in order to benefit the overall DOE Solar Thermal Program.

3.2 DOE San Francisco Operations Office

The San Francisco Operations Office (SAN), on behalf of DOE/HQ, has overall project control consistent with the Cooperative Agreement between DOE and the Associates. SAN coordinates with DOE/HQ through STT to carry out DOE Solar Thermal Program directions. SAN is the DOE contracting organization for the Cooperative Agreement and is the prime interface with Southern California Edison, which acts for the Associates. Overall plans and funding requirements for Pilot Plant activities are contained in Annual Operating Plans prepared in coordination with Sandia National Laboratories Livermore (SNLL).

SAN Responsibilities:

1. Administer as appropriate the following plans as they apply to the power production phase:
 - a. Project Plan
 - b. Quality Assurance Plan
 - c. Data Evaluation Plan in Cooperation with SNLL and SCE
2. Maintain current the Operational Test Management Plan.

3. Prepare DOE Annual Operating Plans.
4. Approve for DOE necessary changes to the Pilot Plant by mutual agreement with SCE and in accordance with the Cooperative Agreement.
5. Provide DOE operational direction to SCE consistent with the Cooperative Agreement.
6. Coordinate with SCE and SNLL the planning and implementation of the Power Production phase.
7. Support SCE in hosting congressional, federal agency DOE and senior public and private sector visitors as appropriate.
8. Prepare and submit periodic highlight status reports to STT.
9. Monitor the costs and schedule of the Power Production phase and initiate corrective action necessary to maintain planned schedule and budget.
10. Exercise "stop operation" authority when necessary to protect the interests of the Government.

3.3 The Associates

As sponsors of the Pilot Plant, the Associates share with DOE funding responsibility for the Pilot Plant's operation and have full responsibility for plant betterment of conventional plant systems which were funded by the Associates. The Associates, in coordination with DOE, establish the Pilot Plant's program and implementing policy.

3.4 Southern California Edison Company

SCE, acting as principal on its own behalf and as agent for the Associates, is responsible for operating and maintaining the pilot plant to effect its safe, reliable, and efficient operation in accordance with established procedures during the three year Power Production program. SCE is the Associates' contracting organization for the Cooperative Agreement and is the prime interface with DOE organizations. During the three year program,

SCE will prepare reports whose purpose will be to evaluate the Pilot Plant from an electrical utility's point of view, to include plant power production, availability, reliability, operation and maintenance costs, and operating and maintenance experience.

Southern California Edison Responsibilities:

1. Administer as appropriate the following plans which were prepared during the plant's two year test program.
 - a. Safety Plan.
 - b. Data Evaluation Plan in Cooperation with SNLL and SAN.
2. Prepare and maintain current the Operating plan for the Plant. This plan will be reviewed by DOE/HQ, SAN and SNLL.
3. Operate the Plant in accordance with the approved Operating Plan, and in furtherance of Cooperative Agreement objectives for the Power Production phase.
4. Maintain the Plant in accordance with the SCE Generation Management System and maintenance instructions provided by equipment suppliers.
5. Prepare an annual budget (cost and labor) for the operation and maintenance of the Plant. (Fig. 4, items A.3, A.4).
6. Approve on behalf of the Associates necessary changes to the Pilot Plant, by mutual agreement with SAN and in accordance with the provisions of the Cooperative Agreement.
7. Hold custody, for operations and maintenance purposes, of all DOE equipment on-site, and assist SAN in maintaining accountability for Government Furnished Equipment.
8. Maintain as-built drawings, including field changes, and other Plant records.
9. Implement an Industrial Technology Transfer program, to include Project Advisory Committee and Project Review Committee meetings.

10. Monitor, collect and analyze data on the Pilot Plant to support utility and supplier industry objectives.
11. Prepare and provide to STT, SAN, and SNLL monthly and annual operating and maintenance reports and other reports as specified in the Reporting Requirements Checklist (Figure 4).
12. Provide to SNLL operational data in accordance with the Project Data Requirements list (Figure 4).

