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APPENDIX

3.8.1

INDUSTRIAL ENERGY CONSERVATION

ENERGY POLICY AND RENEWABLE ENERGY
FIELD TESTING PROJECT

Part 1 of 2

Project No. 263-0123.1

Argonne National Laboratory

PASA No. IEG-0123-P-ER-3089-00

March 1986

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APPENDIX

3.8.1-1

ORGANIZATION FOR ENERGY PLANNING
PROJECT DESCRIPTION

PROJECT NO. 1 - INDUSTRIAL ENERGY CONSER5VATION

Part 1 of 2

The revised October 1984 Project description was not finalized with OEP. However, important elements of this project description such as schedule of activities was incorporated in the March 31, 1985 Management and Implementation Plan. For completeness the revised October 1984 Project Description is appended to the Revised January 1984 Project Description.

Prepared by

Energy and Environmental Systems Division
Argonne National Laboratory

Revised January 1984

Organization for Energy Planning

Project No. 1 - Industrial Energy Conservation

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OEP PROJECT DESCRIPTION

OEP Project No. 1

Industrial Energy Conservation

Objectives

The objectives of this project are to begin the implementation of energy-conserving measures in industrial facilities in Egypt. The focus will be on achieving measurable energy savings at reasonable costs. As there is currently only a limited amount of energy conservation activity in the industrial sector, the project must establish an awareness of the need on the part of industrial plant managers and operators.

Anticipated Outputs

The expected outputs of this project are:

1. A set of recommended energy-conserving measures suitable for implementation in industrial facilities included in the pilot program,

2. A trained team of industrial energy auditors and a tested audit procedure,

3. An industrial energy conservation policy statement and program plan,

4. An initial industrial energy consumption data base, and

5. A plan for training OEP and industrial staff in energy conservation and initial training courses.

Project Tasks

There are four major tasks that comprise this project:

Task 1. Develop and Implement Industrial Energy Audit Program

Task 2. Development of Industrial Project and Policy Plan

Task 3. Development of Industrial Energy Consumption Data Base

Task 4. Development of Industrial Energy Use Training Program

Schedule

The industrial energy audit program is designed to have the first set of energy conservation projects identified 8 months from project start.

The project development task is scheduled to recommend a prioritized list of conservation measures to be implemented 13 months from project start. An industrial energy conservation policy statement and program plan is scheduled for 16 months from project start.

The first version of the industrial data base is scheduled for completion 10 months from project start in time to be used to identify the second round of industrial audits.

A training strategy and program plan is scheduled for completion four months from project start. The earliest training course is scheduled for five months from start with the next set of courses in the period 9-11 months from start.

Personnel

The project will require the following personnel:-

OEP staff	96 person-months
ANL staff	30 person-months
Contractor staff	63 person-months

Startup Requirements

OEP will need to assign a senior staff member and at least 4-6 support staff to Task 1. As the energy audit program will be an ongoing activity, these people should be permanently assigned to this responsibility.

Task 2 will require extensive OEP staff involvement later than Task 1 and need not be assigned immediately.

Task 3 will need coordination with CAPMAS for effective implementation.

Task 4 has a need for an OEP staff member to be responsible for coordinating all training functions.

OEP Project No. 1: Industrial Energy Conservation

Task 1. Develop and Implement Industrial Energy Audit Program

The objective of this task is to design, test, and implement an ongoing program of energy audits at industrial facilities. A pilot program consisting of audits of industrial plants that offer opportunities for short term energy savings will be undertaken. These audits will lead to specific recommendations for energy-saving measures. A review and evaluation of the audit program will be made and procedures established for a second round of audits. It is intended that the audit program be continued in succeeding years to cover the majority of Egyptian industrial facilities.

Subtask 1.1. Establish pilot program operational procedures.

- o OEP will assign responsibility for the audit program to a senior staff member and will assign additional support staff.
- o Discussions will be held with the Tabbin Institute for Metallurgical Research to identify their participation in the program and to make the necessary arrangements.
- o Discussions will be held with the Central Agency for Public Mobilization and Statistics (CAPMAS) to identify their participation in the program and to make the necessary arrangements.
- o Discussions will be held with other organizations to identify their role and solicit their cooperation (e.g. GOFI, Ministry of Industry, etc.).
- o OEP will be responsible for coordinating the participation of these other agencies. It may be desirable to convene an ad hoc committee to deal with this.

Subtask 1.2. Select candidate plants for audit pilot program.

- o A set of preliminary criteria will be developed to select candidate plants for the pilot program audits.
- o Participating organizations and individuals with industrial experience will be asked to identify facilities that meet the criteria and that will be considered candidates for the pilot audits.
- o The procedures to be used to establish contact with the plants will be identified (e.g. contact through GOFI, direct contact from OEP).

Subtask 1.2 continued

- An information package describing the pilot program audits will be prepared. It may also be desirable to prepare a special workshop for plant managers to describe the program and solicit their cooperation.

- The candidate plants will be contacted, sent the information package, and invited to the workshop.

- Following the workshop, a visit will be made to the candidate plants for a preliminary review of the facility and an evaluation of their potential involvement in the audit program.

- OEP will make a decision on the group of plants to be included in the pilot program using information gathered at the workshop and the visits. An audit schedule will be prepared.

Subtask 1.3. Review and select audit procedures.

- ANL will review and evaluate industrial energy audit procedures, equipment, and organizations for their potential application in Egypt. Discussions will be held with the U.S. Department of Energy and its contractors, the U.S. Agency for International Development and its contractors, the Canadian Department of Energy, Mines, and Resources, and any other pertinent organizations.

- A Request for Qualifications (RFQ) and a Request for Proposals (RFP) will be prepared to solicit contractors who can participate in the audit program. OEP and ANL will select the appropriate contractor(s).

- Auditing equipment (e.g. pyrometers, flow meters, temperature gauges) will be reviewed and evaluated. A selection of equipment for OEP use will be prepared. ANL will assist in the procurement of the equipment.

- Auditing analysis computer software will be reviewed and evaluated for OEP use. A selection will be made and ANL will assist in its procurement.

- Integrated audit systems (e.g. a mobile audit bus with measuring equipment and computer software) will be evaluated and recommendations made to OEP.

Subtask 1.4 Prepare pre-audit information.

- o A pre-audit questionnaire will be prepared and submitted to the candidate plants to complete. This will provide the necessary background information for the audit.
- o The selected contractors will conduct a training course for the OEP audit team in the procedures to be used prior to the actual audits.
- o A format for the presentation of audit results will be developed.

Subtask 1.5 Conduct pilot audits.

- o The contractor(s) and the OEP team(s) will conduct the audits at each of the candidate plants.
- o Each audit will be reported in the standard format developed. A set of recommendations on energy-saving measures to be considered will be developed along with potential savings and cost estimates.
- o Audit results for each plant will be submitted as they are completed until all the candidate plants in the pilot program have been evaluated.

Subtask 1.6 Conduct review and evaluation of audit pilot program.

- o OEP, ANL, the contractor(s), and other relevant organizations will conduct a detailed review of the pilot program. An evaluation of strengths and weaknesses of the pilot program will be made.
- o A revised set of procedures for the second round of audits will be developed.
- o Following the review, the second round of audits will be initiated. Subtasks 1.2, 1.4, and 1.5 will be repeated.

Subtask 1.7 Conduct follow-up monitoring of plants.

- o At an appropriate time after the energy-saving measures have been implemented (see Task 2), a follow-up audit will be conducted at each of the plants to determine the effectiveness of the measures.

Task 1 Resource Requirements

Time Schedule:	22 months
OEP Personnel:	
Audit Director	11 person-months
Support Technicians (2 per audit team)	22 person-months per audit team
ANL Personnel:	
Task Director	8 person-months
Engineering Support	4 person-months
Contractor Personnel (per audit team):	
Team Leader	6 person-months
2 Support Engineers	12 person-months

Task 1. Develop and Implement Industrial Energy Audit Program

Subtask	1983	1984											
	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1.1 Establish pilot program operational procedures													
1.2 Select candidate plants for audit pilot program													
1.3 Review and select audit procedures													
1.4 Prepare pre-audit information													
1.5 Conduct initial audits and develop recommendations													
1.6 Conduct review of audit pilot program													
1.7 Conduct follow-up audit												TBD	

Task 2. Industrial Project and Policy Development

This task is designed to deal with two specific issues: the preparation of industrial conservation projects resulting from the audits and the development of industrial conservation policies.

Subtask 2.1 Develop industrial conservation project evaluation methodology.

- A methodology will be designed to evaluate and prioritize the industrial conservation measures that result from the audit program (Subtask 1.5). The methodology will reflect costs of energy based on world market prices and will use standard rate of return estimating procedures.

- ANL will hold discussions with World Bank representatives to insure that the methodology is compatible with the Bank's project evaluation procedures. This will be required if any of the proposed projects are to be presented to the Bank for financing assistance.

- The methodology will be implemented on OEP computer equipment and OEP staff will be trained in its use.

Subtask 2.2 Implement project evaluation methodology on industrial energy audit pilot program results.

- The results of the pilot program audits will be evaluated using the methodology developed.

- The recommendations for energy-saving measures will be evaluated for their costs, rate-of-return (based on world energy prices), their payback period, their implementation constraints, and other factors.

- A prioritized list of measures to be implemented will be developed for presentation by OEP to appropriate organizations.

Subtask 2.3 Evaluate and select implementation mechanisms.

- The various mechanisms whereby the energy conservation measures can be implemented will be identified (e.g. funding by OEP, funding by Ministry of Industry, World Bank financing, private financing).

- The mechanisms will be evaluated and a choice will be made as to the appropriate procedure to be followed.

Subtask 2.4 Prepare implementation recommendations.

- o OEP will prepare a list of recommended actions to be implemented as a result of the audit findings. The list will include a priority set of energy-conserving measures to be taken and an identification of the most appropriate course of action to be taken.

- o OEP will submit the recommendations to the appropriate organizations for actual implementation.

- o OEP will monitor the progress of the implementation process and will report results to the Supreme Council on Energy.

Subtask 2.5 Identify and evaluate industrial conservation policy alternatives.

- o As an initial step towards developing a comprehensive industrial energy conservation policy and plan, OEP will identify a set of policy alternatives that can be considered (e.g. incentive bonus program, energy price adjustments, regulatory measures).

- o Each alternative will be evaluated with respect to its energy savings potential, its cost, and its implementation features.

- o It is expected that some alternatives cannot be evaluated due to a lack of information. Steps will be taken to assemble the necessary data.

Subtask 2.6 Prepare industrial conservation policy and plan.

- o A preliminary industrial conservation policy statement and program plan will be prepared by OEP.

- o The document will be sent for review to appropriate organizations.

- o A revised policy statement and plan will be prepared for submission to the Supreme Council on Energy.

Task 2 Resource Requirements

Schedule	13 months
OEP Personnel:	
Task Director	6 person-months
2 Engineers/Economists	12 person-months
ANL Staff	
Engineer/Economist	5 person-months
Contractor Personnel	
Engineer/Economist Consultant	2 person-months

Task 2. Industrial Project and Policy Development

Subtask	1983	1984											
	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2.1 Develop industrial conservation project evaluation methodology													
2.2 Implement project evaluation methodology on pilot program													
2.3 Evaluate and select implementation mechanisims													
2.4 Prepare implementation recommendations													Jan 1985
2.5 Identify and evaluate industrial conservation policy alternatives													
2.6 Prepare industrial conservation policy statement and plan													May 1985

Task 3. Development of Industrial Energy Consumption Data Base

The objective of this task is to develop a detailed data base on industrial energy consumption patterns. The data base will provide the basis for selecting future candidates for energy audits, will allow OEP to monitor progress in industrial energy use, and will be incorporated into the Network Energy Tracking System (NETS) for use in national energy planning (see Project No. 2).

Subtask 3.1 Define data needs.

- o ANL and OEP will work to define the data needs for both the short term and long term.
- o Short-term needs will be based on providing the necessary information to select the candidate plants for the second round of energy audits (see Task 1).
- o Long-term needs will be based on providing the information necessary for national energy planning (see Project No. 2).
- o The data needs will be defined in terms of the information that is to be collected from individual industrial facilities in a routine survey process.

Subtask 3.2 Review available data.

- o The industrial data currently collected by CAPMAS will be reviewed to determine its utility to OEP needs.
- o The data available from the Ministry of Industry, Ministry of Petroleum, Government Organization for Industrialization, and other groups will be reviewed for relevance.
- o An identification of data that is not now being collected and that is necessary to meet OEP requirements will be made.

Subtask 3.3 Develop survey for short-term needs.

- o A survey of industrial facilities will be designed. The survey will be structured to fill in the missing information needed by OEP to select the second round of energy audit candidates.
- o The surveying procedure will be designed. This may include mail-out questionnaires, site visits, and telephone contacts.

Subtask 3.3 continued

- o OEP staff will be trained in how to conduct the survey procedure.
- o Arrangements will be made with CAPMAS to utilize the personnel and procedures already in place for conducting the survey.
- o Survey schedules will be drawn up.

Subtask 3.4 Develop data handling procedures.

- o A computerized data processing procedure will be designed to handle the survey data as it is available. The procedure will allow the information to be processed quickly and efficiently as it comes in.
- o CAPMAS will be consulted to determine the applicability of its existing computer software to handling the survey information. Arrangements will be made to utilize whatever systems are appropriate.
- o The procedures will be designed to be compatible with the Network Energy Tracking System (see Project No. 2).

Subtask 3.5 Conduct survey for short-term needs.

- o The survey process described in Task 3.3 will be implemented.
- o Survey information will be processed as received.

Subtask 3.6 Develop recommendations for second round of audits.

- o The information from the survey will be processed to develop a better perspective of energy consumption in the surveyed facilities.
- o The data will be reviewed to evaluate candidates for the second round audits. The quantity of energy consumption, the energy use per unit of production, projected growth rates, and other factors will be considered in determining audit candidates.
- o A list of candidate plants for second-round audits will be prepared.

Subtask 3.7 Publish report on industrial energy use.

- o Using the survey results, a report will be published by OEP giving a perspective on current industrial energy use. The report may not be able to be comprehensive due to the survey limitations, but it will provide a valuable insight into the facilities that have been included.

Subtask 3.8 Develop survey for long-term needs.

- o Using the experience of the short-term needs survey, a modified survey procedure will be developed.
- o Decisions will be made on how the survey will be implemented (e.g. using OEP staff, using CAPMAS staff, using contractor assistance).
- o Survey forms and schedules will be developed.
- o Necessary agreements will be signed between OEP and other organizations to implement the survey on an ongoing basis.

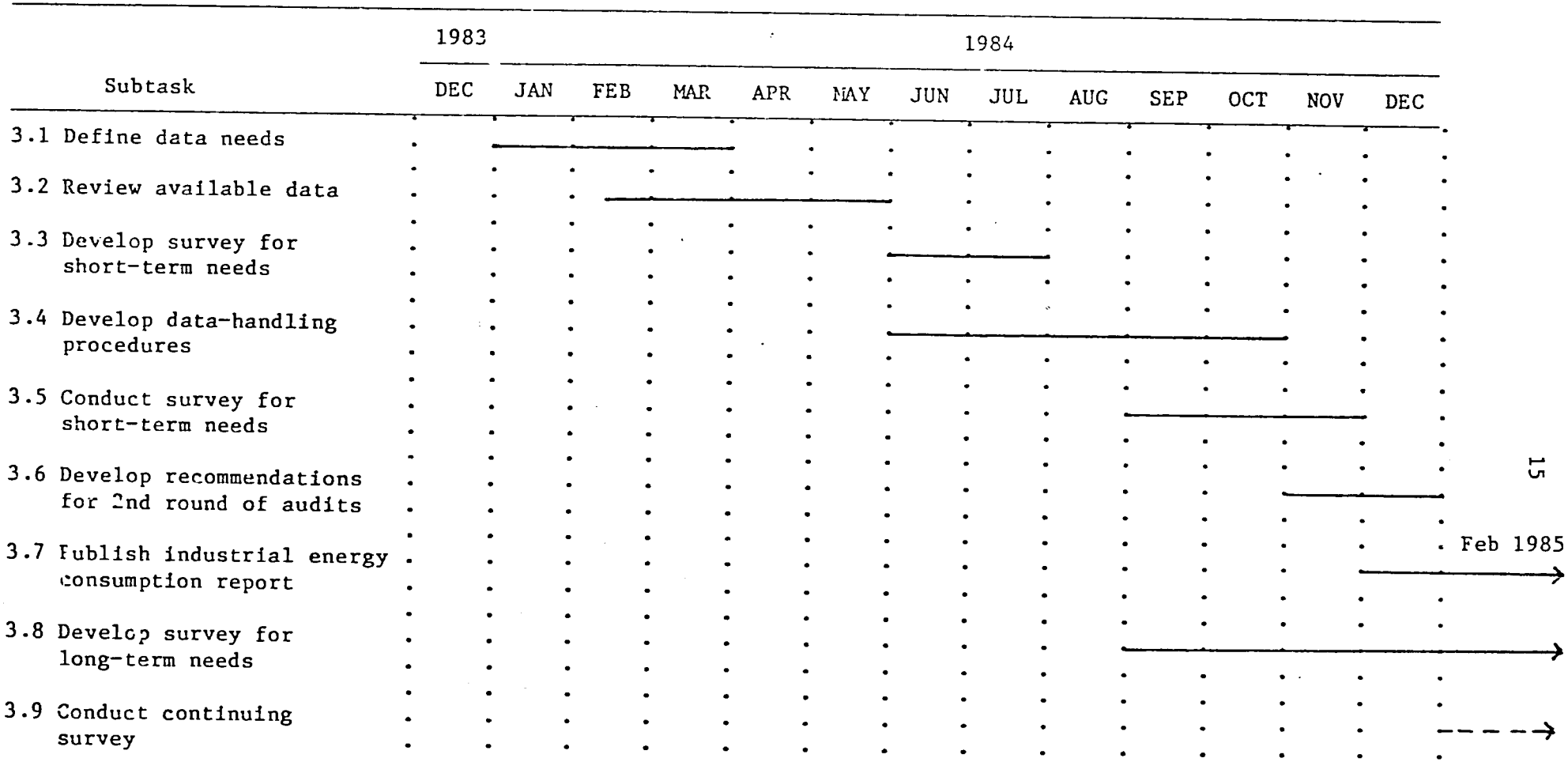
Subtask 3.9 Conduct continuing survey of industrial facilities.

- o The industrial survey procedure will be carried out on a regular basis.

Task 3 Resource Requirements

Time Schedule	12 months (excluding Subtask 3.9)
OEP Personnel:	
Task Director	6 person-months
2 Survey Engineers	18 person-months
Computer Specialist	5 person-months
ANL Personnel:	
Task Director	3 person-months
Survey Engineer	3 person-months
Computer Specialist	4 person-months
Contractor Personnel:	
Survey Consultant	6 person-months
4 Survey Enumerators (local Egyptian)	24 person-months

Task 3. Development of Industrial Energy Consumption Data Base



Task 4. Development of Industrial Energy Use Training Program

The purpose of this task is to develop and conduct a series of training programs. The training is aimed at several groups: OEP staff, industrial plant operators, and industrial plant management. The training program is designed to include formal lecture sessions, field practice, on-the-job training, short courses and symposia, and attendance at training courses in the U.S.

Subtask 4.1 Develop and conduct near-term course for energy managers.

- A follow-up course for energy managers who attended the initial training session in October 1983 will be designed and carried out.
- The results of the October course will be evaluated and a decision made on the thrust of the follow-up course.
- A curriculum for the follow-up course will be prepared.
- Appropriate lecturers from the U.S. will be contracted to participate in the course.
- The course will focus on practical applications of energy conservation principles and may involve some field work in energy auditing procedures.

Subtask 4.2 Assemble information on existing U.S. industrial energy courses.

- A compilation will be made of available training programs in the U.S. on industrial energy use.
- Short courses, on-the-job training opportunities, university courses, and others will be considered.
- The information will be assembled in a form that can be updated regularly to keep OEP aware of available opportunities.

Subtask 4.3 Develop training strategy and plan.

- A comprehensive training program will be prepared for OEP.
- The program will identify appropriate training activities for OEP staff, industrial plant operators, and industrial plant management in energy conservation.

Subtask 4.3 continued

- The plan will describe how the training should be approached, who should conduct the training, who should attend training sessions, how frequently training courses should be offered, and the role of out-of-country training activities.

- The program will include needs for English language as well as technical training.

Subtask 4.4 Select schedule for training activities.

- The schedule for OEP staff training will be selected. This must be done in consideration of their daily work responsibilities.

- The schedule for training programs for industrial plant operators and management will be selected.

Subtask 4.5 Develop curriculum for in-country training efforts.

- For those training courses that will be conducted in Egypt, a contractor will be selected to develop the curriculum material.

- Several sets of material may be required for different courses.

Subtask 4.6 Conduct initial training sessions.

- The first round of training activities using the new material will be conducted.

- It may be desirable to announce an "Industrial Energy Use Symposium" to attract participants. Courses could be offered as part of the symposium.

Subtask 4.7 Evaluate training effort and prepare revised plan.

- The results of the first training effort will be evaluated for its effectiveness.

- Modifications to the training strategy and plan will be made.

- Modifications to the curriculum material will be made.

Task 4 Resource Requirements

Time Schedule	13 months
OEP Staff (does not include staff to be trained)	
Training Director	8 person-months
Training Logistical Support Staff	8 person-months
ANL Staff	
Task Monitor	3 person-months
Contractor Staff	
For plan development	3 person-months
For curriculum development	6 person-months
For training sessions	4 person-months

Task 4. Development of Industrial Energy Use Training Program

Subtask	1983	1984											
	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
4.1 Develop near-term course for energy managers													
4.2 Assemble information in existing U.S. industrial energy courses													
4.3 Develop training strategy and plan													
4.4 Select schedule for training activities													
4.5 Develop curriculum for in-country training efforts													
4.6 Conduct initial training sessions													
4.7 Evaluate training efforts and revise training plan													

APPENDIX

3.8.1-1

ORGANIZATION FOR ENERGY PLANNING
PROJECT DESCRIPTION

PROJECT NO. 1 - INDUSTRIAL ENERGY CONSERVATION

Part 2 of 2

DRAFT

Prepared by

Energy and Environmental Systems Division
Argonne National Laboratory

October 1984

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OEP PROJECT DESCRIPTION

OEP Project No. 1

Industrial Energy Conservation

Objectives

The objectives of this project are to begin the implementation of energy-conserving measures in industrial facilities in Egypt. The focus will be on achieving measurable energy savings at reasonable costs. As there is currently only a limited amount of energy conservation activity in the industrial sector, the project must establish an awareness of the need on the part of industrial plant managers and operators.

Anticipated Outputs

The expected outputs of this project are:

1. A set of recommended energy-conserving measures suitable for implementation in industrial facilities included in the pilot program,

2. A trained team of industrial energy auditors and a tested audit procedure,

3. An industrial energy conservation policy statement and program plan,

4. An initial industrial energy consumption data base, and

5. A plan for training OEP and industrial staff in energy conservation and initial training courses.

Project Tasks

There are four major tasks that comprise this project:

Task 1. Develop and Implement Industrial Energy Audit Program
Task 2. Development of Industrial Project and Policy Plan
Task 3. Development of Industrial Energy Consumption Data Base
Task 4. Development of Industrial Energy Use Training Program

Schedule

The industrial energy audit program is designed to have the first set of energy conservation projects identified 8 months from project start.

The project development task is scheduled to recommend a prioritized list of conservation measures to be implemented 13 months from project start. An industrial energy conservation policy statement and program plan is scheduled for 16 months from project start.

The first version of the industrial data base is scheduled for completion 10 months from project start in time to be used to identify the second round of industrial audits.

A training strategy and program plan is scheduled for completion four months from project start. The earliest training course is scheduled for five months from start with the next set of courses in the period 9-11 months from start.

Personnel

The project will require the following personnel:

OEP staff	96 person-months
ANL staff	30 person-months
Contractor staff	63 person-months

Startup Requirements

OEP will need to assign a senior staff member and at least 2-4 supportstaff to Task 1. As the energy audit program will be an ongoing activity, these people should be permanently assigned to this responsibility.

Task 2 will require extensive OEP staff involvement later than Task 1 and need not be assigned immediately.

Task 3 will need coordination with CAPMAS for effective implementation.

Task 4 has a need for an OEP staff member to be responsible for coordinating all training functions.

OEP Project No. 1: Industrial Energy Conservation

Task 1. Develop and Implement Industrial Energy Audit Program

The objective of this task is to design, test, and implement an ongoing program of energy audits at industrial facilities. A pilot program consisting of audits of industrial plants that offer opportunities for short term energy savings will be undertaken. These audits will lead to specific recommendations for energy-saving measures. A review and evaluation of the audit program will be made and procedures established for additional rounds of audit. It is intended that the audit program be continued in succeeding years to service the majority of Egyptian industrial facilities.

Subtask 1.1 Establish Pilot Program Operational Procedures.

- o OEP will assign responsibility for the audit program to a senior staff member and will assign additional support staff.

  Status: Completed. Dr. Adel Nasser (OEP) has been assigned responsibility for the OEP industrial audit program. Dr. Nasser has taken charge and has already assigned plant screening responsibilities to OEP staff engineers.

- o Discussions will be held with the Tabbin Institute for Metallurgical Research to identify their participation in the program and to make the necessary arrangements.

  Status: Held in abeyance. OEP has determined that is is premature to involve the Tabbin Institute for Metallurgical Research in the industrial audit program. Once the program is under way, OEP will determine if there are areas where the Institute can offer assistance to enhance the program.

- o Discussions will be held with the Central Agency for Public Mobilization and Statistics (CAPMAS) to identify their participation in the program and make the necessary arrangements.

  Status: Ongoing. Preliminary discussions were held with the Central Agency for Public Mobilization and Statistics (CAPMAS). OEP asked for and received CAPMAS public industrial sector census data. OEP is currently reviewing this program. As a result of this review, a determination will be made regarding the future participation of CAPMAS in the industrial audit program.

- o Discussions will be held with other organizations to identify their role and solicit their cooperation (e.g. GOFI, Ministry of Industry, etc.).

Status: Ongoing. OEP has solicited the cooperation of GOFI and the Ministry of Industry in obtaining the cooperation of public sector companies in the industrial audit program. Dr. Hussein Abdallah has sent letters of introduction regarding the audit program to approximately 140 public sector industrial companies. The letter was accompanied by a request for preliminary plant equipment information. (See May-June 1984 Progress Report - Appendix B.) Based on this survey, OEP has received and transmitted to ANL basic survey data for 40 public sector industrial companies. (See July-August 1984 Progress Report.)

- o OEP will be responsible for coordinating the participation of these other agencies. It may be desirable to convene an ad hoc committee to deal with this.

  Status: Held in abeyance. OEP has not convened an ad hoc committee of government organization to participate in the industrial audit program. OEP feels that such a committee is not needed at this time.

Subtask 1.2 Select Candidate Plants for Audit Pilot Program.

- o A set of preliminary criteria will be developed to select candidate plants for the pilot program audits.

  Status: Ongoing. OEP/ANL have developed a procedure with industrial equipment data collection forms to perform plant screening for industrial audit. OEP is currently in the process of selecting several candidate plants for the first round of industrial audit which is expected to commence in early November 1984.

- o Participating organizations and individuals with industrial experience will be asked to identify facilities that meet the criteria and that will be considered candidates for the pilot audits.

  Status: Held in abeyance. OEP/ANL will initially assume this responsibility with contractor support.

- o The procedures to be used to establish contact with the plants will be identified (e.g., contact through GOFI, direct contact from OEP).

  Status. Completed. OEP, after consultation with GOFI and the Ministry of Industry, will assume the sole responsibility of contacting plants for industrial audit. The procedure involves a letter of introduction by OEP followed by a visit by OEP to explain the audit program to plant management.

- As part of the plant screening process, OEP will determine the status of stationary energy-monitoring equipment that would be necessary to conduct an audit. Plants not having the necessary monitoring capability that cannot be duplicated by portable equipment will be dealt with in Subtasks 1.11 and 1.18.

- An information package describing the pilot program audits will be prepared. It may also be desirable to prepare a special workshop for plant managers to describe the program and solicit their cooperation.

  Status: Revised and completed. Instead of development of an information package, OEP has initiated the process with a letter of introduction followed by a plant visit. Also, during a recent (May 1984) plant energy workshop conducted by OEP/ANL in Cairo, plant energy managers were briefed on the industrial audit program

- The candidate plants will be contacted, sent the information package, and invited to the workshop.

  Status: Ongoing. OEP is currently in the process of visiting and evaluating industrial plants for possible audit. Approximately 30 public sector industrial plant energy managers attended a two-week plant energy manager workshop conducted by OEP/ANL in Cairo.

- Following the workshop, a visit will be made to the candidate plants for a preliminary review of the facility and an evaluation of their potential involvement in the audit program.

  Status: Ongoing. OEP initiated plant screening visits in June 1984.

- OEP will make a decision on the group of plants to be included in the Pilot Program using information gathered at the workshop and the visits. An audit schedule will be prepared.

  Status: Ongoing. OEP is currently in the process of selecting candidate plants for the first series (pilot) of audits that will begin in early November. An audit schedule has been prepared. (See July-August Progress Report - Draft Work Order.)

Subtask 1.3. Select Candidate Plants for Second and Third Series of Audits in 1985.

- OEP will continue to conduct plant screening operations to determine candidate plants for audit in 1985 and beyond, using the procedures initially developed in Subtask 1.2.

- o OEP will continue to collect information on stationary "hard-wired" monitoring instrumentation that should be in place prior to an effective audit. This information will be used in Subtasks 1.10 and 1.18.

Subtask 1.4 Review and Select Contractor Audit Procedures.

- o ANL will review and evaluate industrial energy audit procedures, equipment, and organizations for their potential application in Egypt. Discussions will be held with the U.S. Department of Energy and its contractors, the U.S. Agency for International Development and its contractors, the Canadian Department of Energy, Mines, and Resources, and any other pertinent organizations.

  Status. Ongoing. ANL has had discussions with the Canadian Department of Energy, Mines and Resources (See November 1983 Progress Report) and work is commencing on a mobile bus similar to that used by the Canadian Department of Energy. ANL has also held discussions with the U.S. Department of Energy and the U.S. Agency for International Development and their contractors regarding developing country industrial audit programs. This information was used to assist in the development of a Request for Proposal (RFP) that was issued by ANL requesting proposals by consultant firms to perform industrial audits and audit training in Egypt.

- o A Request for Qualifications (RFQ) and a Request for Proposals (RFP) will be prepared to solicit contractors who can participate in the audit program. OEP and ANL will select the appropriate contractor(s).

  Status: Completed. An RFP was issued, eighteen proposals received, and three contracting firms selected to conduct industrial audits and training in Egypt. ANL is currently finalizing Basic Ordering Agreement (BOA) contracts with the three selected firms.

Subtask 1.5 Prepare Pre-audit Information.

- o A pre-audit questionnaire will be prepared and submitted to the candidate plants to complete. This will provide the necessary background information for the audit.

  Status: Ongoing. The pre-audit questionnaire is provided by the contractor audit firms. The questionnaires have been included in the contractors' proposal response to the RFP. The pre-audit questionnaires may be revised as experience is gained in the audit process in Egypt.

- o The selected contractor will conduct a training course for the OEP audit team in the procedures to be used prior to the actual audits.

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Status. Ongoing. The training course for industrial audit is provided for in the first work order to be issued under the BOA (see July-August Progress Report).

- o A format for the presentation of audit results will be developed.

  Status. Ongoing. The format for the presentation of audit results was provided by the contractors in their proposal response to the RFP. The format may be revised as appropriate, based on in-country experience in the audit process.

Subtask 1.6 Conduct Pilot Audits.

- o The contractor(s) and the OEP team(s) will conduct the audits at each of the candidate plants.

  Status: Ongoing. The conduct of two audits over a twelve-week period is specified in the initial work order to be issued under the BOA (see July-August Progress Report). The audits are expected to commence in early November.

- o Each audit will be reported in the standard format developed. A set of recommendations on energy-saving measures to be considered will be developed along with potential savings and cost estimates.

  Status: Ongoing. This is provided for in the contractors' format for presentation of audit results presented in their proposal response to the RFP. The first work order to be issued under the BOA reinforces the requirement for establishment of a set of recommendations on energy-saving measures and estimates of cost to implement these measures.

- o Audit results will be submitted as they are completed until all the candidate plants have been evaluated.

  Status: To be done. Once the first work order is issued under the BOA to one contractor firm, additional work orders will be written for additional audits. It is envisioned that all three contractor firms under the BOA will be involved in the conduct of industrial audits in Egypt.

Subtask 1.7 Conduct Review and Evaluation of Audit Pilot Program.

- o OEP, ANL, the contractor(s), and other relevant organizations will conduct a detailed review of the pilot program. An evaluation of strengths and weaknesses of the pilot program will be made.

  Status. Revised - to be done. The first series of audits will be continuously monitored and reviewed. A critical

review by OEP/ANL will take place after the pre-audit presentation by the contractor audit team. An evaluation of the strengths and weaknesses of the pre-audit evaluation will be made.

- o A revised set of procedures for the second round of audits will be developed.

- o Following the review, the second round of audits will be initiated. Subtasks 1.2, 1.5, and 1.6 will be repeated.

Subtask 1.8 Conduct Second Series of Audits.

- o Once the pilot audit pre-audit evaluation has been made (see Subtask 1.7) a work order will be issued to the contractors under the BOA for a second series of audits.

- o The work order will be for five consectuive audits and is based on an estimate that it takes an average of 8-1/2 weeks to complete an audit. A complete audit includes plant screening; pre-audit analysis, report and presentation; and audit analysis, report and presentation.

- o The work order will be structured so that the pre-audit will serve as a cost estimate and indication of performance for the audit. The contractor will not be authorized to proceed with work on the audit until ANL/OEP has approved the pre-audit recommendations and associated effort costs. This procedure allows OEP/ANL to have effective management control over the contractual audit process.

- o After the contractor completes the pre-audit and presents his report, ANL/OEP will review the report and make a decision regarding a subsequent audit. While OEP/ANL is conducting the review, the contractor will conduct the next pre-audit. Before the second pre-audit is completed, OEP/ANL will have made decisions regarding the first audit and, based on an appropriate pre-audit, OEP/ANL will authorize work on the first audit. This process will repeat itself until all five audits are completed.

- o Based on an estimated average of 8-1/2 weeks per audit, five audits will have been completed in 42-1/2 weeks. However, if the plant systems encountered are, on the average, more complicated, then less audits will be completed in the time period.

- o The audit team will be composed of OEP staff engineers and contractors. If sufficient OEP staff are not available during the time period, then less than five audits will be completed.

- o The schedule assumes that OEP will have visited the candidate plants for audit and will have introduced the program

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to plant management and performed a preliminary plant screening inclusive of preliminary data gathering.

Subtask 1.9 Conduct Third Series of Audits

- This activity is the same as the activity in Subtask 1.8. The reason the audit work orders are issued for groups of five audits is to take advantage of the full technical expertise available from the three contractor firms under the BOA. In this way OEP/ANL can choose the test technical experts among the contractors that would be available in the specified time period.

- The same constraints apply here as in Subtask 1.8. Namely, if there is not sufficient OEP engineer audit staff or if the audits take longer on an average than 8-1/2 weeks per audit, less than five audits will be completed in the time frame.

Subtask 1.10 Select Candidate Plants for Fourth, Fifth, Sixth Series of Audits in 1986.

- Same procedure as Subtask 1.9.

Subtask 1.11 Purchase Plant Energy Monitoring Instruments Necessary for Audit in 1986.

- OEP will assemble the data on plant-monitoring instrument requirements that is collected in Subtask 1.3.

- A task order will be issued to provide contractual support toward making a final determination of energy-monitoring instrumentation. The contractor will have the responsibility of inspecting all the plants requiring instrumentation and assembling all the technical specifications required for purchase orders.

- The necessary instrumentation will be purchased and arrangements will be made for installation by plant staff or a local engineering firm.

Subtask 1.12 Review, Select and Purchase Audit Equipment.

- Auditing equipment (e.g., pyrometers, flow meters, temperature gauges) will be reviewed and evaluated. A selection of equipment for OEP use will be prepared. ANL will assist in the procurement of the equipment.

  Status. Ongoing. The specification of auditing equipment that the contractor will use is a requirement of the initial work order (See July-August 1984 Progress Report.) under the BOA. OEP staff will be trained in the use of the contractor's auditing equipment after which a decisiion will be made on the type of equipment that should be pur-

chased by OEP. ANL will also purchase some select auditing equipment based on the recommendations of instructors that participated in the plant energy manager workshop held in May 1984 in Cairo.

- o Auditing analysis computer software will be reviewed and evaluated for OEP use. A selection will be made and ANL will assist in its Procurement.

  Status. Ongoing. The specification of auditing analysis software that the contractor will use is a requirement of the initial work order under the BOA. The contractor must also specify that the software is available for licensing under reasonable terms and provide those terms to ANL/OEP. ANL is also in the process of purchasing some general engineering analysis support software for OEP.

Subtask 1.13 Design and Purchase Audit Van

- o Integrated audit systems (e.g. a mobile audit bus with measuring equipment and computer software) will be evaluated and recommendations made to OEP.

  Status: Ongoing. ANL has developed a set of specifications (See July-August 1984 Progress Report.) for a mobile audit bus that will be used by OEP to conduct industrial energy audits. ANL procurement has submitted the specifications to a number of firms specializing in van customization requesting a response on the design criteria.

Subtask 1.14 Select Candidate Plants for Seventh, Eighth and Ninth Series of Audits in 1987.

- o Same procedure as Subtask 1.10

Subtasks 1.15, 1.16 and 1.17 Conduct Fourth, Fifth and Sixth Series of Audits in 1986.

- o Each series of audit will involve five audits for a total of 15 audits during the time period.
- o Three work orders will be issued for contractor support, each for five audits.
- o The procedure specified in the contractor work order will be the same as indicated in Subtask 1.7.
- o Again, it is estimated that each audit will take 8-1/2 weeks to complete. If the audits are, on an average, more complicated, fewer audits will be completed.
- o Again, the target of fifteen (15) audits in 1986 assumes that there will be sufficient OEP audit staff to support the contractual audit effort. By 1986 it is expected that

OEP will have sufficient trained audit staff to support the full audit activity.

Subtask 1.18 Purchase Plant Energy Monitoring Instruments Necessary for Audit in 1987.

- o Same procedure as Subtask 1.11.

Subtasks 1.19 and 1.20 Conduct Seventh and Eighth Series of Audits in 1987.

- o Subtasks 1.14 and 1.20 will involve a total of 10 audits for 1987 with contractor support. It is anticipated that the activity will proceed as Subtasks 1.15 through 1.17 (audit activity for 1986).

Subtask 1.21 Conduct Ninth Series of Audits in 1987, Managed by OEP Audit Staff.

It is anticipated that OEP will have developed a well-trained staff of audit managers and engineers by 1987 and will be in a position to subcontract their own technical support for special audit situations. Much of this specialized technical support may well come from Egyptian engineering firms doing business with Egypt.

Subtask 1.22 Conduct Follow-up Monitoring of Plants.

- o At an appropriate time after the energy-saving measures have been implemented (see Task 2), a follow-up audit will be conducted at each of the plants to determine the effectiveness of the measures.