3.5 Sandia National Laboratories Livermore

SNLL, on behalf of SAN, is responsible for technical management and evaluation of the Power Production phase. Consistent with the administrative policies established by DOE, SNLL will provide the technical guidance for operating and maintaining the solar portion of the plant, and the technical resources necessary for diagnosing and resolving non-routine problems which may occur in the solar portion. SNLL will evaluate and interpret data from the plant and prepare reports disseminating the results. These reports will include comparison of measured performance with design expectations. Overall plans and funding requirements for all Pilot Plant activities are contained in Annual Operating Plans prepared in coordination with SAN.

SNLL's Responsibilities:

1. Evaluate and assess the technical performance of the plant and develop plans for and provide technical support.
2. Hold all contracts for technical support, for evaluation and for diagnosing and resolving non-routine problems.
3. Keep STT, SAN and SCE fully informed of technical management and evaluation activities, and of potential technical problem areas.
4. Provide technical assistance to SCE as appropriate.
5. Prepare DOE Annual Operating Plans, in coordination with SAN.

6. Prepare procedures for special tests as required, in coordination with SCE.
7. Document test results on a test-by-test basis, including an evaluation of test results as compared with test objectives.
8. Analyze, interpret and report test data in terms of overall Central Receiver Program needs and objectives, and in accordance with the Data Evaluation Plan.
9. Recommend to SAN exercise of "stop operation" authority, when necessary to prevent damage to equipment or insure that test or operational objectives are met.
10. Prepare and submit to STT periodic reports on technical management and evaluation activities, including cost and schedule status.

3.6 Coordinating Committee

The Coordinating Committee, under the general direction of the project participants, has responsibility for carrying out the provisions of the Cooperative Agreement and for identifying and coordinating project resources necessary to ensure fulfillment of the three year Power Production phase objectives. The Coordinating Committee is composed of a SAN and a SNLL representative, the SCE R&D Project Manager, and the SCE R&D Site Manager, who will meet approximately quarterly, in conjunction with the regular Project Advisory Committee meetings, and at such other times as necessary to fulfill its responsibilities.

Coordinating Committee Responsibilities:

1. Prioritization of Power Production phase activities.
2. Review and evaluation of proposed plant improvements.
3. Allocation and coordination of activities between project participants.
4. Technology transfer.
5. Reviews and recommendations regarding future Pilot Plant test programs.

4.0 Budgeting

Coordinated Annual Operating Plans will be prepared by SAN and SNLL for STT approval. SCE will provide SAN with estimates of the operating and maintenance resources that are required.

5.0 Documents

Together with Cooperative Agreement DE-FC03-77SF10501 as currently amended (to which this Plan is Appendix C), the documents described below constitute the governing documents for the five-year Operational Testing period of the 10-MWe Pilot Plant Project. Figure 2 provides the document flow chart for the three-year Power Production phase (key Power Production phase documents are also indicated by asterisks in the paragraphs that follow). Figure 3 indicates responsibilities for document preparation, review and approval.

5.1 Project Plan

The Project Plan defines and describes the mission need and objectives, technical plan, technical risk assessment, management approach, acquisition strategy, project schedule, and resource plan. It is prepared by SAN, endorsed by DOE/HQ (STT), and approved by the Assistant Secretary (Conservation and Renewable Energy) and the Under Secretary.

5.2 Operational Test Management Plan (this document)

The Operational Test Management Plan prepared by SAN delineates the interrelationships among those organizations and individuals that are needed to execute operational testing of the Pilot Plant. As the basis for management of the Pilot Plant over the five-year operational test program, the Plan will be reviewed for updating at least once a year. This Plan is approved by DOE/HQ (STT), SCE, SAN, SNLL.

* 5.3 Annual Operating Plans

The Annual Operating Plans prepared by SAN and SNLL and approved by STT

describe the overall goals, schedules and costs for all DOE-funded Pilot Plant activities.

* 5.4 Plant Operating Plan

Based upon testing performed during the Experimental Testing and Evaluation phase, SCE prepares, for SAN concurrence, an Operating Plan for operation of the Plant in its various operating modes. The Operating Plan, updated as required as a result of experience and possible Plant modifications, summarizes strategies and priorities for plant operations. It serves as the basis for operation of the Pilot Plant during the three-year Power Production phase.

* 5.5 Special Test Procedures

Special Test Procedures with test specifications, operating instructions, cautions and supplemental information, will be provided by SNLL for any special testing required during the Power Production phase.