Task 1 Resource Requirements

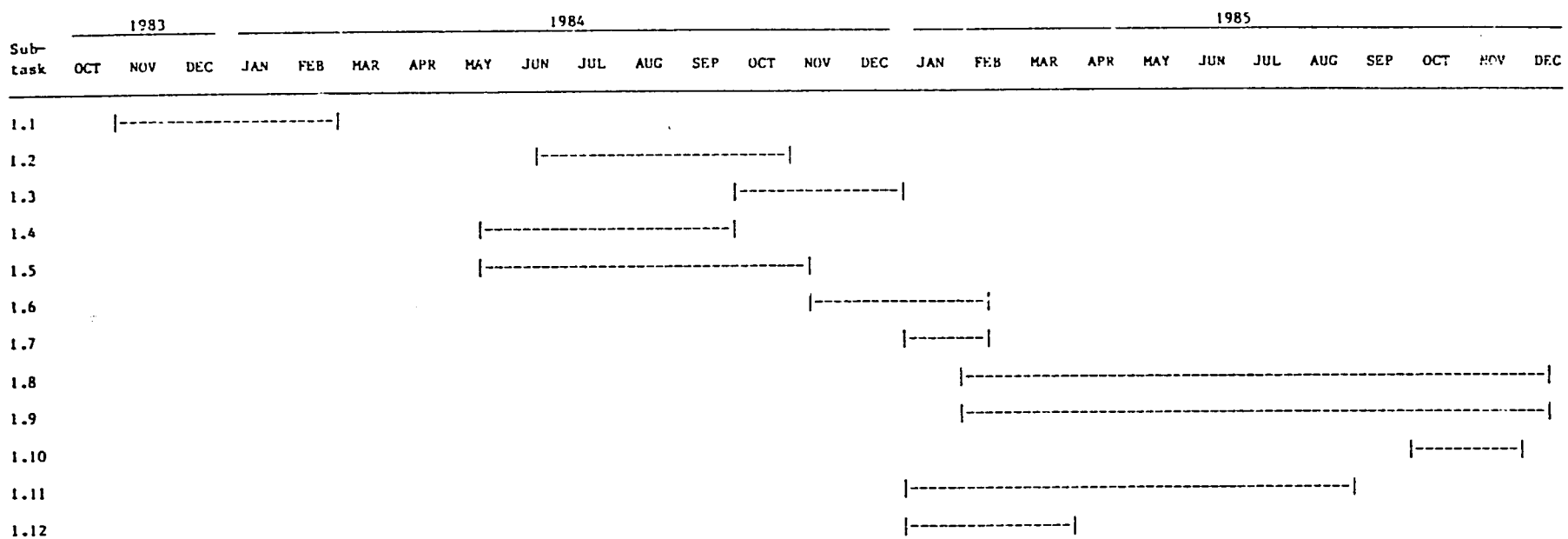
Time Schedule:	22 months
OEP Personnel:	
Audit Director	11 person-months
Support Technicians (2 per audit team)	22 person-months per audit team
ANL Personnel:	
Task Director	8 person-months
Engineering Support	4 person-months
Contractor Personnel (per audit team):	
Team Leader	6 Person-months
2 Support Engineers	12 person-months

TABLE 1.1 Develop and Implement Industrial Energy Audit Program

table reduced

TABLE 1.1 (Cont'd)

Figure 1.1 (reduced)



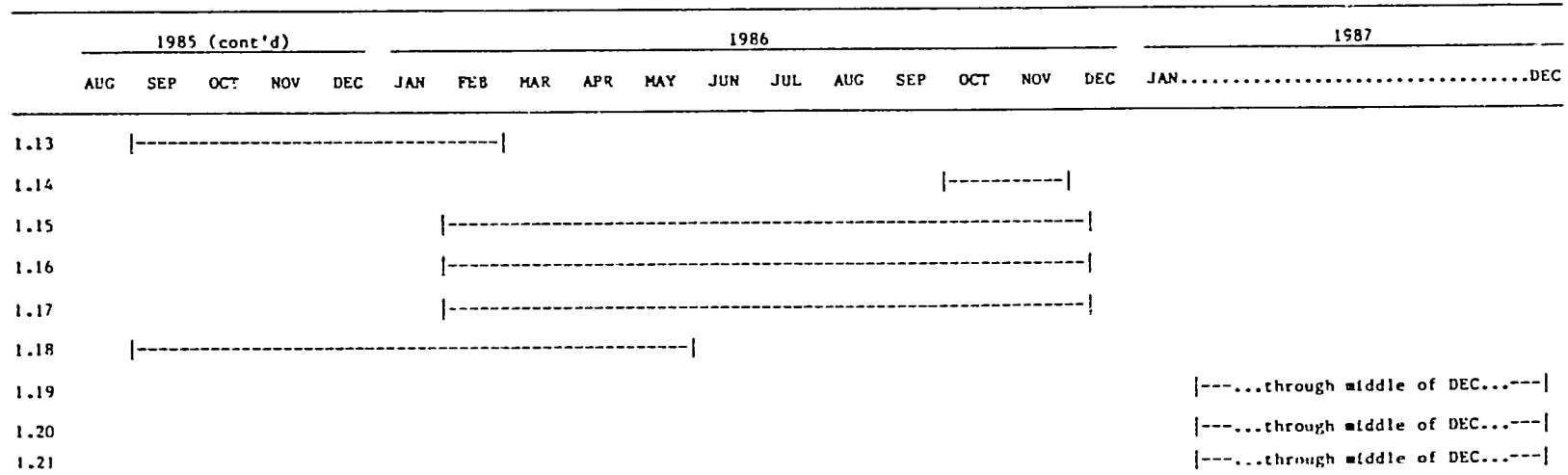


FIGURE 1.1 Task 1 Time Schedule

Task 2. Industrial Project and Policy Development

This task is designed to deal with two specific issues: the preparation of industrial conservation projects resulting from the audits and the development of industrial conservation policies.

Subtask 2.1 Develop Industrial Conservation Project Evaluation Methodology.

- o A methodology will be developed to evaluate and prioritize the industrial conservation recommendations that will result from the audit program.
- o Criteria for project evaluation will include the audit report technical and economic analysis but will be expanded to cover other important considerations such as size of capital outlay, magnitude of fuel savings, whether the project labor and equipment would be foreign or domestic, constraints imposed by lending institutions (when identifiable), and other relevant factors exogenous to the plant audit.
- o The prioritization methodology will allow evaluation by different selected mixes of evaluation criteria.
- o ANL will hold discussions with World Bank representatives to determine the criteria used to evaluate financing of energy conservation projects. Definable criteria will be incorporated in the project evaluation scheme.
- o OEP will hold discussions with Egyptian institutions and branches of government that are in a position to finance energy conservation projects. Definable criteria will be incorporated in the project evaluation scheme.
- o As appropriate, the methodology will be designed for computer analysis to enhance the prioritization of a number of projects by different mixes of evaluation criteria.

Subtask 2.2 Test and Tune Project Evaluation Methodology on Industrial Energy Audit Program Results

- o The energy conservation project recommendations resulting from the audit program will be used to test the performance of the project evaluation methodology.
- o The methodology will be revised, as appropriate, based on the performance of the test cases.
- o A report of the prioritized energy conservation projects will be prepared and be part of a set of recommendations for the initiation of project implementation in Subtask 2.4.

Subtask 2.3 Energy Conservation Project Implementation Program

The audit process ends with a recommendation for an energy conservation project. The next step is to carry out the recommendations concluding in a successfully implemented energy conservation measure. A plant project has different phases of development such as project design, fabrication, installation, and plant startup and debugging. Also, in some cases energy conservation projects may require the training of plant personnel in operation and maintenance.

- o A model for implementation of energy conservation projects will be developed to allow scheduling of the different phases of project development.
- o Once the project development activities have been specified, alternative mechanisms for implementation will be evaluated. Such mechanisms include a determination of project responsibilities of OEP, other Egyptian institutions and governmental organizations, private engineering design and construction firms, financial institutions and plant management.
- o OEP will consult with the appropriate Egyptian governmental organizations and institutions to determine their role and recommended procedures in the energy conservation project program.
- o The project development model will be finalized based on the specific role of Egyptian organizations.

Subtask 2.4 Apply Implementation Program to Energy Conservation Projects

- o OEP will submit a list of prioritized energy conservation projects resulting from the audits (using the methodology developed in Subtask 2.1 and applied in Subtask 2.2) to the appropriate governmental authorities (determined in Subtask 2.3). OEP will assist the appropriate governmental authorities to begin work on energy conservation projects.
- o OEP will monitor the progress of the development of energy conservation projects selected for implementation according to the program procedures developed in Subtask 2.3.

Subtask 2.5 Identify and Evaluate Industrial Energy Conservation Policy Alternatives

- o As an initial step towards developing a comprehensive industrial energy conservation policy and plan, OEP will identify a set of policy alternatives that can be considered by the Egyptian government (e.g. incentive bonus program, energy price adjustments, regulatory measures).

- Each alternative will be evaluated with respect to its energy savings potential, its cost, implementation features, and other important policy considerations.

- It is expected that some alternatives cannot be evaluated due to a lack of information. Steps will be taken to assemble the necessary data.

- A report will be produced that can be used by policy makers to guide their decisions in the development of an industrial conservation policy.

Subtask 2.6 Prepare a Set of Recommendations for an Industrial Conservation Policy and Plan.

- A preliminary industrial conservation policy statement and program plan will be prepared by OEP.

- The document will be sent for review to appropriate organizations.

- A revised policy statement and plan will be prepared for submission to the Supreme Council on Energy.

Task 2 Resource Requirements

Schedule	24 months
OEP Personnel:	
Task Director	6 person-months
2 Engineers/Economists	12 person-months
ANL Staff	
Engineer/Economist	5 person-months
Contractor Personnel	
Engineer/Economist Consultant	2 person-months

TABLE 2.1 Task 2 Industrial Project and Policy Development

Subtask No.	Milestone	Date	Stat
2.1	Initiate development of industrial conservation project evaluation methodology	1 JAN 85	
	Complete draft of industrial conservation project evaluation methodology	1 JUN 85	
2.2	Test and tune project evaluation methodology on audit program results	1 SEP 85	
	Finalize industrial conservation project evaluation methodology	1 DEC 85	
2.3	Initiate development of energy conservation project implementation program	1 MAR 85	
	Complete development of energy conservation project implementation program	1 JUL 85	
2.4	Begin application of implementation program on energy conservation projects	1 AUG 85	
2.5	Begin identification and evaluation of industrial energy conservation policy alternatives	1 OCT 85	
	Complete identification of industrial energy conservation policy alternatives	1 JUL 86	
2.6	Begin preparation of a set of recommendations for an industrial energy conservation policy and plan	1 JUL 86	
	Finalize and present a set of recommendations for an industrial energy conservation policy and plan	15 DEC 86	

Figure 2.1 (reduced)

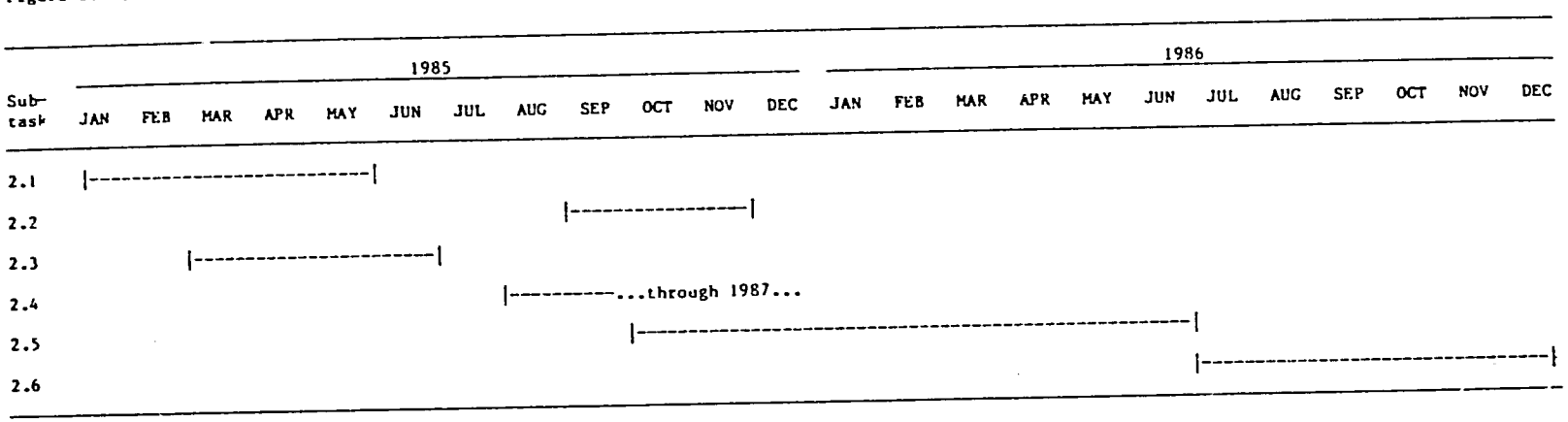


FIGURE 2.1 Task 2 Time Schedule

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Task 3. Development of Industrial Energy Consumption Data Base for Industrial Energy Conservation Policy and Plan

The objective of this task is to develop a detailed data base on industrial energy use. The data base will provide the basis for evaluating industrial energy conservation policy alternatives (Subtask 2.5) that will culminate in a set of recommendations for an industrial energy conservation policy and plan (Subtask 2.6). The data will also be used in Project 2 The National Energy Analysis.

Subtask 3.1 Define Preliminary Data Needs and Develop Industrial Survey Procedure to Collect Data.

- o ANL and OEP will work to define the data needs for both the short term and long term.
- o Data needs will be based on providing the information necessary for national energy planning (see Project No. 2).
- o The data needs will be defined in terms of the information that is to be collected from individual industrial facilities in a routine survey process.
- o The data needs and survey procedure will be reviewed and revised as appropriate in Subtask 3.6.

Status: Ongoing. OEP/ANL have defined the data necessary to develop an industrial energy use data base (see Subtask 1.2). The data base will also serve to target plant energy consumption systems for industrial audit. Data will be collected for different types of plant energy-consuming equipment. The data will include annual consumption of energy by fuel type (e.g., fuel oil, electricity), useful energy produced (e.g., steam, hot air), and units of production. This data will assist in an estimation of plant equipment energy efficiency and energy consumption per unit of production. Other relevant data will also be collected such as equipment operating hours and downtime as this data has a bearing on energy efficiency.

Subtask 3.2 Review Industrial Data Collected by Egyptian Government Organizations and Institutions.

- o The industrial data currently collected by CAPMAS will be reviewed to determine its utility to OEP needs.

Status: Ongoing. OEP has received some industrial data from CAPMAS. The data has yet to be completely reviewed to determine its utility to OEP industrial data base needs.

- o The data available from the Ministry of Industry, Ministry of Petroleum, Government Organization for Industrialization, and other groups will be reviewed for relevance.

Status: Ongoing. A request for available data has been made of the Ministries and government organizations, but OEP has not indicated that they have received any information.

- An identification of data that is not now being collected and that is necessary to meet OEP requirements will be made.

Status: Completed subject to revision per Subtask 3.6.

Subtask 3.3 Develop Computerized Data Handling Procedures.

- A computerized data processing procedure will be designed to handle the survey data as it is available. The procedure will allow the information to be processed quickly and efficiently as it comes in.

- CAPMAS will be consulted to determine the applicability of its existing computer software to handling the survey information. Arrangements will be made to utilize whatever systems are appropriate.

- The procedures will be designed to be compatible with the Network Energy Tracking System (see Project No. 2).

Status: No work done pending decision on OEP computer equipment.

Subtask 3.4 Conduct Initial Survey for Industrial Data Base.

- The survey process described in Task 3 will be implemented.

- Survey information will be processed as received.

Status: Ongoing. The survey procedure has been implemented; data collection forms have been developed. OEP is currently collecting energy use data from public sector plants.

Subtask 3.5 Publish Report on Industrial Energy Use.

- Using the survey results, a report will be published by OEP giving a perspective on current industrial energy use. The report may not be able to be comprehensive due to the survey limitations, but it will provide a valuable insight into the facilities that have been included. The report will serve as a guide to identify and evaluate industrial energy conservation policy alternatives (Subtask 2.5).

Subtask 3.6 Review Data Base Needs and Survey Procedures.

- o Data base needs will be reevaluated.
- o Using the experience of the industrial survey, a modified survey procedure will be developed if appropriate.
- o Decisions will be made on whether changes should be made in the survey procedures (e.g. using OEP staff, using CAPMAS staff, using contractor assistance).
- o Survey forms and schedules will be reevaluated and revised if necessary.
- o Necessary agreements will be signed between OEP and other organizations to implement the survey on an ongoing basis.

Subtask 3.7 Conduct Second Series Survey of Industrial Facilities.

- o The industrial survey procedure will be carried out on a regular basis.

Task 3 Resource Requirements

Time Schedule	12 months (excluding Subtask 3.9)
OEP Personnel:	
Task Director	6 person-months
2 Survey Engineers	18 person-months
Computer Specialist	5 person-months
ANL Personnel:	
Task Director	3 person-months
Survey Engineer	3 person-months
Computer Specialist	4 person-months
Contractor Personnel:	
Survey Consultant	6 person-months
4 Survey Enumerators (local Egyptian)	24 person-months

TABLE 3.1 Task 3 Development of Industrial Energy Use Data Base for Industrial Energy Conservation Policy and Plan

Subtask No.	Milestone	Date	Stat
3.1	Define preliminary industrial data needs and develop industrial survey procedure	JUN 84	compl
3.2	Begin review of industrial data collected by Egyptian government orghanizations and institutions	1 NOV 84	1 JUN
	Finalize review of industrial data	1 MAY 86	
3.3	Begin development of computerized data handling procedures	1 SEP 85	
	Finalize computerized data handling procedures	1 MAY 86	
3.4	Begin initial survey for industrial data base	15 JUN 84	
	Finalize initial survey	1 MAY 86	
3.5	Begin work on report on industrial energy use	1 JUL 86	
	Publish report on industrial energy use	1 DEC 86	
3.6	Begin review of data base needs and survey procedures	1 MAY 86	
	Finalize review of data needs and procedures and make appropriate adjustments	1 OCT 86	
3.7	Begin second series survey of industrial facilities	1 OCT 86	
	Finalize second series survey	1 DEC 87	

Figure 3.1 (reduced)

Sub-task	1984											1985												1986				
	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY
3.1		|----------	----------	----------	----------	|																						
3.2										|----------	----------	----------	----------	----------	----------	|											
3.3																				|----------	----------	----------	----------	----------	----------	----------	----------	|
3.4					|----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	|

	1986 (cont'd)									1987										
	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
3.5				|----------	----------	----------	----------	|													
3.6		|----------	----------	----------	----------	----------	|														
3.7							|----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	|

FIGURE 3.1 Task 3 Time Schedule

Task 4. Development of Industrial Energy Use Training Program

The purpose of this task is to develop and conduct a series of training programs aimed at several groups: OEP staff, industrial plant operators, and industrial plan training program is designed to include formal lecture sessions, field practice, on-the- courses and symposia, and attendance at training courses in the U.S.

Subtask 4.1 Develop and Conduct First In-County Workshop for Plant Managers.

- o A follow-up course for energy managers who attended the initial training session in October 1983 will be designed.
- o The results of the October course will be evaluated and a decision made on the thrust of the follow-up course.
- o A curriculum for the follow-up course will be prepared.
- o Appropriate lecturers from the U.S. will be contracted to participate in the course.
- o The course will focus on practical applications of energy conservation principles and may involve some field work in energy auditing procedures.

Status: Completed. See May-June 1984 Progress Report - Report on Plant Energy Manager Workshop.

Subtask 4.2 Assemble Information on Existing U.S. Industrial Energy Courses.

- o A compilation will be made of available training programs in the U.S. on industrial energy use.
- o Short courses, on-the-job training opportunities, university courses, and others will be considered.
- o The information will be assembled in a form that can be updated regularly to keep OEP aware of available opportunities.

Status: Ongoing. Some preliminary information has been collected on industrial energy conservation course conducted in the U.S.

Subtask 4.3 Develop and Conduct First In-County Classroom/Training Program on Industrial Audits

- o A classroom training program on the conduct of industrial audits will be developed.
- o The emphasis of classroom training will be on data gathering during the preaudit evaluation and use of measurement instrumentation in the field.

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- A field audit training program will be developed in conjunction with the classroom training.

- Field training will continue with the trainees being used to assist audit contractors.

- The training course will be primarily designed for OEP staff but may be expanded to include other groups such as plant energy managers.

Su' ask 4.4 Develop Comprehensive Program on Industrial Energy Conservation

- A training strategy and plan will be prepared for OEP.

- The program will identify appropriate training activities for OEP staff, industrial plant operators, and industrial plant management in energy conservation.

- The plant energy manager workshops (Subtasks 4.1, 4.10, 4.11, and 4.12) and the audit training (Subtasks 4.3 and 4.9) will be part of the comprehensive program.

- Three types of training activity will be considered; U.S. based, U.S. training activity transferred to Egypt, and Egypt based activity.

- The plan will describe how the training should be approached, who should conduct the training, who should attend training sessions, how frequently training courses should be offered, and the role of out-of-country training activities.

- The program will include needs for English language as well as technical training.

Subtask 4.5 Develop Schedule for Training Program Activities.

- The schedule for OEP staff training will be developed. This must be done in consideration of their daily work responsibilities.

- The schedule for training programs for industrial plant operators and management will be developed.

Subtask 4.6 Develop Curriculum for In-County Training Program Efforts.

- For those training courses that will be conducted in Egypt, a contractor will be selected to develop the curriculum material.
- Several sets of material may be required for different courses.

Subtask 4.7 Conduct Initial Training Program Sessions.

- The first round of training activities using the new material will be conducted.
- It may be desirable to announce an "Industrial Energy Use Symposium" to attract participants. Courses could be offered as part of the symposium.

Subtask 4.8 Evaluate Training Program Effort and Prepare Revised Plan.

- The results of the first training effort will be evaluated for its effectiveness.
- Modifications to the training strategy and plan will be made.
- Modifications to the curriculum material will be made.

Subtask 4.9 Develop and Conduct Second In-County Classroom/Field Training Program on Industrial Audit.

- The first training program will be evaluated and a second training program will be developed based on the first program evaluation.

Subtask 4.10 Develop and Conduct Second Workshop for Energy Managers.

- The performance of the first workshop will be evaluated and a course outline will be developed for the second workshop to be held in Egypt.

Subtask 4.11 Develop and Conduct a Third Workshop for Energy Managers.

- The performance of the second workshop will be evaluated and a course outline will be developed for the third workshop to be held in Egypt.

<u>Subtask 4.12</u> Develop and Conduct Fourth Workshop for Energy Managers.

- The performance of the third workshop will be evaluated and a course outline will be developed for the fourth workshop to be held in Egypt.

Task 4 Resource Requirements

Time Schedule	13 months
OEP Staff (does not include staff to be trained)	
Training Director	8 person-months
Training Logistical Support Staff	8 person-months
ANL Staff	
Task Monitor	3 person-months
Contractor Staff	
For plan development	3 person-months
For curriculum development	6 person-months
For training sessions	4 person-months

TABLE 4.1 Development of Industrial Energy Use Training Program

Subtask No.	Milestone	Date	Status
4.1	Develop and conduct first in country workshop for plant	MAY 84	completed
4.2	Begin assembly of information on existing U.S. industrial energy conservation courses	1 NOV 83	
	Finalize information on U.S. energy conservation courses	1 JUL 85	
4.3.	Begin conduct of first in-country classroom/field training program on industrial audits	NOV 84	
	Conclude classroom/field training program on industrial audit	MAR 85	
4.4	Begin development of a comprehensive training program plan on industrial energy conservation	1 JUN 85	
	Finalize training program plan	1 NOV 85	
4.5	Begin development of training program schedule	1 NOV 85	
	Finalize schedule	1 MAR 86	
4.6	Begin development of curriculum for in-country training program activities	1 MAR 86	
	Finalize curriculum	1 OCT 86	
4.7	Begin initial training program sessions	1 FEB 87	
	Conclude sessions	1 MAY 87	
4.8	Begin training program effort	1 MAY 87	
	Conclude training program and revised program plan	1 AUG 87	
4.9	Begin second in-country classroom/field training program on industrial audits	1 FEB 86	
	Conclude training program	1 DEC 86	
4.10	Develop second in-country workshop for plant energy managers	1 JUL 85	
	Conduct second workshop for plant energy managers	1 DEC 85	
4.11	Develop third in-country workshop for plant energy managers	1 JUL 86	
	Conduct third workshop for plant energy managers	1 DEC 86	
4.12	Develop fourth in-country workshop for plant energy managers	1 JUL 87	
	Conduct fourth workshop for plant energy managers	1 DEC 87	

TABLE 4.1 Task 4 Development of Industrial Energy Use Training Program

Figure 4.1 (reduced)

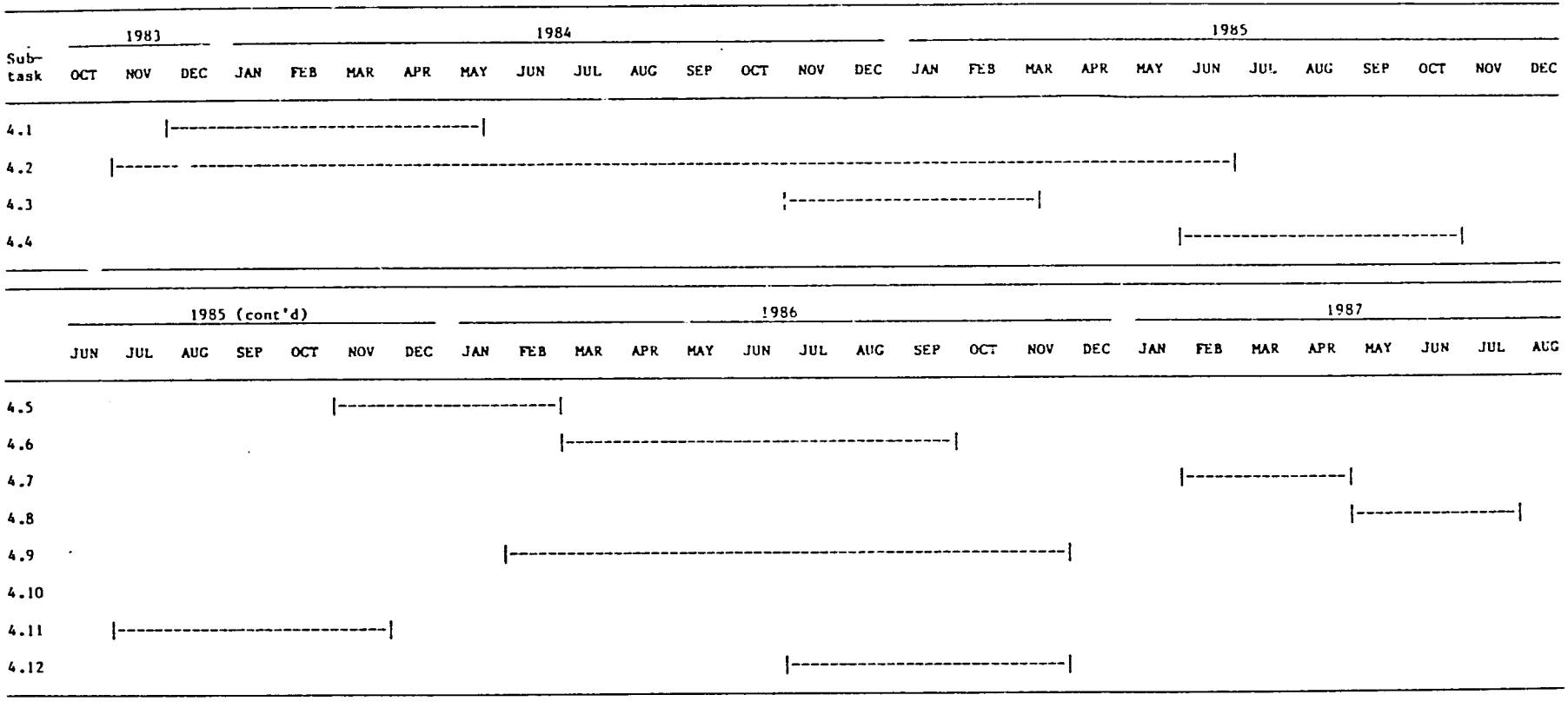

FIGURE 4.1 Task 4 Time Schedule

The project development task is scheduled to recommend a prioritized list of conservation measures to be implemented 13 months from project start. An industrial energy conservation policy statement and program plan is scheduled for 16 months from project start.

The first version of the industrial data base is scheduled for completion 10 months from project start in time to be used to identify the second round of industrial audits.

A training strategy and program plan is scheduled for completion four months from project start. The earliest training course is scheduled for five months from start with the next set of courses in the period 9-11 months from start.

Personnel

The project will require the following personnel:

OEP staff	96 person-months
ANL staff	30 person-months
Contractor staff	63 person-months

Startup Requirements

OEP will need to assign a senior staff member and at least 2-4 supportstaff to Task 1. As the energy audit program will be an ongoing activity, these people should be permanently assigned to this responsibility.

Task 2 will require extensive OEP staff involvement later than Task 1 and need not be assigned immediately.

Task 3 will need coordination with CAPMAS for effective implementation.

Task 4 has a need for an OEP staff member to be responsible for coordinating all training functions.

ORGANIZATION FOR ENERGY PLANNING
PLANT ENERGY MANAGER WORKSHOP

MAY 19 - 31 , 1984

BARON METROPOLE HOTEL

HELIOPOLIS, CAIRO

REPORT ON PLANT ENERGY MANAGER WORKSHOP

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ARGONNE NATIONAL LABORATORY

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REPORT ON PLANT ENERGY MANAGER WORKSHOP

MAY 19 - MAY 31
BARON METROPOLE HOTEL
HELIOPOLIS,CAIRO

1.0 ATTENDENCE

The workshop was attended by 41 trainees. Of this total 30 are plant energy managers for public sector Egyptian industrial companies.The remaining trainees are staff members of OEP. The plant energy manager trainees represented the top students with good English language capability from a group of 100 trainees that participated in an energy conservation course conducted by OEP in November,1983. The trainees represented public sector plant operations throughout Egypt including Cairo,Alexandria and Aswan. The trainees were provided with hotel accomodations and meals at the Baron Hotel. A roster of the trainees and their organization affiliation is contained in Appendix A-1.

2.0 COURSE MATERIAL AND REGISTRATION

A significant amount of course material (see Appendix A-2) was shipped to Cairo prior to the course. This material was distributed to the trainees in a very efficient manner by the OEP staff. The OEP staff also did an excellent job in registering the trainees and managing their hotel accomodations .

3.0 WORKSHOP SCHEDULE

The workshop proceeded according to schedule with some minor alterations that served to enhance the overall success of the entire training session. Also hotel accomodations for the instructors were changed from the Ramses Hilton to the Baron when it was realized the distance between the two hotels would introduce a time-consuming element due to travel. The change in accomodations proved to be beneficial to both instructors and trainees as several of the instructors reported that they were able to spend some evening sessions with the trainees providing additional instruction in the course material as well as providing some assistance in plant-related problems posed by the trainees. A copy of the original course schedule is in the Appendix (see Appendix A-3)

3.1 Session 1-3 : Opening Remarks

The opening remarks were given by Deputy Prime Minister Ahmed Hilal in Arabic with some closing comments in English to the effect that the trainees should stick close to the energy conservation experts from the U.S day and night and learn as much as they can. Dr. Abdallah then addressed the class in Arabic. The opening session was also attended by the senior committee of OEP .

3.2 Session 4-7 : Instructor W. Stebbins

Sessions 4.0 and 5.0 proceeded per schedule. The panel discussion was attended by W.Stebbins, Dr. Adel Nasser and Dr. Ali Kamel. Some of the questions discussed during the panel discussion are presented in Appendix A-4 along with an outline for session 4-7. Session 7.0 was begun earlier at 5 p.m on May 19th. An Exam was given on May 20th and reviewed by Mr. Stebbins after the test papers were collected.

3.3 Session 8-11 : Instructor D. Dyer

The exams 8.2 (Combustion Efficiency), 9.2 (Boiler/Steam System Efficiency) and 10.2 (Waste Heat Recovery) were combined in one exam that was given the afternoon of May 24th. At the conclusion of the exam, a review was given by Dr. Dyer .

The boiler combustion analysis demonstration proceeded on schedule on May 24th. Fortunately we were able to make arrangements with the hotel management and Chief Engineer to use the hotel boilers for the demonstration. The hotel boilers met Dr. Dyer's requirements. The class was divided into four groups of approximately 10 trainees. Dr. Dyer prepared a set of example problems (see Appendix A-4) that the class worked on while the different groups participated in the boiler combustion analysis demonstration. Dr. Dyer reviewed the example problems with the class at the conculsion of the boiler demonstration. Dr. Dyer brought his own portable (solid -state) combustion analysis instrumentation for the demonstration. Using the hotel boilers for the demonstration saved considerable time and effort that would have been expended in transporting the students to another location.

In addition to the other course material (Appendix A-2), Dr.Dyer distributed and discussed a boiler facility data collection form (see Appendix A-5). This data collection form illustrates the type of data that should be collected during an energy conservation audit of a boiler steam system .

3.4 Session 12 : Instructor Dr. Ali Kamel

Dr. Ali Kamel kindly consented to provide instruction on the need for and problems associated with a plant preventative maintenance program. The session conducted by Dr. Kamel in Arabic linked the need for proper scheduling of equipment maintenance to good energy conservation.

3.5 Session 13 : Instructor R. Larson

The exams for sessions 13.0 (Process Design for Energy Conservation) and 14.0 (Practical Project Economic Evaluation) were combined and given on May 28. At the conclusion of the exam, a review of the solutions to the exam problems was given by Mr. Larson. Mr. Larson also

decided to reverse the order of presentation of the sessions since Session 13.0 (Process Design) contained some economic treatment that would be discussed in Session 14.0 .

Since the AICHE course notes for Session 14.0 were not in print at the time of the workshop , a text book was used. The text book "Plant Design and Economics for Chemical Engineers" (used by Mr. Larson in previous courses in th U.S) was not referred to in its entirety but ideas or data from select chapters were used (see Appendix A-6). Also in addition to the text material, Mr. Larson developed a series of case study engineering economic problems with solutions that were distributed to the trainees(see Appendix A-7 and A-8) .

3.6 Session 15 and 16 : Instructor E. Dockstader and C. Mitchell

Sessions 15 and 16 proceeded on schedule with the class being split into two groups of approximately 20 students. The course sessions were modified from the original AICHE courses since the AICHE course is geared to chemical engineers in the U.S with a number of years of industrial experience. An outline of Sessions 15 and 16 are in Appendix A-9 and A-10. Instructors Dockstader and Mitchell also prepared a conversion table that would allow cross-conversion from U.S (customary) units and S.I (metric) units (see Appendix A-11)

4.0 SURVEY OF TRAINEE COMMENTS

At the close of each course session the trainees were handed a survey form and asked to grade the performance of the instructor and course session and indicate the applicability of the course material to their work .

4.1 Response to Multiple Choice Questions

Nine multiple choice survey questions were presented. The trainee was asked to select a statement that was in closest agreement with his or her opinion. The number of specific responses to each multiple choice question ffor each instructor is presented in Appendix B. For questions 1 through 8 the trainee response is expressed as a percentage of the total number of trainees completing the survey. For question 9 the total number of trainee responses is stated since the trainee may select more than one response. In all cases the trainee response data is presented immediately after the multiple choice statement on a copy of the actual survey questionnaire (ie, Appendix B) .

4.2 Written Comments

In item 10 of the survey the trainees were asked to provide any additional comments on the session not covered by the multiple choice questions. The trainees were invited to give their written comments

in Arabic or English. Below is a summary of the comments that were given in English and applicable to most course sessions or the entire workshop .

- Many of the written comments followed the response to multiple choice questions .

- Some trainees indicated they did not have sufficient time to discuss their particular plant problems .

- A number of trainees indicated a desire to have the exam in the morning .

- A few trainees indicated it would be desirable to have access to a technical dictionary during the sessions to look up technical terms used in the workbooks and other session printed material .

- Some trainees indicated some confusion regarding the use of different units - metric, engineering and SIU .

- One trainee commented that the first instructor Mr. Stebbins was easier to understand the second day indicating a gain in familiarity with understanding spoken English .

- Many trainees desired to have access to the session material at their plant .

- Some trainees indicated the course spent too much time on fundamentals and should have devoted more time to problem solving. Other trainees believed the reverse was true .

- A number of trainees felt that too little time was devoted to Project Design for Energy Conservation (session 13) at the expense of Practical Project Economic Evaluation (session 14).

- Some trainees felt that not enough textbook material on economic analysis (session 14) was discussed .

- One trainee felt that the economic analysis (session 14) should be conducted by an Egyptian specialist because U.S financial considerations and constraints are different from those in Egypt.

- A number of trainees indicated that the economic terminology (session 14) was difficult to understand and a glossary of terms and definitions in both English and Arabic would have been helpful .

5.0 WORKSHOP TEST RESULTS

Copies of the tests given by the five workshop instructors are contained in Appendix C. A compilation of test results is presented in Table 5-1. OEP determined that a score of 50% or better would be considered a passing grade. Examination of Table 5-1 indicates that the average or mean score for all examinations given was 62.1% and 92.7% of the class or 38 trainees out of a class of 41 achieved a passing score of 50% or better. Table 5-1 also indicates that 24% of the class or 10 trainees had an average workshop test score between 70 and 80%. The highest workshop average test score was 76.4%.

Examination of Table 5-1 indicates that the spread of test score results varies among instructors. All the trainees passed the exams given by Dyer and Larson but only 24% of the students passed the exam given by Mr. Dockstader. Except for Mr. Larson's exam, none of the trainees scored 90% or more on an exam and none scored 80% or better in Dockstader's exam.

6.0 INSTRUCTOR COMMENTS AND RECOMMENDATIONS

At the close of their workshop session the instructors were asked to provide comments and recommendations for future revisions regarding the sessions they taught and provide recommendations for new course sessions. The instructors comments and recommendations are summarized below .

6.1 Instructor Wayne Stebbins

Mr Stebbins felt that session 4.0 and 5.0 were too short and that half a day should be spent on each topic. Also, the trainees should have the course material for review well in advance of the course session. Mr. Stebbins felt there was strong trainee involvement in session 7 but that the trainees were not at all familiar with the concepts apparently due to lack of exposure to meters and monitoring systems in their plants. Trainees also indicated to Mr. Stebbins that their responsibilities involved other areas beside energy management. Mr. Stebbins also felt that the panel discussion (session 6.0) was not too successful and that the time should have been better spent expanding the time spent on sessions 4.0 and 5.0. Mr. Stebbins felt that session 7 should last an entire day with an exam being given the following morning thereby allowing the trainees the evening for study. Also the students should provide examples of current plant metering illustrated by photographs or drawing for class discussion .

Mr. Stebbins recommended the following topics (which he currently teaches) for future course sessions :

- Analyzing Energy Management Performance
- Forecasting Energy Consumption and Resulting Dollar Variances.
- The Role of the Plant Energy Coordination. An Integrated Approach to Plant Engineering, and
- Evaluation of an Energy Management Project as seen through a Reusable Insulation Example .

TABLE 5-1 COMPILATION OF WORKSHOP TEST SCORES

INSTRUCTOR	TEST SUBJECT	AVERAGE SCORE %	PERCENT OF CLASS ACHIEVING SCORE				
			% a > 50	% > 60	% > 70	% >80	% > 90
W. Stebbins	Plant Energy Management Energy Monitoring and Reporting	53.8	61	34	10	5	-
D. Dyer	Combustion;Boiler Steam System;Waste Heat Recovery	65.6	100	61	37	10	-
R. Larson	Project Economics ; Design for Energy Conservation	84.9	100	99	93	76	24
K. Dockstader	Compressor Technology	41.7	24	10	7	-	-
C. Mitchell	Pump Technology	64.9	80	63	44	20	-
Total Workshop Average		62.1	93	59	24	-	-

[a] A score of 50% or more is required to pass the course

6.2 Instructor David Dyer

Dr. Dyer indicated that he would reduce the time spent in session 8.0 on the theoretical explanation of combustion and spend more time with practical demonstration using instruments and a simple demonstration burner that could be shipped from the U.S ahead of time. The boiler program (session 9.0) should be expanded to cover boiler burners and controls and the waste heat recovery session should be expanded by a couple of hours to include a limited design philosophy descussion .

In terms of future courses, Dr. Dyer believes the trainees are badly in need of hands on " boiler expertise". He recommends that the five best people be chosen to audit one or two industrial plants .

6.3 Instructor Robert Larson

In his course Practical Proejct Economic Evaluation (session 14.0), Mr. Larson discussed the following four topics :

1) Capital Estimating

2) Estimation of Project Expense

3) Return on Investment (ROI)

4) Internal Rate of Return (IRR); and Investment Equivalents

It is Mr. Larson's conclusion that the above subjects were too advanced for most of the trainees. Mr. Larson indicates that most of the class tried hard to absorb the subject material but he was never able to proceed to an area of significant understanding. Mr. Larson concludes that "if this subject is to be assimilated to a serious level of skill, much more time must be allotted" .