* 5.6 Data Evaluation Plan (SAND 82-8027)

The Data Evaluation Plan, prepared by SNLL for STT concurrence, describes the approach to evaluation of the overall Plant and its systems and components in terms of performance, costs, maintenance, safety and interaction with the environment during the five-year Operational Testing period. For each special evaluation test called for under this Plan during the Power Production Phase the objectives, test and data requirements, approach, applicability, expected output and planned data dissemination are described.

Data requirements include the operational and maintenance data required for Pilot Plant evaluations, to be collected during the Power Production phase. These data will be collected with the aid of the Data Acquisition System, operated and maintained by SCE and SNLL.

5.7 Supporting Plans and Programs

In addition to the foregoing documents directly governing Pilot Plant Operational Testing activities, the Project is also subject to certain overall requirements imposed by DOE Orders, state and local regulations, and SCE Company procedures and policies. These are addressed in the following documents:

5.7.1 Environmental Plan: Based upon the Environmental Impact

Assessment/Report prepared for the Pilot Plant Project by the San Bernardino County Environmental Improvement Agency, and the DOE Environmental Assessment (DOE/EA-0016) derived therefrom, an Environmental Plan was prepared by DOE/HQ Project personnel as an attachment to the design-phase Project Plan. This Plan served as the basis for construction and start-up phase environmental studies funded by SAN through the DOE Laboratory of Biomedical and Environmental Sciences, University of California at Los Angeles, and by SCE through the Los Angeles County Natural History Museum. These studies showed no significant or unanticipated impacts from Plant construction or operation. The Plan is maintained by SAN as a guideline for further monitoring through the Experimental Testing and Evaluation phase, by personnel from both previous study groups funded through SNLL and UCLA/LBES. Power Production phase activities by SCE as Plant Operator will continue to follow the recommendations of the Plan and the prior-phase studies, as well as the general environmental policies to which SCE power generation activities are subject.

- * 5.7.2 Safety Plan: Based upon design analyses and experimental tests (primarily with respect to heliostat reflected-beam safety) conducted during the start-up phase by SCE and SNLL, an addendum to the SCE Accident Prevention Manual was developed and approved by SAN. Together, these constitute the Project Safety Plan, which ensures that all Plant operation and maintenance activities throughout the Operational Testing period are conducted safely and in accordance with State of California and Cal/OSHA regulations, and in conformance with applicable DOE Orders and policies. When test activities extend beyond the conditions covered in the Plan, additional safety requirements are specified in the applicable Test Procedures.
- * 5.7.3 Quality Assurance Plan: Design, construction and startup phase activities were conducted under the nuclear-industry standards of ANSI NQA-1, and the DOE Orders (5700.6, 5700.6A) and SCE nuclear plant policies derived therefrom. Pending establishment of the SAN format for Project Quality Assurance Plans under DOE 5700.6A, a preliminary Quality Assurance Plan was prepared by the SAN Project staff, and serves as the Quality Assurance Plan for the Operational Testing period. QA documentation, including specifications, material receipt and inspection records, test data, as-built documentation and operating and maintenance records, will be maintained by SCE through the Power Production phase.
- * 5.7.4 Maintenance Program: Maintenance on the SCE system is controlled by a computerized, Company-wide Generation Management System (GMS). In the course of startup and acceptance of the Plant components and subsystems and their transfer to SCE, these were entered into the GMS. The GMS was reviewed by SAN Project personnel and approved as the maintenance management system required by DOE Order 4330.4.

Detailed maintenance procedures are documented in the Plant Maintenance/Training Manual, issued at the outset of the Operational Testing period, and scheduled to be updated (to reflect field changes made during the Experimental Testing and Evaluation phase, and to fully integrate the DOE-supplied solar facilities with the SCE-supplied non-solar facilities) and reissued at the start of the Power Production phase.