In his session "Process Design for Energy Conservation"(session 13.0) Mr. Larson covered the following topics :

1) Thermodynamics and Overall Plant Energy Balance

2) Energy Conservation in Existing Plants

3) Heat Exchanger Design

Mr. Larson felt that the broad background of the trainees made it difficult to get across material prepared specifically for chemical engineers. Mr. Larson felt the trainees tried hard but the broad range of background and experience hampered real progress.

For both his courses, Mr. Larson believes that the trainees should be grouped in class room situations based on similar background and experience. Having a homogenious group of trainees, the courses could be better designed or placed to meet their requirements and capability .

6.4 Instructors K. Dockstader and C. Mitchell

Messers Dockstader and Mitchell felt it was a good idea to split the class into two groups as they did in order to deal more effectively with the class. They recommended that future courses be developed after the instructors have an opportunity to visit some Egyptian plant operations. They suggested that future sessions should be conducted in part in Arabic possibly using audio tapes .

7.0 INSTRUCTOR BUDGET

In this section an estimate has been developed for the instructor expenses incurred for the workshop. The estimate is preliminary and does not include air travel, a $30/day per diem and incidental instructor expenses such as taxi travel and the like; nor does it include the cost of workbooks; textbooks and other course related printed matter shipped to Cairo. A complete budget accounting of the workshop will be developed and submitted according to the approved program procedure. The intent of this section is to target instructor costs only as a guide for estimating an instructor budget for future workshops.

A breakdown of instructor workshop effort level and associated costs is displayed in Table 7-1. The support effort level (see footnote a of Table 7-1) is approximately twice that of the effort expended in the classroom. Nearly all the instructors received a day of orientation prior to their first day of instruction. This allowed the instructors to adjust to the change in time and environment, obtain a briefing and get their material in order prior to the first classroom session. A total of 45 instructor effort days was expended by the 5 instructors for the 13 day workshop session. The instructor hotel expenses are described further in Table 7-2.

It is estimated that the air travel expenses for each instructor would be approximately $1000. An allotment of $30/day per diem was provided to cover meals during the instructor actual travel and hotel stay. Based on 34 instructor-days of travel and course-related lodging in Egypt, the total per diem is $ 1,020. Therefore the estimated travel and per diem cost for all five instructors is $6,020. Adding this amount to the total instructor expense of $13,093 in Table 7-1 results in an estimated total instructor expense of approximately $19,100 that should result in approximately $20,000 inclusive of incidental instructor expense and variation in air travel expense. Using this figure, the approximate instructor cost of the 13 day workshop is approximately $1540 per session day. However based on the class of 41 trainees this results in an approximate cost of $ 38 per trainee per session day or approximately $ 495 expended per trainee for the 13 day workshop.

8.0 GENERAL RECOMMENDATIONS FOR FUTURE WORKSHOPS

The past workshop was a good first step that served to expose the trainees to important topics related to energy conservation. However, the varied professional background and experience levels of the class posed some barriers to effective instruction especially for the more experienced engineers .

TABLE 7-1 PLANT ENERGY MANAGER WORKSHOP INSTRUCTOR EXPENSES

nstructor	Effort Days At $ 250 /Day			Total Fee ($)	Hotel ($)	Total[b] ($)
	Classroom Session	Support[a]	Total			
ayne Stebbins	2	5	7	1750	307	2057
avid Dyer	4	8	12	3000	461	3461
.J. Larson	2½	5½	8	2000	307	2307
. Dockstader	3	6	9	2250	384	2634
. Mitchell	3	6	9	2250	384	2634
TOTAL	14½	30½	45	11250	1843	13093

[a] Support effort-days include orientation day in country, travel days and course preparation days ,

[b] The total is approximate and does not include air travel, $30/day per diem and incidental expenses such as taxis and the like nor does it include the cost of workbooks, textbooks and other course-related printed matter.

TABLE 7-2 Instructor Hotel Registration and Payment Schedule at Baron Metropole Hotel

Instructor	Arrival Date	Orientation Date	Session Dates (inclusive)	Authorized Hotel Payment Dates (inclusive)	Number Days Hotel	Total Hotel Payment	
						Egyptian Pounds[1]	U.S $[2]
Wayne Stebbins	May 17	May 18	May 19 - 20	May 17 - 20	4	252	307
David Dyer	May 19	May 20	May 21 - 24	May 19 - 24	6	378	461
R.J. Larson	May 25	May 26 (½ day)	May 26 - 28	May 25 - 28	4	252	307
E. Dockstader	May 27	May 28	May 29 - 31	May 27 - 31	5	315	384
C. Mitchell	May 27	May 28	May 29 - 31	May 27 - 31	5	315	384
Total	-	-	-	-	24	1512	1843

Instructor Notice: Please do not charge any meals, beverages, telephone calls etc. to your hotel. Argonne has only sufficient funds to pay for your hotel lodging. Pay your hotel bill the morning of your departure converting U.S $ to Egyptian Pounds at the official exchange rate with a conversion receipt required by the hotel .

[1] Quoted rate at approximately 63 Egyptian Pounds (L.E)/ night.

[2] Based on an exchange rate of .82 $/Egyptian Pound .

For most sessions, the pace of instructors had to be slowed down to accomodate those trainees with a lessor technical background or experience level (more than one senior engineer trainee expressed his frustration at this situation). It is therefore recommended that future workshop classes be constructed of trainees of similar professional background and experience level .

Some of the course sessions were too brief and did not provide adequate time for the trainee to digest and then discuss the topic information presented in class. It is recommended that for future course sessions that at least a full day be devoted to each major topic with a review the following morning followed by an exam. This schedule allows the trainee to study the material the evening before the exam. The review session before the exam would allow the trainees to discuss problems encountered during individual study.

Session material (ie, workbooks, textbooks) should be available to the students at least two weeks prior to the session with a study guide. The study guide should be constructed to acquaint the trainee with the material that will be covered during the session, highlighting important topics . The session printed matter should include a list of definitions of important terms possibly in both Arabic and English. Also a table showing the cross-conversion between English and Metric (SI.) units should be provided.

It is recommended that prior to the technical course sessions, a session be given on problem solving using a calculator. This session would serve more than one purpose. First, the session should be given in English to allow the trainees to be accustomed to having lectures in English. Although all the trainees in the May workshop had English language capability, many had not been in a concentrated English speaking environment for some time . Second, the session would serve to acquaint the trainees with numerical problem solving, maintaining the units integrity of the solution. In all engineering problem solving, carrying out the problem with full unit display (dimensional analysis) is a very useful habit that serves to double check the answer (if the answer has the wrong units a mistake in the calculation has been made). Use of dimensional analysis is also necessary when converting from one set of units to another, for example :

$$\rho\,(\text{density}) = 10\ \text{lb}_m/\text{ft}^3$$
$$= 10\ \text{lb}_m/\text{ft}^3 \times 4.54\ \text{gm}/\text{lb}_m \times \text{ft}^3/(.305)^3\,\text{m}^3 \times 1\text{kg}/1000\text{gm}$$
$$= 1.62\ \text{kg}/\text{m}^3$$

For advanced, senior plant energy manager trainees the workshop might be built around actual plant problems that the trainees would bring . class. These problems would have to be well thought out with estimates of data where recorded data is not available. OEP could review the problems and turn them into case studies. Once the case studies have been assimilated, a workshop session could be designed around them .

The above are only some general recommendations that were developed after a cursory reflection of the experience of the May workshop. Other solid recommendations will develop through OEP after further discussion of the experience with plant energy managers and OEP staff that attended the workshop.

ROSTER OF TRAINEES

NAME	ORGANIZATION
1- Ismail Ahmed Abdel Hakim	Middle Egypt for Spinning & Weaving
2- Abdel Azim Mohamed El Abbasi	Societe Financial &Industrial/Super Phosphate
3- Yousri Abdel Aziz El Khayat	Abu Kir Fertilizers Company
4- Sabet Noman El Fooly	National Spinning & Weaving Company
5- Mohamed Hafez Swidan	Damietta Spinning & Weaving
6- Galal Abdel Maksoud El Shazly	El Nasr Co., for Coke & Chemicals
7- Yousri Fatouh Hassan	Misr Engineering & Tools
8- Mohamed Adel Moussan Diab	Delta Industrial Company (IDEAL)
9- Mostafa Taha El Gazar	Egyptian General Railway Company
10- Safwat Saleh Marzouk	Cairo for cloths (Tricona)
11- Yehia Mohamed Salah El Din	Kafr el Dawar Chemicals Company
12- Nassef Mohamed Abdel Gawad	Spring & Transport Company
13- Ahmed Hassan Ali Habliza	Kafr El Dawar for Fine Spinning Company
14- Mahmoud Khairy Mahmoud	Egyptian Starch Company
15- Ali Osman Gado	Misr-Helwan for Spinning & Weaving
16- Ibtesam Mohamed Ahmed El Ziat	Egyptian Food Company (Bisco Misr)
17- Aisha Zakaria Mohamed	Cairo Clothing Company
18- Rafat Reed Morkos	Egyptian Navy , Main Workshop
19- Mohamed Abdel Latif Hamid	Helwan Foundries
20- Abdel Malak Mesiha Gerguis	Misr Oil & Soap Company
21- Mohamed Khaled El Bery	Delta Spinning & Weaving
22- Noshi Shawky Said	Delta Spinning & Weaving
23- Salah Eldin Mohamed Salem	National Metals Industrial Company
24- Sami Abdel Halim Hussein	Tanta Oil & Soap Company
25- Zagloul Youssef Ali	Helwan Foundries
26- Said El Feky	

NAME	ORGANIZATION
27- Mahmoud El Kady	Kima for Chemicals - Aswan
28- Karam Saleh Lawendy	Kima for Chemicals - Aswan
29- Ahmaed Mohamed El Shafy	Behera Electricity Company
30- Fekry Abu Araf	
31- Suzan Anis Mesiha	Organization for Energy Planning(OEP)
32- Shawki Farid Arafa	
33- Shehata Abbas Nadim	" " " "
34- Hamid Ali Korkor	" " " "
35- Abdel Rehim Salah Eldin	" " " "
36- Samir Eskandar	" " " "
37- Adel Mahmoud Ibrahim	" " " "
38- Sabry Ahmed Hassanein	" " " "
39- Ibrahim Mahmoud Hegazy	" " " "
40- Zeinab Ibrahim Zeed	" " " "
41- Mona Khodir	" " " "

PLANT ENERGY MANAGER WORKSHOP

COURSE MATERIAL

* o Advisory on Rotor Dynamics - CAGI (55 copies)
* o Thermo Electron Mechan. Vapor Recompression System (21 copies)
* o Electrical Power Meas. Handbook - YEW (55 copies)
* o Fundamentals of Flow Metering TDS 3031 - Rosemount (55 copies)
* o Sample pipe markers (150)
  o Dranetz User's Guide for Series 808 Electric Power/Demand Analyzer (5 copies)
  o Brady Signmark Division Catalog (4 copies)
* o Rotary Positive Displacement Compressors - Louis Allis (50 copies)
  o Gestra Condensate Manual (4 copies)
* o Cardboard Steam Loss Calculator - Furmanite (58 copies)
  o Leak Sealing Catalog - Furmanite (4 copies)
  o Yewflow Vortex Flowmeter Bulletin (3 copies)
  o Model YFCT Flow Computing Totalizer Bulletin (4 copies)
  o Speed Measuring Instruments - Biddle (5 copies)
  o Testing and Measuring Instruments for the Professional - AEMC (4 copies)
  o Series 808 Electric Power/Demand Analyzer (4 copies)
  o Power Factor Measurement - Power Factor Correction Catalog (4 copies)
* o Energy Conservation Tech. Bulletins (55 copies - 1 sheet ea.)
* o Reprint - Which Flexible Coupling - 71/72 Power Transmission & Bearing Handbook (48 copies)
* o Hydraulically Fitted Hubs, Mounting and Dismounting Procedures - Koppers (48 copies)
* o Hydraulically Fitted Hubs, Theory and Practice - Koppes (48 copies)
  o Maintenance Management - Rev. Ed., Lawrence Mann, Jr. - 2 copies

* o Analog Control Techniques and Tuning - Babcock & Wilcox (55 copies)

* o Engineering and Product Applications Handbook, Bulletin K-20 (55 copies)

o Dwyer Control and Gages Catalog (5 copies)

o Energy-Conserving Technologies for Industry, ANL/CNSV-TM-129 (2 copies)

* o Sulzer Centrifugal Compressor Catalog (43 copies)

* o Errata sheet for Course Sessions 4.0, 5.0 and 6.0 (65 copies)

o Nashua Thermal Transparencies TF-30 (1 box/100)

o Faber Castell Overhead projection markers (2 doz. assorted colors)

* o Course Outlines (55 copies)

* o Test for Course Sessions 4.0, 5.0 and 6.0 (55 copies)

** o Collection of bound notes for sessions 4.0, 5.0, 7.0 (55 copies)

** o Textbook "Energy Conservation Program Guide for Industry-and Commerce (EPIC)"

* o Westinghouse Watt/Hour Meter with 6" fan blade and small 115V electric motor (1)

* o Dresser Clark Bulletin #336, "Multistage Centrifugal Compressors" (45 copies)

* o Dresser Clark Bulletin #343, "Balance/Opposed Reciprocating Compressors" (45 copies)

** o AIChe Handbooks - 55 copies each as follows:

"Compressors for Chemical Processes"
"Pump Technology"
"Process Design for Energy Conservation"

** o Textbook, "Plant Design and Economics for Chemical Engineer" (55 copies)

** o Workbook, "Steam Efficiency Improvement" by David Dyer (55 copies)

** o Workbook, "Boiler Efficiency Improvement" by David Dyer (55 copies)

o - OEP library material
* o - Supplementary course material
** o - Textbooks and workbooks

ORGANIZATION FOR ENERGY PLANNING

PHASE II TRAINING COURSE

ON

INDUSTRIAL ENERGY CONSERVATION

Plant Energy Manager Workshop
May 19-31, 1984
Cairo, Egypt

Module II - Energy Conservation Program and Management

Prepared by

Energy and Environmental Systems Division
Argonne National Laboratory

Note: Change in course outline: Session 13 - Instructor C. Mitchell; Session 15 - Instructor E. Dekstaler

May 19-31, 1984
Cairo, Egypt

TIME	May 19	May 20
9:00-10:10	Mod. 1 Energy Conservation Policy Review 1.0 Opening Remarks - (Egypt) 2.0 Overview of Workshop (M. Monarch, Argonne)	7.0 Energy Monitoring and Reporting (EMR) System Overview (W. Stebbins)
10:10-10:25	Break	Break
10:25-11:35	3.0 Program Perspective (Egypt)	7.1 Setting up an EMR (W. Stebbins)
11:35-11:50	Break	Break
11:50-1:00	Mod. 2 Energy Conservation Program & Management 4.0 U.S. Perspective on Industrial Energy Conservation Program (W. Stebbins) 5.0 U.S. Perspective on Role of Industrial Plant Energy Mgr. (W. Stebbins)	7.1 continued 7.2 EMR Workshop ~~and Discussion~~ (W. Stebbins)
1:00-3:00	Break	Break
3:00-4:30	6.0 Panel Discussion on Industrial Energy Conservation Program and Role of Plant Energy Manager Egypt (Abdallah to arrange) U.S. (W. Stebbins) Moderator (M. Monarch, ANL)	7.2 continued
4:30-5:00	Break	Break
5:00-6:30	Open	7.3 Exam on EMR System

PLANT ENERGY MANAGER WORKSHOP
May 19-31, 1984
Cairo, Egypt

TIME	MAY 21	MAY 22
9:00-10:10	Mod.3 Technical Sessions 8.0 Improving Combustion System Efficiency (David Dyer)	9.0 Boiler/Steam System Efficiency (David Dyer)
10:10-10:25	Break	Break
10:25-11:35-	8.0 continued	9.0 continued
11:35 11:50	Break	Break
11:50-1:00	8.1 Combustion Efficiency Workshop (David Dyer)	9.1 Boiler/Steam System Efficiency Workshop (David Dyer)
1:00-3:00	Break	Break
3:00-4:30	8.1 continued	9.1 continued
4:30-5:00	Break	Break
5:00-6:30	8.2 Exam on Combustion Efficiency or Question and Answer Period*	9.2 Exam on Boiler/Steam System Efficiency or Question and Answer Period*

*Question and Answer Period will take place if field trip to boiler is not possible on May 24 since Exams will then be given on that day.

May 19-31, 1984
Cairo, Egypt

TIME	MAY 23	MAY 24
9:00-10:10	10.0 Waste Heat Recovery (David Dyer)	11.0 Field Trip to Industrial Boiler (David Dyer) or 11.A Review of Sessions 8 through 10
10:10-10:25	Break	Break
10:25-11:35-	10.0 continued...	11.0 continued... or 11.A continued
11:35 11:50	Break	Break
11:50-1:00	10.1 Waste Heat Recovery Workshop (David Dyer)	11.0 continued... or 11.B Exam on Sessions 8 through 10
1:00-3:00	Break	Break
3:00-4:30	10.1 continued...	11.0 continued... or 11.B Exam on Sessions 8 through 10
4:30-5:00	Break	Break
5:00-6:30	10.2 Exam on Waste Heat Recovery Workshop or Question and Answer Period*	11.0 continued... or 11.C Review of Exam

*Question and Answer Period will take place if field trip to boiler is not possible on May 24 since Exams will then be given on that day.

May 19-31, 1984
Cairo, Egypt

TIME	MAY 25	MAY 26
9:00-10:10	Off	12.0 Setting Up and Running a Preventative Maintenance Program in Egypt. (Dr. Ali Kamel)
10:10-10:25	Break	Break
10:25-11:35-	Off	12.0 continued...
11:35 11:50	Break	Break
11:50-1:00	Off	13.0 Process Design for Energy Conservation (R. J. Larsõn)
1:00-3:00	Break	Break
3:00-4:30	Off	13.0 continued...
4:30-5:00	Break	Break
5:00-6:20	Off	13.0 continued...

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PLANT ENERGY MANAGER WORKSHOP
May 19-31, 1984
Cairo, Egypt

TIME	MAY 27	MAY 28
9:00-10:10	13.1 Process Design for Energy Conservation Workshop (R. J. Larson)	14.0 Practical Project Economic Evaluation (R. J. Larson)
10:10-10:25	Break	Break
10:25-11:35-	13.1 continued...	14.0 continued...
11:35-11:50	Break	Break
11:50-1:00	13.1 continued...	14.1 Practical Project Economic Evaluation Workshop (R. J. Larson)
1:00-3:00	Break	Break
3:00-4:30	13.2 Exam on Process Design for Energy Conservation Workshop (R. J. Larson)	14.1 continued...
4:30-5:00	Break	Break
5:00-6:30	13.3 Review of Exam	14.2 Exam on Practical Project Economic Evaluation (R. J. Larson)

PLANT ENERGY MANAGER WORKSHOP
May 19-31, 1984
Cairo, Egypt

TIME	MAY 29	MAY 30
9:00-10:10	GROUP A* 15.0 Pump Technology (E. Dockstader) GROUP B 16.0 Compressor Technology (C. Mitchell)	GROUP A 15.1 continued... GROUP B 16.1 continued...
10:10-10:25	Break	Break
10:25-11:35-	GROUP A 15.0 continued... GROUP B 16.0 continued	GROUP A 15.2 Exam on Pump Technology (E. Dockstader) GROUP B 16.2 Exam on Compressor Technology (C. Mitchell)
11:35 11:50	Break	Break
11:50-1:00	GROUP A 15.0 continued... GROUP B 16.0 continued...	GROUP B 15.0 Pump Technology (E. Dockstader) GROUP A 16.0 Compressor Technology (C. Mitchell)
1:00-3:00	Break	Break
3:00-4:30	GROUP A 15.1 Pump Technology Workshop (E. Dockstader) GROUP B 16.1 Compressor Technology Workshop (C. Mitchell)	GROUP B 15.0 continued... GROUP A 16.0 continued...
4:30-5:00	Break	Break
5:00-6:30	GROUP A 15.1 continued GROUP B 16.1 continued	GROUP B 15.0 continued GROUP A 16.0 continued

*Class is evenly divided into two groups - A and B.

PLANT ENERGY MANAGER WORKSHOP
May 19-31, 1984
Cairo, Egypt

TIME	MAY 31	
9:00-10:10	GROUP B 15.1 Pump Technology Workshop (E. Dockstader) GROUP A 16.1 Compressor Technology Workshop (C. Mitchell)	
10:10-10:25	Break	
10:25-11:35-	GROUP B 15.1 continued... GROUP A 16.1 continued...	
11:35 11:50	Break	
11:50-1:00	GROUP B 15.1 continued... GROUP A 16.1 continued...	
1:00-3:00	Break	
3:00-4:30	GROUP B 15.2 Exam on Pump Technology (E. Dockstader) GROUP A 16.2 Exam on Compressor Technology (C. Mitchell)	
4:30-5:00	Break	
5:00-6:30	17.0 Closing Remarks (Egypt) (M. Monarch, ANL)	

*Class is evenly divided into two groups - A and B.

TOPICAL OUTLINES

I. SESSION 4.0

A. Current U.S. energy situation and 5-year outlook on energy prices.

B. Nine major guidelines in establishing and maintaining an effective EM program.

C. Influence of the "First Law of Energy Management"

D. Four basic tasks for a successful EM program

II. SESSION 5.0

A. Role of the plant energy coordinator and how to select the best person for the job.

B. Energy awareness as a key ingredient of a successful program

C. Techniques to control and reduce energy consumption by proper use of meters, energy standards, and energy audits.

D. The detection and changeout of large, underloaded induction motors using simple techniques and common test equipment.

E. Concept of a utility's test program (UTP) based on the three outlined goals.

F. Justifying a suitable level of manning, based on $MM spent per year for energy.

SESSION 6.0 - Panel Discussion (see separate page)

III. SESSION 7.0

A. Discussion on the benefits from applying good monitoring and reporting principles and guidelines.

B. Illustrations of how annual energy improvements can be achieved, predicted, and plotted for quick understanding by upper management.

C. Development of energy standards for specific applications by using metering data which provides energy profiles of individual processes.

D. How to scrutinize the potential problems and costs associated with meters and go on to produce suitable plans to deal with these problems.

E. Instituting methods to score results of individual departments using meter readings

F. Differentiating between the various types of flow meters available and the best application for each type.

G. The difference between power (rate of doing work) and energy (the quantity of work), with practical examples.

H. Development of $/MM BTU values for fuel and electricity, and $/KW-yr and $/HP-yr.

I. Calculation of refrigeration KW/ton values and comparison of plant values with industry-wide accepted norms.

J. Evaluation of available equipment and sorting out the fact and fiction of vendor claims.

FACILITY FORM

Date _____

Contact _____ Phone ( ) -

Plant Name _____

Address _____
_____
_____

Boiler Operater _____

Test Conducted by _____

Softener Make & Type _____
Hardness leaving softener _____ ppm
Feed water hardness _____ ppm Temp _____ F TDS _____ ppm
Boiler Water
TDS _____ Sulfite _____ ppm Phosphate _____ ppm
Alkalinity _____ ppm
Condensate
Return _____ % Tin _____ F Tout _____ F
pH _____ TDS _____ ppm
Total uninsulated area
Inlet line area _____ ft^2
Outlet line area _____ ft^2
Receiver tank area _____ ft^2

Deaerator Make & Type _____
Spray/Tray/Hotwell Pressure _____ psig Temp _____ F
Plume length _____ ft Vent orfice diamater _____ in

Condensing Turbines Yes/No
Total capacity _____ lbm/hr Avg load _____ %

Uninsulated Fittings & Lines

Size (in)	description, temp

Traps

Size (in/out)	Type	Tin	Tout
/			
/			
/			
/			
/			
/			
/			
/			
/			
/			

Line Pressure

Current	Min Allowable	% Steam Flow
_____ psig	_____ psig	_____
_____ psig	_____ psig	_____
_____ psig	_____ psig	_____

Required steam flow rate to keep lines hot at pressure? _____ lbm/h
Is there a regular trap maintenance program? Yes/No
Number of traps found leaking? _____

Boiler #1 Modulating/Manual % Full load _____ %
Boiler #2 Modulating/Manual % Full load _____ %
Boiler #3 Modulating/Manual % Full load _____ %
Boiler #4 Modulating/Manual % Full load _____ %

Efficiency/Load curve used to determine loading? Yes/No

AIR COMPRESSORS

Capacity of air in boiler room? _____ hp Air press leaving compressor? _____ psig
Required pressure? _____ psig Do compressors cycle on/off? Yes/No
Were leaks observed? Yes/No

GENERAL INFORMATION

Electricity Cost _____ c/KWH

Total plant boiler fuel cost _____ $/year

Fuels available in area

Natural Gas	_____ $/MBTU	
# 2 Fuel Oil	_____ c/gal	
# 4/5 Fuel Oil	_____ c/gal	
# 6 Fuel Oil	_____ c/gal	
Propane	_____ c/gal	
Coal	_____ $/ton	_____ BTU/lbm

ANNUAL CLEANING AND STORAGE

Waterside		Fireside	
Acid clean	Y/N	High pres jet clean	Y/N
Mechanical clean	Y/N	Brushes	Y/N
Wet storage		Storage	
Water properly treated	Y/N	Oil surfaces	Y/N
Positive pressure	Y/N	Steam blanket	Y/N
Dry storage		Dry	
Inert gas	Y/N	Dessicant	Y/N
Dessicant	Y/N	Vented	Y/N

Length of storage _____ weeks

ANNUAL INSPECTION AND REPAIR

Clean waterside	Y/N	Clean fireside	Y/N
Repair refractory	Y/N	Recondition relief valve	Y/N

SAFETY CHECKS

		Frequency
Check flame safeguard (shutoff fuel)	Y/N	_____ wks
Check low water cutoff (shutoff feed water)	Y/N	_____ wks
Check relief valve (override press limit switch)	Y/N	_____ wks
Hydrostatic pressure check	Y/N	_____ wks

BOILER LOG

Attach boiler log for typical summer/winter operation.
Note any observations on back of this sheet in "report ready" form.

INDIVIDUAL BOILER FORM

Plant Name _____

Boiler Number _____ Make _____ firetube/watertube

Boiler Pressure (psig)
Rated _____ Operating _____ Required _____

Boiler Capacity (lbm/hr / hp) Rated _____
Required Avg _____ Max _____ Min _____

Controls Make & Type _____

Economizer/Air Preheater
Type Heatwheel/Heatpipe/Shell & tube/ _____

Feed Water Pump Modulating/On-Off
Driven By Electric Motor/Turbine

Burner Make & Type _____ Atomizer Air/Steam
Capability _____

Primary Fuel _____ _____ % Used _____
Alternate Fuel _____ _____ % Used _____

Heavy Oil System Yes/No
Oil temperature in tank? _____ F Oil heated year-round? Yes/No
Heaters in Tank/Line Is tank insulated? Yes/No
Surface area of tanks? _____ ft^2
Uninsulated area of lines? _____ ft^2
Type of heater Steam/Electric/ _____
Additives used in oil _____

Bottom Blow Down Measured Yes/No
Frequency _____ seconds every _____ hours

Continuous Blow Down Yes/No TDS _____ ppm
Heat Recovery Flash tank, Heat exchanger
Tin _____ F Tout _____ F

Soot Blow Air/Steam
Frequency _____ seconds every _____ hours

Ceiling Height _____ ft Comb air inlet height _____ ft
Air Temp at Ceiling _____ F

Total uninsulated area on Boiler Shell _____ ft^2
Avg Temp _____ F

Does boiler switch on and off? Yes/No

Does boiler pressure surge up and down? Yes/No

Does boiler fire side have Slagging/Sooting/Ash/ _____

As Found Performance Parameters

		Notes
Load	%	
CO_2	%	
O_2	%	
CO	%	
T_{stack}	F	
$T_{comb\ air}$	F	
T_{fuel}	F	
Pressure	psig	

List any burner defects noted :

Adjusted Performance Parameters

		Notes
Load	%	
CO_2	%	
O_2	%	
CO	%	
T_{stack}	F	
$T_{comb\ air}$	F	
T_{fuel}	F	
Pressure	psig	

Boiler Water
TDS _____ Sulfite _____ ppm Phosphate _____ ppm
Alkalinity _____ ppm

SAFETY DEVICES

Gas Train
Low pressure cutout? Yes/No set point _____psig
High pressure cutout? Yes/No set point _____psig
# of automatic shutoff valves (0/1/2)
# of manual shutoff valves (0/1/2)
Space between automatic valves properly vented Yes/No
Comments _____
Pressure regulator valve properly vented Yes/No

Oil Train
Low pressure cutout? Yes/No set point _____psig
High pressure cuoout? Yes/No set point _____
# of automatic shutoff valves (0/1/2)
# of manual shutoff valves (0/1/2)

Water Side
# of low water cutoffs (0/1/2)
Low cutoffs in separate legs Yes/No
# of relief valves (0/1/2)
Flame safeguard Ultraviolet/Flamerod/Thermocouple

OTHER

Write on the back of this page in "Report Ready" format any other deficiencies noted.

PLANT ENERGY MANAGER WORKSHOP
MAY 19 - 31, 1984

EXAMPLE PROBLEMS - SESSIONS 8,9 and 10

1. No. 2 Fuel Oil with the composition given in Table A.3 of Text , (page A.10) Boiler Efficiency Improvement, is burned completely with 100% excess air in a boiler with a stack temperature of 400°F. Fuel and air enter the boiler at 80°F. Feedwater at 200°F enters the boiler at 30,000 lb/hr and steam leaves as saturated vapor at 150 psi(absolute pressure). Radiation heat loss amounts to 3% of the available energy in the fuel entering the boiler. The blowdown rate is 600 lb/hr of saturated liquid at boiler pressure. Compute without using efficiency tables :

   a. % CO_2(dry basis) in stack gas (Note: obtain by balancing combustion equation)

   b. % O_2 (dry basis) in stack gas

   c. % H_2O (wet basis) in stack gas

   d. Heat transfer to the feedwater to produce steam, BTU/hr

   Using the efficiency table B.2 (page B.18) compute(or look up)

   e. Combustion efficiency

   f. Boiler efficiency (neglect blowdown loss)

   g. The fuel flow rate

2. A boiler fired with sulfur, S_2, operates with 4% O_2 (no combustibles) in the stack gas. The fuel and air enter the boiler at 77°F and the stack gas leaves at 457°F. The boiler uses 1000 lbm/hr of fuel. What is the mass flow rate of flue gas. Calculate the amount of energy saved, BTU/hr, by dropping the stack temperature to 357°F through an economizer . (assume Cp of flue gas = .2 $\frac{BTU}{lbm°F}$) .

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OF CHEMICAL ENGINEERS

Appendix A-6

HAROLD I ABRAMSON
STAFF DIRECTOR
EDUCATIONAL SERVICES

March 13, 1984

TO: All Registrants for "Practical Project Economic Evaluation"

FROM: Harold I. Abramson, Staff Director

The areas of the text to be covered are:

We will use extensively and in detail:

Chapter 5 - Cost Estimation

We will use ideas or data from the following chapters (but will not necessarily cover each in detail):

Chapter 2 - Process Design Development
Chapter 6 - Interest and Investment Costs
Chapter 7 - Taxes and Insurance
Chapter 8 - Depreciation
Chapter 9 - Profitability, Alternative Investments, and Replacements
Chapter 12 - Interest and Investment Costs
Chapter 13 - Materials Transfer, Handling and Treatment Equipment--Design and Costs
Chapter 14 - Heat Transfer Equipment--Design and Costs
Chapter 15 - Mass Transfer and Reactor Equipment--Design and Costs
Appendix B - Auxiliary, Utility, and Chemical Cost Data

Corrected Version
March 20, 1984

"IRR from Capital Estimates"

by

Robert J. Larson

Senior Engineering Evaluations Consultant
Corporate Research Laboratories
MONSANTO CO.; St. Louis, Missouri

Presented by

James M. Allman
Senior Research Chemical Engineer
Corporate Research Laboratories
MONSANTO CO.; St. Louis, Missouri

It is possible to estimate the IRR of a project from an estimate of the incremental capital required. The estimate of IRR is obtained from a chart (attached) relating capital and IRR, developed below. It will become evident that the reliability of the chart is entirely dependent o the assumptions used to derive it. The chart (attached) may or may not be applicable to a specific problem. However, the derivation is simple enough so that a new chart can be derived, using the principles describe to produce a new chart which is applicable to a specific situation or class of situations.

The assumptions used to derive the chart are given below in Table I:

Table I
Assumed Values for Input Items

Uniform Inflation Rate for Savings	8%/yr
Capital Associated Expense	10% of new fixed capital in the first year of operation
Uniform Inflation Rate for Capital Associated Expense	6%/yr
Depreciation Method	5 year useful life, with the rates in each year being: 15%, 22%, 21%, 21%, 21%.
Income Tax Rate	48%
Investment Tax Credit - 10% of new fixed capital in the start-up year	
Cash Flow Discount Rate	15%
Period of the Study	Capital invested at time 0, six years of operation.
On Stream Time	8000 hrs/yr
Symbols	M = 1,000,000; k = 1,000

Using conventional Discounted Cash Flow techniques, the Net Present Value of a unit of Capital Investment can be calculated, based on these assumptions, as shown in Table II, below:

Table II
Net Present Value of a unit of Capital ($1000)

Time year	0	1	2	3	4	5	6
Capital $	-1000	0	0	0	0	0	0
Capital Assoc. Expense (a.t.) $	0	- 52	- 55	- 58	- 62	- 66	- 70
Tax Effect of Depreciation $	0	72	106	101	101	101	0
Investment Tax Credit $	0	100	0	0	0	0	0
Cash Flow $	-1000	120	51	43	39	35	- 70
Discounted Cash Flow (i = 15%) $	-1000	104	39	27	22	17	- 30
Cumm. Disc. Cash Flow $	-1000	- 896	- 857	- 830	- 808	- 791	- 821

Net Present Value of a unit of capital = $821 / $1000 of capital

In similar fashion, the Net Present Value of a unit of Revenue (Savings) can be calculated, using the same assumptions, as shown in Table III, below:

Table III
Net Present Value of a Unit of Revenue (or Savings; unit is $1000)

Time year	0	1	2	3	4	5	6
Cash Flow (after Taxes) $	0	520	562	606	655	707	764
Discounted Cash Flow (i = 15%) $	0	452	425	399	375	352	330
Cumm. Disc. Cash Flow $	0	452	877	1275	1650	2002	2332

Net Present Value of a unit of Revenue (Saving) = $2332 / $1000 of Revenue

A useful factor can be calculated from the Net Present Values calculated above. The ratios of the Net Present Values gives the so called "Investment Equivalent of unit of Savings", thus:

$2332 / $821 = $2.84 Capital / $1 of Revenue (Saving)

If 15% (the assumption for discount rate, see Table 1) is the minimum acceptable average earnings rate ("hurdle rate") for a company, then the Investment Equivalent calculated above can be interpreted to mean:

> "The maximum amount of Capital that can be spent to achieve a dollar of Revenue (Savings), and still meet company standards for minimum average earnings rate."

This "Investment Equivalent" permits a "quick and dirty" solution to the following problem:

Problem:
Is an idea which proposes to invest $3500 to achieve Savings of $1300 (b.t.) in the first year of operation, economically attractive?

Evaluation Criteria
Investment Equivalent of $1 of Savings = $2.84.

Solution
Maximum Capital allowed: $1300 * $2.84 = $3692
Since the proposed investment, $3500. is less than the maximum allowed as calculated from Investment Equivalents, the proposal is economicall attractive.

The concept described above has already provided a useful tool for idea evaluation. From the estimated Savings, the estimated Capital, and the "Investment Equivalent", a preliminary judgement can be made of the potential economic acceptability of a proposal. However, it is now useful to explore the effect of changing values for the discount rate, which, so far, has had the value of 15% (see Table 1). If Tables II, and III are recalculated using a variety of values for the Discount Rates, new values for the Investment Equivalent are derived from the new values for the Net Present Values, as follows:

Table IV
Sensitivity to Discount Rate

Discount Rate	Net Present Values Capital	Revenue	Investment Equivalent	Ratio Inv Eq (x%) to Inv Eq (15%)
5%	$804	$3192	$3.97	1.398
10%	$812	$2710	$3.34	1.176
15%	$821	$2332	$2.84	1.000
20%	$829	$2030	$2.45	0.863
25%	$837	$1786	$2.13	0.750
30%	$844	$1586	$1.88	0.662
40%	$857	$1282	$1.50	0.528
50%	$868	$1066	$1.23	0.433
60%	$877	$ 905	$1.03	0.363

It is evident that:

a. if the minimum acceptable average earnings rate is 15%, and
b. if project savings are estimated to be $1300 in the first year,
c. then maximum capital allowable is $1300 * $2.84 = $3692. Also,
d. if the estimate of actual incremental capital required is $3692,
e. then the Internal Rate of Return (IRR) for the project is 15%.

And:

a. if the minimum acceptable average earnings rate is 20%, and
b. if project savings are estimated to be $1300 in the first year,
c. then maximum capital allowable is $1300 * $2.45 = $3185. Also,
d. if the estimate of actual incremental capital required is $3185,
e. then the Internal Rate of Return (IRR) for the project is 20%.

It is observed, that:

$3185 / $3692 = 0.863 $2.45 / $2.84 = 0.863

This implies that if the ratio of the Actual Estimated Capital investment for an idea to the Maximum Allowable Capital investment, as calculated from savings in the first year of operation and the Investment Equivalent of Savings, has the value 0.863, then the IRR of the idea is 20%. In addition, the ratio of the Investment Equivalents at these Discount Factors will have the same value as the ratio of these investments.

This understanding provides two opportunities. A chart can be drawn which relates IRR to the ratio between the Investment Equivalent at any Discount Rate and the Investment Equivalent at the "hurdle rate" (15% in this discussion). The chart can be used to relate the ratio of the of the Actual Estimated Capital investment in a proposal to the Maximum Allowable Capital investment in the proposal (and still meet the "hurdle rate", as calculated from first year savings and the Investment Equivalent) to the IRR. A chart of this kind is appended.

An Example of the use of this chart is as follows:

The estimated capital to carry out a project is $24,000.

The estimated savings to be experienced in the first year of operation is $11,300."

The assumptions of Table I are acceptable.

The appended chart is acceptable.