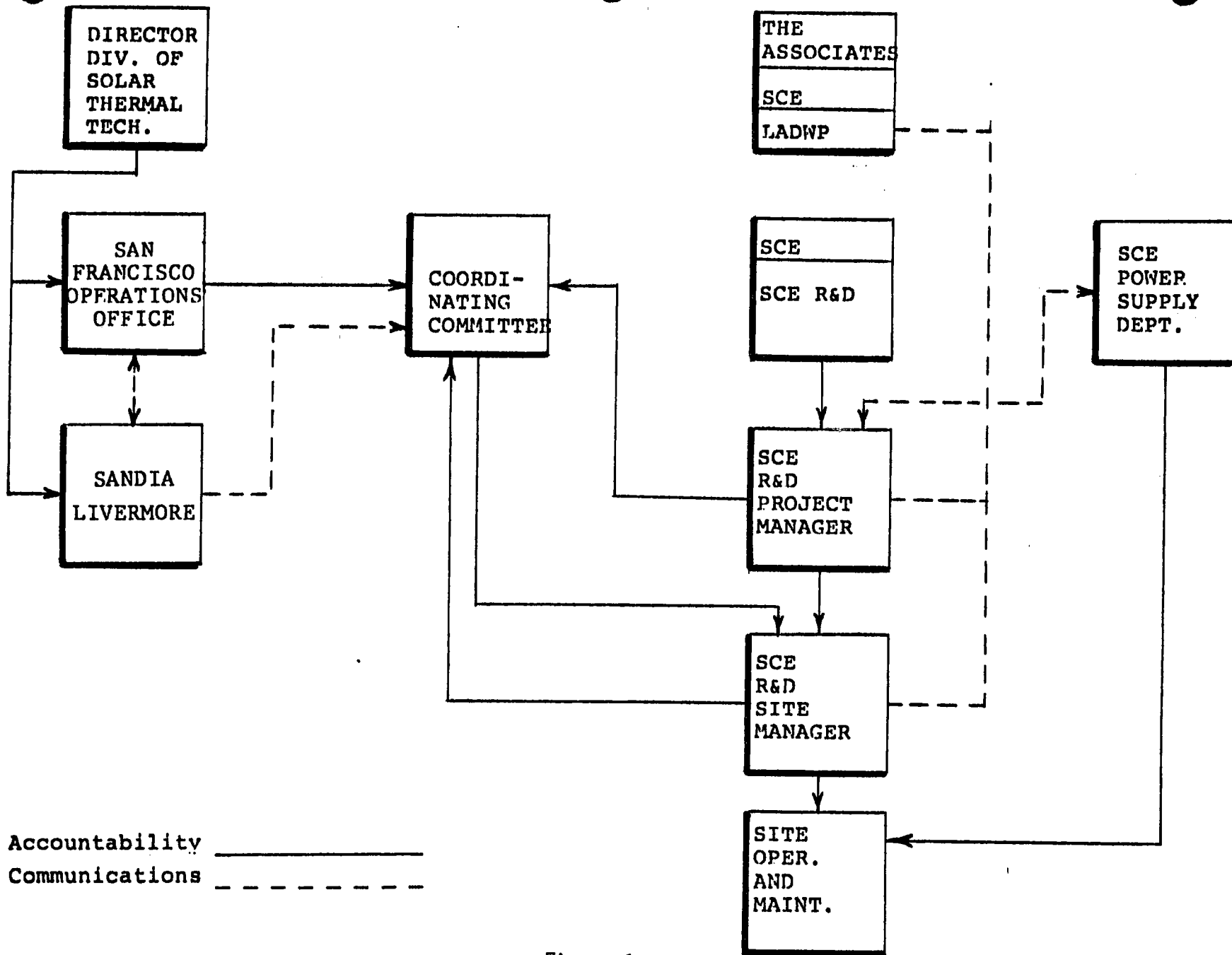


Figure 1.
 BARSTOW PILOT PLANT MANAGEMENT STRUCTURE
 POWER PRODUCTION PHASE

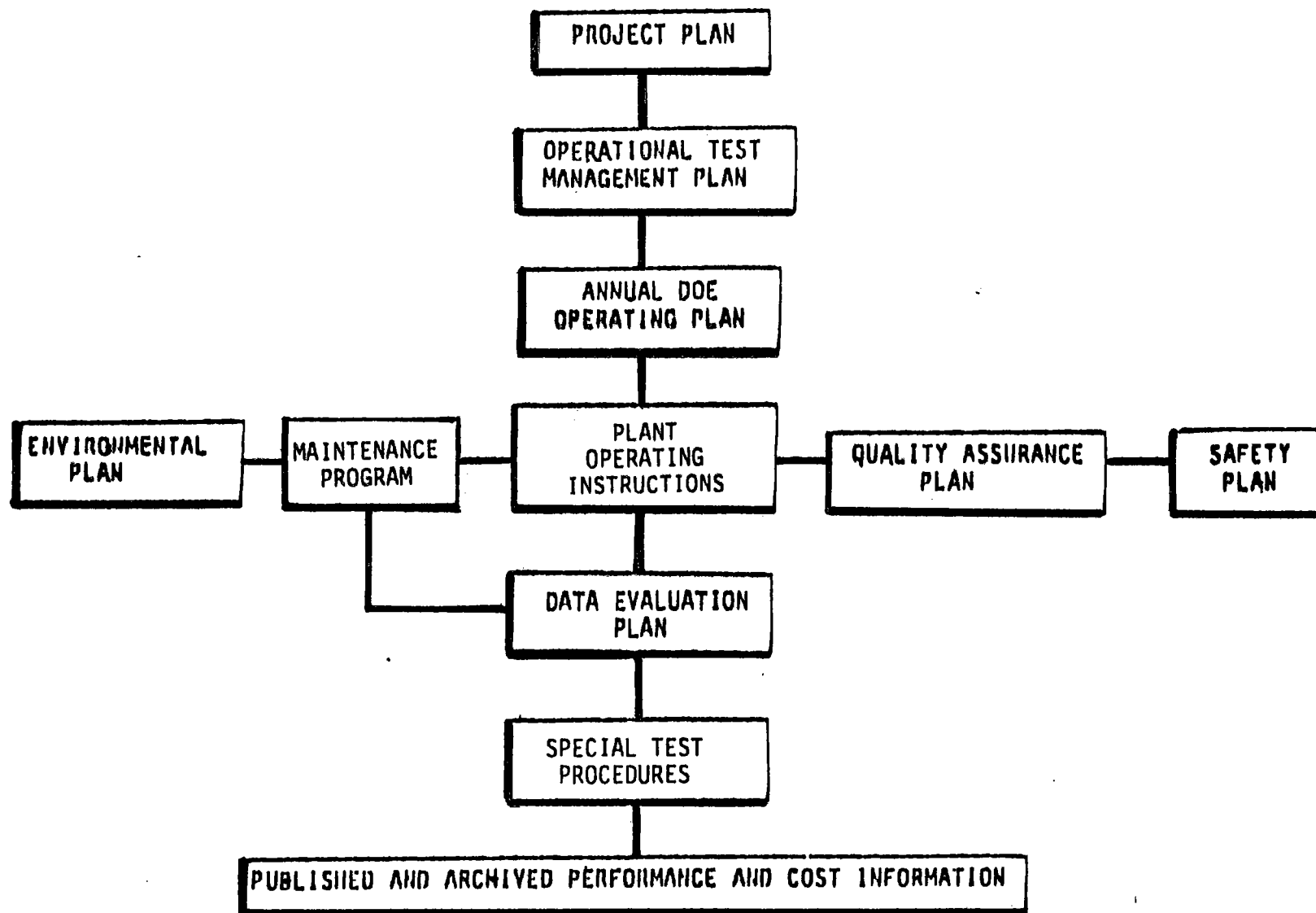


Figure 2.
PILOT PLANT OPERATIONAL CONTROL DOCUMENTS
POWER PRODUCTION PHASE

| | <u>STI</u> | <u>SAN</u> | <u>SCE</u> | <u>SNLL</u> |
|----------------------------------|------------|------------|------------|-------------|
| PROJECT PLAN | A | P | R | R |
| OPERATIONAL TEST MANAGEMENT PLAN | A | P/A | A | A |
| ANNUAL OPERATING PLANS | A | P | | P |
| PLANT OPERATING INSTRUCTIONS | | A | P | R |
| DATA EVALUATION PLAN | R/A | R | R | P |
| SPECIAL TEST PROCEDURES | | R | A | P |

P = Prepare

R = Review

A = Approve

Figure 3.
 PILOT PLANT OPERATIONAL CONTROL DOCUMENTS
 PREPARATION, REVIEW AND APPROVAL

STMP0964 ①

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memorandum

DATE: SEP 10 1984

REPLY TO
ATTN OF

S. D. Elliott, Jr., Director, DOE Solar One Project Office

SUBJECT: Transmittal of Five Documents Prepared under Cooperative Agreement DE-FC03-77SF 10501 for Patent Review and Clearance, OSTI Processing and Forwarding to NTIS

TO: Roger S. Gaither, DOE/SAN (OPC)
William D. Matheny, OSTI Document Control


Enclosed are five documents prepared by the various parties to Cooperative Agreement DE-FC03-77SF10501 in connection with the 10-MWe Solar Thermal Central Receiver Pilot Plant Project ("Solar One"):

| <u>DOE Number</u> | <u>Secondary No.</u> | <u>Brief Title</u> |
|-------------------|----------------------|---|
| DOE/SF/10501-004 | (STMP0-040) | "Solar One" Brochure, Revision 2 |
| DOE/SF/10501-061 | (STMP0-539) | Safety Plan: 10-MWe...Pilot Plant" |
| DOE/SF/10501-062 | (STMP0-062) | Maintenance Program: 10-MWe...Pilot Plant" |
| DOE/SF/10501-063 | (STMP0-964) | ..Operational Test Management Plan: Three-Year Power Production Phase |
| DOE/SF/10501-064 | (STMP0-598) | ..Project Summary Report and Lessons Learned |

One copy of each report, with accompanying SAN Form 70, is forwarded to DOE/SAN Office of Patent Counsel for patent review and clearance. Please return a copy of the clearance form for each document to this office when completed; review copies of all documents may be discarded except for STMP0-598, which should be returned to SAN/FGS, Attn. M. Lopez.

Two copies of each document, with accompanying DOE Form RA-426, are forwarded to DOE Office of Scientific and Technical Information for archiving, announcement, microcopying and forwarding to the National Technical Information Service, as appropriate.

Encls.: 5 Documents:
1 ea. to SAN/OPC w/ SAN Form 70
2 ea. to DOE/OSTI w/ DOE Form RA-426


S. D. Elliott, Jr., Director,
DOE Solar One Project Office

cc: M. Lopez, DOE/SAN (FGS)
P. Skvarna/J. Wells, SCE R&D
D. Holz, DOE/SAN (ISEA)
M. Soderstrum, Burns & McDonnell



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| Prime Contract No. DE-FC03-77SF10501 |
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| Report No. DOE/SF/10501-063 (STMPO-964) |
| Date of Report AUGUST 1984 |
| Name & Phone No. of DOE Technical Representative S. D. ELLIOTT, JR. (619) 254-2672 |

TO: Roger S. Gaither, Asst. Chief for Prosecution
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Signature *S. D. Elliott* Date 10 September, 1984

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Office of Patent Counsel/Livermore Office

- No patent objection to above-identified release.
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4. Title "10-Mwe Solar Thermal Central Receiver Pilot Plant; Operational Test Management Plan: Three-Year Power Production Phase"

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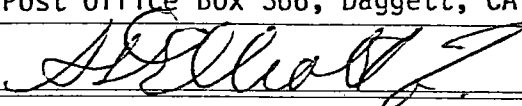
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| Prime Contract No. |
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| (N/A) |
| Report No. |
| DOE/SF/10501-063 (STMPO-964) |
| Date of Report |
| AUGUST 1984 |
| Name & Phone No. of DOE Technical Representative |
| S. D. ELLIOTT, JR. (619) 254-2672 |

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2. Type of Document: Technical Report, Conference Paper, Journal Article, Abstract or Summary,
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b. This document describes matter relating to an invention:

- i. Contractor Invention Docket No. _____
- ii. A disclosure of the invention was submitted to DOE on _____ (date)
- iii. A disclosure of the invention will be submitted shortly _____ (approximate date)
- iv. A waiver of DOE's patent rights to the contractor:
 - has been granted, has been applied for; or will be applied for _____ (date)

5. This document is being submitted, but no review has been made of this document for possible inventive subject matter.

6. Remarks: Return copy of clearance to Project Office; document may be discarded

Reviewing/Submitting Official: Name (Print/Type) S. D. Elliott, Jr., Director
Title DOE Solar One Project Office
Signature [Signature] Date 10 September, 1984

TO: INITIATOR OF REQUEST

FROM: ASSISTANT CHIEF FOR PROSECUTION
Office of Patent Counsel/Livermore Office

No patent objection to above-identified release.

Please defer release until advised by this office.

Signed [Signature] Date Mailed 9/17/84