Estimate the IRR of the project

The IRR can be estimated, using the chart, in the following way:

Maximum Allowable Capital - $11,300 * $2.84 = $32,000

Ratio, Actual/Maximum - $24,000 / $32,000 = 0.75

IRR is 25% (see chart)

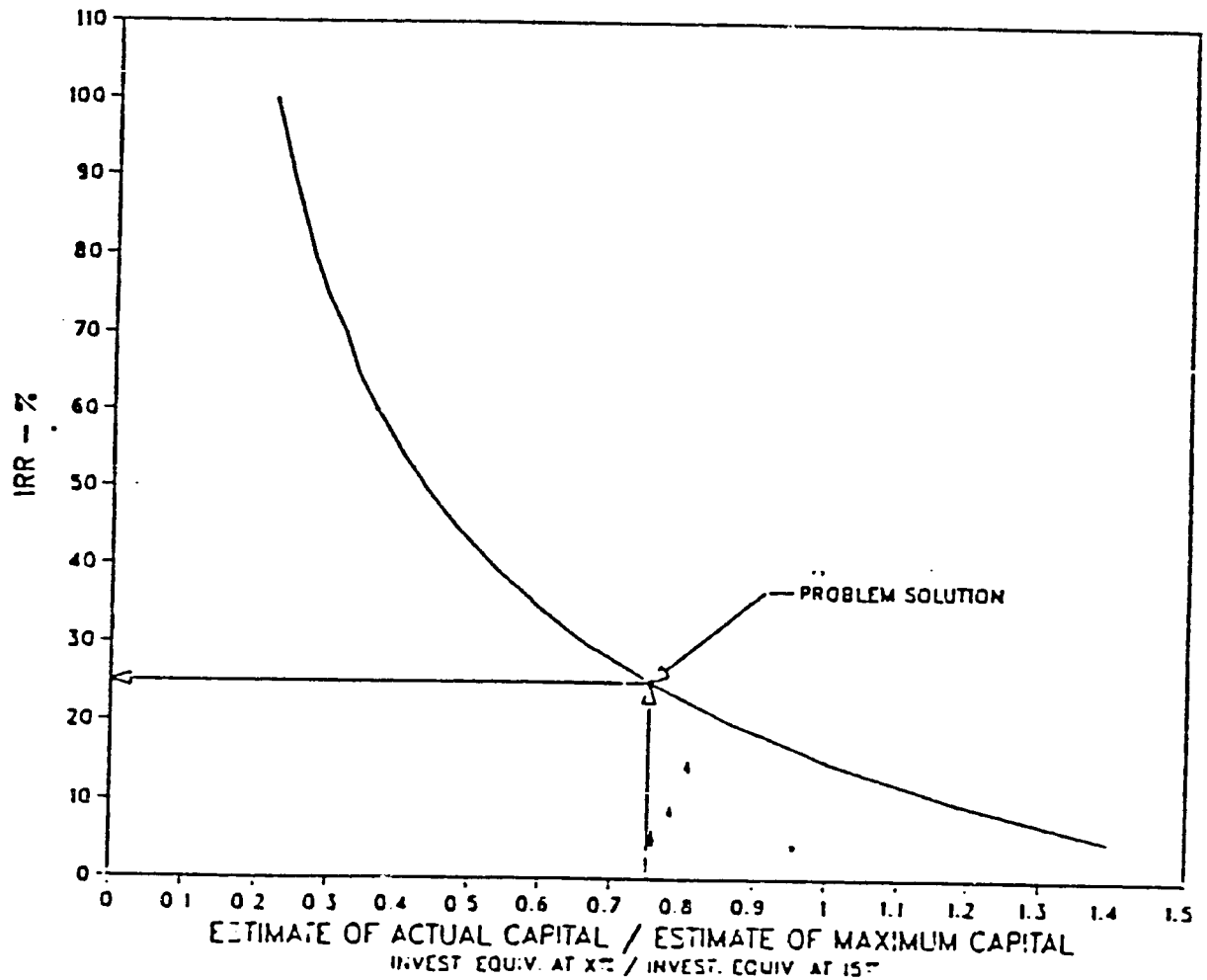
This is a "quick and dirty" way to estimate the IRR of a project from two simple estimates. It is obvious that a chart, based on economic assumptions which are meaningful to the user, must be available. Such a chart is easily constructed from the discussion above.

Finally, it must be re-emphasized, that the reliability of the IRR estimates obtained from charts similar to the appended are entirely dependent on the assumptions used to develop the charts.

IRR FROM CAPITAL EQUIVALENT OF SAVINGS: M & E INVESTMENT

DEPRECIATION RATE AND USEFUL LIFE FROM THE 1981 ECONOMIC RECOVERY ACT AND THE 1982 TAX EQUITY AND FISCAL RESPONSIBILITY ACT

USEFUL LIFE FOR TAX PURPOSES IS 5 YEARS



TG4 L/ 4/9/84

ENERGY CONSERVATION PROJECT EVALUATION BY INVESTMENT EQUIVALENTS

by
Robert J. Larson
Senior Engineering Evaluations Consultant
Corporate Research Laboratories
Monsanto Company, St. Louis, Missouri

ABSTRACT

Using discounted cash flow techniques, a new parameter for the quick economic evaluation of energy conservation ideas is calculated. The meaning of the calculated value, an "Investment Equivalent of Energy Saving", is:

"The maximum amount of capital which can be spent to save a unit of energy and still meet the criteria for profitability."

"Investment Equivalents" can be calculated easily for any form of energy, at any location. The "Investment Equivalent" can be used to screen energy saving proposals, justify energy conservation projects, and choose between energy sensitive alternatives.

Investment Equivalents are calculated, and are used to evaluate energy savings proposals in sample problems.

Concern over energy conservation, and the search for more efficient ways to employ energy will continue as long as easily available energy becomes more and more scarce (more and more costly). Most predictions agree that this condition will exist for many years to come.

Simplified techniques, which are quick and easy to use for selection between alternates or preliminary justification of projects, are valuable tools to have available when working under these conditions. This paper proposes such a "quick and easy" technique, based on well known and accepted Discounted Cash Flow methods. The technique has become known as "Investment Equivalents of Energy Savings".

In developing procedures of this kind, the usual method employed to achieve some simplification is to assume values for as many of the input items as possible. These values should be such that, though not very accurate, they will be close much of the time, and any inaccuracies will be acceptable for the sake of ease and speed, and consistent with the reliability of the other input items.

In developing "Investment Equivalents of Energy Savings", it is convenient to make assumptions for several of the necessary input items. The items, and the values for the assumptions used in this discussion, are listed in Table I, attached.

It is important to remember that the values of the "Investment Equivalents" computed below are entirely dependent on these assumptions. On the other hand, it will become evident that different "Investment Equivalents" can easily be calculated, based on a new set of assumptions, which can be made specific for any situation (plant location, company policy, special condition).

The Annual Savings for conserving a unit of natural gas per hour, as fuel, can be calculated as follows:

1 MBtu/hr * 8k hrs/yr * $5.00/MBtu = $40,000/yr

Using well known Discounted Cash Flow methods, the Net Present Value of a unit of energy saved can be calculated as shown in Table II, attached.

In a similar fashion, the net present value of a unit of capital can be calculated, as shown in Table III, attached.

The NPV's of a Unit of Energy Saved and of a Unit of Capital Investment are now available, calculated on consistent bases. It is clear that the number of units of Capital that can be invested to save a unit of energy (1M Btu/hr of Natural Gas fuel at $5.00/MBtu) is:

$93.3k / $0.821k = $114 of capital / kBtu/hr
(note change in units from $k to $, and MBtu/hr to kBtu/hr)

This parameter is named the "Investment Equivalent of Energy Saving" for Natural Gas fuel.

Problem 1:

Is an idea which proposes to invest $3500 to save 35 kBtu/hr of Natural Gas fuel economically attractive?

Evaluation Criteria

Investment Equivalent for Natural Gas fuel is $114 per kBtu of fuel.

Solution

Maximum Capital allowed: 35 kBtu/hr * $114/kBtu/hr = $3990
Since the proposed investment, $3500, is less than the maximum allowed as calculated from Investment Equivalents, the proposal is economically attractive.

Problem 2:

Should a steam turbine or an electric motor be used to drive a particular pump?

Evaluation Criteria

Energy required is 1500 HP (driver shaft output);
a steam turbine is 60% efficient;
an electric motor is 90% efficient;
the investment equivalent of steam is $190/kBtu/hr;
the investment equivalent of purchased electric power is $1000/kW;
installed cost of a 1500 HP, low pressure, condensing, steam turbine is estimated to be $100,000;
the installed cost of a 1500 HP electric motor is estimated to be $50,000;
1 HP = 2546 Btu/hr, 1HP = 0.746 kW

Solution

Capital Equivalent of energy consumed by the turbine:
(1500HP * 2546 Btu/hr/HP * $190/kbtu/hr) / (0.60 * 1k) = $1209k Inv Eq

Capital Equivalent of energy consumed by the motor:
(1500HP * 0.746 kW/HP * $1000/kW) / (0.90) = $1243k Inv Eq

The Capital Equivalent of total turbine cost - $1209k + $100k = $1309k

The Capital equivalent of total motor cost - $1243k + $ 50k = $1293k

Additional capital is required to install the turbine. If the turbine is installed, savings in energy usage are experienced which tend to favor the installation of the turbine. However, operating expense can be cooverted to capital terms, using the "Investment Equivalent" concept, so that capital and expense can be related to each other in the same units. When this is done, and a minimum acceptable rate of earnings is required (15% in this case), it is evident that the motor is the economically attractive (least costly) alternative.

Table II
Net Present Value of a Unit of Energy (1M Btu/hr as Natural Gas fuel)

Time	year	0	1	2	3	4	5	6
Cash Flow (after Taxes)	$	0.0k	20.8k	22.5k	24.3k	26.2k	28.3k	30.6k
Discounted Cash Flow (i = 15%)	$	0.0k	18.1k	17.0k	16.0k	15.0k	14.0k	13.2k
Cumm. Disc. Cash Flow	$	0.0k	18.1k	35.1k	51.1k	66.1k	80.1k	93.3k

Net Present Value of a unit of energy saved per hour = $93.3k / MBtu/hr

Table III
Net Present Value of a unit of Capital ($1000)

Time	year	0	1	2	3	4	5	6
Capital	$	-1000	0	0	0	0	0	0
Capital Assoc. Expense (a.t.)	$	0	-52	-55	-58	-62	-66	-70
Tax Effect of Depreciation	$	0	72	106	101	101	101	0
Investment Tax Credit	$	0	100	0	0	0	0	0
Cash Flow	$	-1000	120	51	43	39	35	-70
Discounted Cash Flow (i = 15%)	$	-1000	104	39	27	22	17	-30
Cumm. Disc. Cash Flow	$	-1000	-896	-857	-830	-808	-791	-821

Net Present Value of a unit of capital = -$0.821k / $1000 of capital

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The description of this parameter can be stated as follows:

> The Investment Equivalent of Energy Saved is the maximum amount of Capital which can be spent to save a unit of energy and still meet the requirement for minimum annual earnings required by company policy.

The "requirement for minimum annual earnings" in the above example is 15%.

It is obvious that a similar factor can be calculated for other fuels or forms of purchased energy. It is also evident that simple relations between purchased energy sources and secondary energy sources, eg. CF of Natural Gas per MBtu of energy in Steam, can be used to estimate an "Investment Equivalent of Energy Saved" for such secondary energy sources as refrigeration, cooling water, condensate return, etc.

Various of the input assumptions (study term, discount rate) can be adjusted to reflect the financial and operating policies of any firm. Other input assumptions (unit cost of fuel, inflation rates, cost of capital associated expense) can be varied to reflect the experience at any specific location. This permits the tailoring of the parameter to most sets of circumstances, and quick and easy periodic up-dates to reflect new conditions. Of course, frequent modification of many specific values require many individual calculations. However, the system is easily programmed for efficient and rapid calculation of many cases by computer.

An example of a fundamental use of the "Investment Equivalent" to justify an energy saving idea is shown in Problem 1. An example of the use of the Investment Equivalent concept to choose between alternatives is given in Problem 2. Both problem statements and their solutions are appended.

Table I
Assumed Values for Input Items

Unit Savings	1 MBtu as natural gas at $5.00/MBtu in year 1
Uniform Inflation Rate for Savings	8%/yr
Unit Capital Investment	$1000
Capital Associated Expense	10% of new fixed capital in the first year of operation
Uniform Inflation Rate for Capital Associated Expense	6%/yr
Depreciation Method	5 year useful life, with the rates in each year being: 15%, 22%, 21%, 21%, 21%.
Income Tax Rate	48%
Investment Tax Credit	10% of new fixed capital in the start-up year
Cash Flow Discount Rate	15%
Period of the Study	Capital invested at time 0, six years of operation.
On Stream Time	8000 hrs/yr
Symbols	M = 1,000,000; k = 1,000

COMPRESSOR TECHNOLOGY

Plant Energy Managers Workshop May 29, 30 & 31, 1984

COURSE OBJECTIVE

Energy conservation through

- Proper selection and sizing
- Quality installation
- Optimum operation for productivity
- Efficiency with investment economy
- Effective maintenance

COURSE EMPHASIS

Value of each type of compressor to specific end use

Steps to assure a successful compression facility

- Design, specification and installation
- Importance of every auxiliary system
- Business and engineering aspects

COURSE CONTENT

Types of compressors

- Centrifugal
- Axial
- Reciprocating
- Rotary

Uses of compressors

- Chemical production
- Powerhouse - Plant air, instrument air, refrigeration
- Iron and steel production
- Refineries
- Construction industry

Thermodynamics of compression

- Units - English, metric
- Compression process - Adiabatic, polytropic, isotherma
- Properities of gasses - Compressibility, Gas mixtures

Compressor audit items and check lists

- Auxiliary Systems - Instrumentation
- Installation - Start-up
- New or existing facilities

SUMMARY

Energy conservation from

- Reliability of operation
- Producing required quantity and quality of product
- Minimum energy consumption by efficient compression

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- Units - English, metric
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- Properities of gasses - Compressibility, Gas mixtures

Compressor audit items and check lists

- Auxiliary Systems - Instrumentation
- Installation - Start-up
- New or existing facilities

SUMMARY

Energy conservation from

- Reliability of operation
- Producing required quantity and quality of product
- Minimum energy consumption by efficient compression

	U. S. CUSTOMARY UNITS			S I (METRIC) UNITS			Exact *
QUANTITY	SYMBOL	NAME	UNITS	SYMBOL	NAME	UNITS	MULTIPLIER OF US UNITS TO OBTAIN S I UNITS
Acceleration	a	foot per second per second	ft/sec^2	a	meter per second per second	m/s^2	3.048* E-01
Accel. of Gravity	g	foot per second per second	ft/sec^2	g	meter per second per second	m/s^2	9.9067 E+00
Adiabatic Exponent	k	~	~	k	~	~	1 E+00
Area	A	square foot	ft^2	A	square meter	m^2	9.2903 E-02
Density	ρ	pound mass per cubic foot	lbm/ft^3	ρ	kilogrm per cubic meter	kg/m^3	1.6018 E+01
Efficiency	η	~	~	η	~	~	~
Energy, work	W	foot pound force	ft·lbf	W	joule	J	1.3558 E+00
heat	Btu	British thermal unit	Btu		joule	J	1.0551 E+03
Flow Rate (mass)	w	pound mass per second	lbm/sec	w	kilogram per second	kg/s	4.5359 E-01
Flow Rate (Volume)	V	cubic foot per minute	ft^3/min	V	cubic meter per second	m^3/s	4.7195 E-04
Flow Rate (Volume)	GPM	gallon (US liquid) per minute	gal/min		cubic meters per second	m^3/s	6.3090 E-05
Force	lbf	pound force	lbf		newton	N	4.4482 E+00
Gas Constant	R	foot pound force per pound mass degree Rankine	$\frac{ft \cdot lbf}{lbm \cdot {}^oR}$	R	joule per kilogram·kelvin	J/kgK	5.3803 E+00
Head	H	foot	ft	H	meter	m	3.048* E-01
Length	L	foot	ft	L	meter	m	3.048* E-01
Mass	m	pound mass	lbm	m	kilogram	kg	4.5359 E-01
Polytropic Exponent	n	~	~	n	~	~	~
Power	HP	horsepower	hp	KW	kilowatt	kw	7.4570 E-01
Pressure	P	pound force per square foot	psf	P	bar	bar	4.7880 E-04
Pressure	p	pound force per square inch	psi	p	pascal	Pa	6.8948 E+03
Rotational Frequency	RPM	revolutions per minute	min^{-1}	rps	revolutions per second	s^{-1}	1.6667 E-02
Specific Gravity	s	~	~	s	~	~	1 E+00
Specific Heat	c	British thermal unit per pound mass degree Rankine	$\frac{Btu}{lbm \cdot {}^oR}$	c	joule per kilogram·kelvin	J/kgK	4.1868 E+03
Specific Volume	v	cubic foot per pound mass	ft^3/lbm	v	cubic meter per kilogram	m^3/kg	6.2428 E-02
Temperature (measured	t	degree Fahrenheit	^oF	t	degree celsius	^oC	$t_C=(t_f-32)/1.8$
Temp. (thermodynamic)	T	degree Rankine	^oR	T	degree kelvin	K	$T_R = T_R/1.8$
Time	t	second	sec	t	second	s	1 E+00
Value $[(p_2/p_1)^{\frac{k-1}{k}} - 1]$	x	~	~	x	~	~	1 E+00
Velocity	v	foot per second	ft/sec	v	meter per second	m/s	3.048* E-01
Viscosity (dynamic)	μ	pound force·second per square ft	$\frac{lbf \cdot sec}{ft^2}$	μ	pascal·second	Pa·s	4.7880 E+01
Viscosity (kinematic)	ν	square foot per second	ft^2/sec	ν	square meter per second	m^2/s	9.2903 E-02
Volume	V	cubic feet	ft^3	V	cubic meter	m^3	2.8317 E-02

ORGANIZATION FOR ENERGY PLANNING

PLANT ENERGY MANAGER WORKSHOP SURVEY

SURVEY RESULTS [a]

INSTRUCTOR WAYNE STEBBINS COURSE SESSION # 4, 5 and 7.

The following are a series of multiple choice questions. Please circle the letter corresponding to the answer which you choose (example (a)).

1. I found this session to be:
   a. very interesting and informative. - 40%
   b. interesting and informative. - 60%
   c. not very interesting and informative. - 0 %

2. If the course were given again, I would recommend that:
   a. the session should last the same length of time. - 5%
   b. twice as much time should be allocated to the course material.-62.5%
   c. three times as much time should be allocated to the course material. - 15%
   d. a great deal more time should be allocated to the course material. - 17.5%

3. If the course were given again, I would recommend that:
   a. more time be devoted to lecture than problem solving.- 15%
   b. more time be devoted to problem solving than lecture.- 35%
   c. the same amount of time be devoted to lecture and problem solving. - 50%

4. I felt that the instructor:
   a. spoke clearly and I had no trouble understanding him.-25%
   b. spoke fairly well and I had only a little trouble understanding him. - 52.5%
   c. spoke in a manner which made it very difficult to understand.-22.5%

a There were 41 respondents out of a class of 41

	U. S. CUSTOMARY UNITS			S I (METRIC) UNITS			Exact*
QUANTITY	SYMBOL	NAME	UNITS	SYMBOL	NAME	UNITS	MULTIPLIER OF US UNITS TO OBTAIN S I UNITS
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nsity	ρ	pound mass per cubic foot	lbm/ft^3	ρ	kilogrm per cubic meter	kg/m^3	1.6018 E+01
fficiency	η	~	~	η	~	~	~
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heat	Btu	British thermal unit	Btu		joule	J	1.0551 E+03
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ead	H	foot	ft	H	meter	m	3.048* E-01
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olytropic Exponent	n	~	~	n	~	~	~
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emperature (measured	t	degree Fahrenheit	^oF	t	degree celsius	^oC	$t_C=(t_f-32)/18$
emp. (thermodynamic)	T	degree Rankine	^oR	T	degree kelvin	K	$T_R = T_R/18$
ime	t	second	sec	t	second	s	1 E+00
alue $[(p_2/p_1)^{\frac{k-1}{k}} - 1]$	x	~	~	x	~	~	1 E+00
elocity	v	foot per second	ft/sec	v	meter per second	m/s	3.048* E-01
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ORGANIZATION FOR ENERGY PLANNING

PLANT ENERGY MANAGER WORKSHOP SURVEY

SURVEY RESULTS [a]

INSTRUCTOR WAYNE STEBBINS COURSE SESSION # 4, 5 and 7.

The following are a series of multiple choice questions. Please circle the letter corresponding to the answer which you choose (example (a)).

1. I found this session to be:
   a. very interesting and informative. - 40%
   b. interesting and informative. - 60%
   c. not very interesting and informative. - 0 %

2. If the course were given again, I would recommend that:
   a. the session should last the same length of time. - 5%
   b. twice as much time should be allocated to the course material.-62.5%
   c. three times as much time should be allocated to the course material. - 15%
   d. a great deal more time should be allocated to the course material. - 17.5%

3. If the course were given again, I would recommend that:
   a. more time be devoted to lecture than problem solving.- 15%
   b. more time be devoted to problem solving than lecture.- 35%
   c. the same amount of time be devoted to lecture and problem solving. - 50%

4. I felt that the instructor:
   a. spoke clearly and I had no trouble understanding him.-25%
   b. spoke fairly well and I had only a little trouble understanding him. 52.5%
   c. spoke in a manner which made it very difficult to understand.-22.5%

a There were 41 respondents out of a class of 41

5. I found that the instructor:

   a. presented enough examples to aid problem solving or understanding the material. - 35%

   b. could have given more examples to aid problem solving and understanding the material. - 60%

   c. gave hardly any examples to illustrate the application of the subject material. - 5%

6. After reviewing the workbook and other prepared material, I feel that:

   a. the lecture followed the prepared material. - 27.5%

   b. the lecture made the prepared material easier to understand.-52.5%

   c. the lecture did not follow the prepared material well. -20%

7. After reviewing the session relative to my position as plant energy manager, I find that:

   a. I will have <u>little</u> use for the information presented.-13%

   b. I will have <u>some</u> use for the information presented.-24%

   c. I will have a <u>great deal</u> of use for the information presented.-26%

   d. the subject material is <u>very important</u> to my position.- 37%

8. The weakness of the session is that the subject material will have limited use for me as a plant energy manager because :

   a. the plant equipment discussed does not exist at my plant.-15%

   b. the plant equipment discussed does not consume a significant amount of energy at my plant. -19%

   c. in my current position I do not have any authority to become involved with the equipment. - 8%

   d. my responsibilities in this area have not been defined.-8%

   e. none of the above are applicable. -50%

9. I would recommend that this course be given for others working in my plant that have responsibility for: (circle as many as are applicable)

   a. plant operation -17

   b. plant maintenance -23

   c. other (specify) _____

   d. all of the above

   e. none of the above - 3

ORGANIZATION FOR ENERGY PLANNING

PLANT ENERGY MANAGER WORKSHOP SURVEY

SURVEY RESULTS [a]

INSTRUCTOR DR. David Dyer COURSE SESSION # 8,9,10

The following are a series of multiple choice questions. Please circle the letter corresponding to the answer which you choose (example (a)).

1. I found this session to be:
   a. very interesting and informative. -76%
   b. interesting and informative. - 23%
   c. not very interesting and informative.

2. If the course were given again, I would recommend that:
   a. the session should last the same length of time. -48%
   b. twice as much time should be allocated to the course material.-27%
   c. three times as much time should be allocated to the course material. -25%
   d. a great deal more time should be allocated to the course material.

3. If the course were given again, I would recommend that:
   a. more time be devoted to lecture than problem solving. -17%
   b. more time be devoted to problem solving than lecture. -17%
   c. the same amount of time be devoted to lecture and problem solving. - 66%

4. I felt that the instructor:
   a. spoke clearly and I had no trouble understanding him.-79%
   b. spoke fairly well and I had only a little trouble understanding him. — -21%
   c. spoke in a manner which made it very difficult to understand.

[a] There were 29 respondents out of a class of 41

5. I found that the instructor:

   a. presented enough examples to aid problem solving or understanding the material. - 79%

   b. could have given more examples to aid problem solving and understanding the material. 21%

   c. gave hardly any examples to illustrate the application of the subject material.

6. After reviewing the workbook and other prepared material, I feel that:

   a. the lecture followed the prepared material. - 31%

   b. the lecture made the prepared material easier to understand.-69%

   c. the lecture did not follow the prepared material well.

7. After reviewing the session relative to my position as plant energy manager, I find that:

   a. I will have little use for the information presented.

   b. I will have some use for the information presented.-26%

   c. I will have a great deal of use for the information presented.-26%

   d. the subject material is very important to my position. -48%

8. The weakness of the session is that the subject material will have limited use for me as a plant energy manager because :

   a. the plant equipment discussed does not exist at my plant.- 7%

   b. the plant equipment discussed does not consume a significant amount of energy at my plant. - 4%

   c. in my current position I do not have any authority to become involved with the equipment. - 4%

   d. my responsibilities in this area have not been defined.- 7%

   e. none of the above are applicable. 78%

9. I would recommend that this course be given for others working in my plant that have responsibility for: (circle as many as are applicable)

   a. plant operation 20

   b. plant maintenance 24

   c. other (specify) Utility engineers

   d. all of the above

   e. none of the above

ORGANIZATION FOR ENERGY PLANNING

PLANT ENERGY MANAGER WORKSHOP SURVEY

SURVEY RESULTS [a]

INSTRUCTOR Robert Larson COURSE SESSION # 13, 14

The following are a series of multiple choice questions. Please circle the letter corresponding to the answer which you choose (example (a)).

1. I found this session to be:
   a. very interesting and informative. -38%
   b. interesting and informative. - 57%
   c. not very interesting and informative. - 5%

2. If the course were given again, I would recommend that:
   a. the session should last the same length of time.-15%
   b. twice as much time should be allocated to the course material.- 35%
   c. three times as much time should be allocated to the course material. - 25%
   d. a great deal more time should be allocated to the course material. - 25%

3. If the course were given again, I would recommend that:
   a. more time be devoted to lecture than problem solving. -10%
   b. more time be devoted to problem solving than lecture. - 35%
   c. the same amount of time be devoted to lecture and problem solving. -55%

4. I felt that the instructor:
   a. spoke clearly and I had no trouble understanding him.-70%
   b. spoke fairly well and I had only a little trouble understanding him. - - 30%
   c. spoke in a manner which made it very difficult to understand.

a There were 21 respondents out of the class of 41 trainees

5. I found that the instructor:

   a. presented enough examples to aid problem solving or understanding the material. - 53%

   b. could have given more examples to aid problem solving and understanding the material. - 37%

   c. gave hardly any examples to illustrate the application of the subject material. - 10%

6. After reviewing the workbook and other prepared material, I feel that:

   a. the lecture followed the prepared material. - 40%

   b. the lecture made the prepared material easier to understand. 35%

   c. the lecture did not follow the prepared material well. - 25%

7. After reviewing the session relative to my position as plant energy manager, I find that:

   a. I will have little use for the information presented. - 15%

   b. I will have some use for the information presented. - 21%

   c. I will have a great deal of use for the information presented. - 32%

   d. the subject material is very important to my position. - 32%

8. The weakness of the session is that the subject material will have limited use for me as a plant energy manager because :

   a. the plant equipment discussed does not exist at my plant.

   b. the plant equipment discussed does not consume a significant amount of energy at my plant.

   c. in my current position I do not have any authority to become involved with the equipment. -8%

   d. my responsibilities in this area have not been defined. -8%

   e. none of the above are applicable. - 84%

9. I would recommend that this course be given for others working in my plant that have responsibility for: (circle as many as are applicable)

   a. plant operation - 6

   b. plant maintenance - 7

   c. other (specify) Accountant , Project Engineer

   d. all of the above

   e. none of the above

ORGANIZATION FOR ENERGY PLANNING

PLANT ENERGY MANAGER WORKSHOP SURVEY

SURVEY RESULTS [a]

INSTRUCTOR C. Mitchell COURSE SESSION # 15.0

The following are a series of multiple choice questions. Please circle the letter corresponding to the answer which you choose (example (a)).

1. I found this session to be:
   a. very interesting and informative. - 43%
   b. interesting and informative. - 43%
   c. not very interesting and informative. - 14%

2. If the course were given again, I would recommend that:
   a. the session should last the same length of time. - 23%
   b. twice as much time should be allocated to the course material. - 31%
   c. three times as much time should be allocated to the course material. - 23%
   d. a great deal more time should be allocated to the course material. - 23%

3. If the course were given again, I would recommend that:
   a. more time be devoted to lecture than problem solving. - 21%
   b. more time be devoted to problem solving than lecture. - 64%
   c. the same amount of time be devoted to lecture and problem solving. - 15%

4. I felt that the instructor:
   a. spoke clearly and I had no trouble understanding him. - 29%
   b. spoke fairly well and I had only a little trouble understanding him. - 50%
   c. spoke in a manner which made it very difficult to understand. - 21%

a There were 14 respondents out of a class of 41 .

5. I found that the instructor:

   a. presented enough examples to aid problem solving or understanding the material. - 14%

   b. could have given more examples to aid problem solving and understanding the material. - 50%

   c. gave hardly any examples to illustrate the application of the subject material. - 36%

6. After reviewing the workbook and other prepared material, I feel that:

   a. the lecture followed the prepared material. - 28%

   b. the lecture made the prepared material easier to understand. - 28%

   c. the lecture did not follow the prepared material well. - 44%

7. After reviewing the session relative to my position as plant energy manager, I find that:

   a. I will have little use for the information presented. - 6%

   b. I will have some use for the information presented. - 36%

   c. I will have a great deal of use for the information presented. - 29%

   d. the subject material is very important to my position. - 29%

8. The weakness of the session is that the subject material will have limited use for me as a plant energy manager because :

   a. the plant equipment discussed does not exist at my plant. - 11%

   b. the plant equipment discussed does not consume a significant amount of energy at my plant. - 11%

   c. in my current position I do not have any authority to become involved with the equipment.

   d. my responsibilities in this area have not been defined. - 22%

   e. none of the above are applicable. - 56%

9. I would recommend that this course be given for others working in my plant that have responsibility for: (circle as many as are applicable)

   a. plant operation - 7

   b. plant maintenance - 7

   c. other (specify) Project Engineer, Maintenance Worker

   d. all of the above

   e. none of the above

ORGANIZATION FOR ENERGY PLANNING

PLANT ENERGY MANAGER WORKSHOP SURVEY
SURVEY RESULTS [a]

INSTRUCTOR K. Dockstader. COURSE SESSION # 16.0

The following are a series of multiple choice questions. Please circle the letter corresponding to the answer which you choose (example (a)).

1. I found this session to be:
   a. very interesting and informative. - 39%
   b. interesting and informative. - 46%
   c. not very interesting and informative. - 15%

2. If the course were given again, I would recommend that:
   a. the session should last the same length of time.- 33%
   b. twice as much time should be allocated to the course material.- 25%
   c. three times as much time should be allocated to the course material. - 17%
   d. a great deal more time should be allocated to the course material. - 25%

3. If the course were given again, I would recommend that:
   a. more time be devoted to lecture than problem solving. - 18%
   b. more time be devoted to problem solving than lecture. - 64%
   c. the same amount of time be devoted to lecture and problem solving. - 18%

4. I felt that the instructor:
   a. spoke clearly and I had no trouble understanding him. - 8%
   b. spoke fairly well and I had only a little trouble understanding him. - 50%
   c. spoke in a manner which made it very difficult to understand.- 42%

a There were 13 respondents out of a class of 41 .

5. I found that the instructor:

   a. presented enough examples to aid problem solving or understanding the material. - 8%

   b. could have given more examples to aid problem solving and understanding the material. - 46%

   c. gave hardly any examples to illustrate the application of the subject material.- 46%

6. After reviewing the workbook and other prepared material, I feel that:

   a. the lecture followed the prepared material. - 31%

   b. the lecture made the prepared material easier to understand. 23%

   c. the lecture did not follow the prepared material well. - 46%

7. After reviewing the session relative to my position as plant energy manager, I find that:

   a. I will have little use for the information presented. - 7%

   b. I will have some use for the information presented. - 31%

   c. I will have a great deal of use for the information presented. - 31%

   d. the subject material is very important to my position. - 31%

8. The weakness of the session is that the subject material will have limited use for me as a plant energy manager because :

   a. the plant equipment discussed does not exist at my plant.- 10%

   b. the plant equipment discussed does not consume a significant amount of energy at my plant. - 20%

   c. in my current position I do not have any authority to become involved with the equipment. - 20%

   d. my responsibilities in this area have not been defined.- 10%

   e. none of the above are applicable. - 40%

9. I would recommend that this course be given for others working in my plant that have responsibility for: (circle as many as are applicable)

   a. plant operation - 8

   b. plant maintenance - 7

   c. other (specify) Project Engineer, Maintenance Engineer

   d. all of the above

   e. none of the above

MODULE II - ENERGY CONSERVATION PROGRAM AND MANAGEMENT

Test on Sessions

4.0 U.S. Perspective on Industrial Energy Conservation Program

5.0 U.S. Perspective on Role of Industrial Plant Energy Manager

7.0 Energy Monitoring and Reporting (EMR) System Overview

Instructions

1. Please print your name on the first sheet of questions and on the answer sheet.
2. Place all of your answers on the answer sheet.
3. When you finish the test, turn in both the question sheets and the answer sheet.

Test Points

This test is made up of three parts:

Part I has 16 matching questions worth 2 points each

16 x 2 = 32 points

Part II has 12 multiple-choice questions worth 4 points each

12 x 4 = 48 points

Part III has 2 math problems worth 10 points each

2 x 10 = 20 points

Total Test = 100 points

PART I - Matching

_____
NAME

Instructions

For each item in column A, select the letter by the phrase in column B which best describes or relates to the column A item.

Note: Use each item in column B only once, and ten of them will not be used at all.

Column A	Column B
1. KW	A. refrigeration rate
2. KWH	B. fundamental EM requirement
3. Ton	C. falling back into old habits
4. Ton-hour	D. theoretical equipment BTU/unit of production
5. Orifice meter	E. difference between standard and actual consumption
6. Vortex meter	F. $/MM BTU electricity costs
7. Varience	G. energy audits
8. 2% rule	H. justifies use of an individual KWH meter
9. 80-20 rule	I. energy poster compaign
10. Total management commitment	J. can equal equipment costs
11. Monitor results	K. determined by digital tachometer
12. Energy standard	L. differential pressure drop
13. Software costs	M. electrical energy
14. Underloaded motors	N. refrigeration quantity
15. Utilities test program	O. flow past a bluff body
16. Motors 200 HP and larger	P. basic importance of metering
	Q. system BTU/unit of production
	R. electrical power
	S. determine utility equipment capability and efficiency
	T. first law of energy management
	U. $/MM BTU fuel costs
	V. energy management performance analysis
	W. inportance of attitude compared to technology
	X. plant energy coordinator
	Y. variable and fixed energy
	Z. energy management forecasting techniques

PART II - Multiple Choice

Instructions

For each question, select the one best answer.

17. Instantaneous power can be determined by timing the rotating disc of a KWH meter and using the formula:

a. $KW = (PK_h)(sec/rev)$

b. $KW = \frac{(PK_h)(sec/rev)}{3.6}$

c. $KW = \frac{3.6}{(PK_h)(sec/rev)}$

d. $KW = \frac{(PK_h)\ 3.6}{sec/rev}$

e. None of the above are correct.

18. Which of the following guidelines for utility equipment performance are true?

1. Centrifugal air compressors at 125 psig should consume 0.4 to 2.3 KWH/1000 scf.

2. Centrifugal chiller drives producing 45°F water should consume 0.6 to 1.0 KW/ton refrigeration rate.

a. Only No. 1 is true.

b. Only No. 2 is true.

c. Both No. 1 and No. 2 are true.

d. Neither No. 1 nor No. 2 are true.

PART II - Multiple Choice (continued)

Instructions

For each question, select the one best answer.

19. Which of the following guidelines for Δ P (pressure drop) across an air compressor inlet filter are true?

    1. New filters will typically have a ΔP of 1" to 2" water column.

    2. Filters should be changed or cleaned when the Δ P reaches 8" to 10" water column.

    a. Only No. 1 is true

    b. Only No. 2 is true

    c. Both No. 1 and No. 2 are true.

    d. Neither No. 1 nor No. 2 is true.

20. There are several basic tasks of any successful energy management program. Which of the following tasks are not correct?

    a. Maximize producer efficiency.

    b. Use energy in its most economical form.

    c. Maintain as low an energy load factor as possible.

    d. All of these tasks are correct.

    e. None of these tasks are correct.

PART II - Multiple Choice (continued)

21. Regarding the following 3 statements about KWH meters, which one answer is correct?

    1. The disc rotates under the influence of voltage and current coils.

    2. There are several incorrect ways, and only one correct way, to connect a KWH meter.

    3. Instantaneous power can be determined by reading the meter dials.

    a. Only No. 1 is false
    b. Only No. 2 is false
    c. Only No. 3 is false
    d. Both 1 and 2 are false
    e. All of the statements are false
    f. All of the statements are true.

22. Regarding the following 3 statements about orifice meters, which one answer is correct?

    1. The pressure drop across the orifice plate is proportional to the square of the velocity.

    2. A typical turndown ratio is 4:1

    3. One practical advantage of the orifice plate is that cost does not increase significantly with pipe size.

    a. Only No. 1 is false
    b. Only No. 2 is false
    c. Only No. 3 is false
    d. Both 1 and 3 are false.
    e. All of the statements are false
    f. All of the statements are true

PART II - Multiple Choice (continued)

23. Regarding the following 3 statements about vortex meters, which one answer is correct?

    1. A typical turn down ratio is 5:1.

    2. The frequency at which the vortices are shed is directly proportional to the flow velocity.

    3. Vortex meters offer the advantage of good metering accuracy with no moving parts.

    a. Only No. 1 is false.
    b. Only No. 2 is false.
    c. Only No. 3 is false.
    d. Both 1 and 2 are false.
    e. All of the statements are false.
    f. All of the statements are true.

24. Regarding the following 3 statements concerning a plot of BTU/VOP vs production rate, which one answer is correct?

    1. This plot does not account for the effect of production changes.

    2. The steeper the slope of the line the less the effect of overhead or fixed energy usage.

    3. The horizontal distance between performance lines determines the annual improvement.

    a. Only No. 1 is false.
    b. Only No. 2 is false
    c. Only No. 3 is false.
    d. Both 1 and 3 are false.
    e. All of the statements are false.
    f. All of the statements are true.

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PART II - Multiple Choice (continued)

25. Regarding the following 3 statements about refrigeration machines, which one answer is correct?

    1. Ton rate is equal to GPM times Δ t evap., all divided by 24.

    2. Lowering the cooling water temperature will usually increase the KW/ton power usage of the chiller drive.

    3. Flow rate can be approximated by measuring the Δ P across the evaporator and comparing to the flow/pressure curve for that machine.

    a. Only No. 1 is false.
    b. Only No. 2 is false.
    c. Only No. 3 is false.
    d. Both 2 and 3 are false.
    e. All of the statements are false.
    f. All of the statements are true.

26. Regarding the following 3 statements about steam boilers, which one answer is correct?

    1. One method of calculating boiler efficiency involves stack gas temperature and % oxygen.

    2. Profile readings should be used to accurately determine stack gas temperatures.

    3. Reducing blowdown to a minimum level can improve boiler effiency.

    a. Only No. 1 is false
    b. Only No. 2 is false.
    c. Only No. 3 is false.
    d. Both 1 and 3 are false.
    e. All of the statements are false.
    f. All of the statements are true.

PART II - Multiple Choice (continued)

27. Regarding the following 3 statements about induction motors, which one answer is correct?

    1. Power factor and efficiency fall off with decreasing load.

    2. At no output load, shaft RPM is close to but never equals synchronous RPM.

    3. Induction motors may be wound with any number of poles.

    a. Only No. 1 is false
    b. Only No. 2 is false
    c. Only No. 3 is false.
    d. Both 2 and 3 are false.
    e. All of the statements are false.
    f. All of the statements are true.

28. Regarding the following 3 statements about centrifugal air compressors, which one answer is correct?

    1. Increased Δ P across the inlet filter has little effect on KW/1000 scf values.

    2. Typical turn down ratio values are 2:1 to 4:1 before surging occurs.

    3. Intercooler water temperatures should be kept as low as possible to minimize KW/1000 scf values.

    a. Only No. 1 is false.
    b. Only No. 2 is false.
    c. Only No. 3 is false.
    d. Both 1 and 2 are false.
    e. All of the statements are false.
    f. All of the statements are true.

PART III - Math Problems

29. A 25 HP four pole induction motor operating at 480 volts, 60 Hz power has a nameplate full load speed of 1750 RPM. The shaft speed under a particular load is measured by a digital tachometer and found to be 1755 RPM.

    a. What is the synchronous speed in RPM?

    b. What is the full load slip speed in RPM?

    c. What is the HP load on the motor?

Note: Show all work below and put answers on answer sheet.

PART III - Math Problems (continued)

30. A main KWH meter on the 480 volt secondary side of a 2000 KVA transformer has the following data:

Reading at 8 AM on day one.....6789

Reading at 8 AM on day thirty.....7890

Meter multiplier.....1000

K_h value.....1.2

Current transformer ratio.....3000/5

Potential transformer ratio.....480/120

Time for one disc revolution.....6 seconds

a. What was the average KW power level over the 30-day period?

b. What was the instantaneous KW power rate during the 6-second timing interval?

c. Assuming the peak power rate was 1,800 KW, what was the average load factor over the thirty days?

Note: Show all work below and put answers on answer sheet.

ORGANIZATION FOR ENERGY PLANNING

PLANT ENERGY MANAGER WORKSHOP

MAY 19 - 24 , 1984

MODULE 3 - TECHNICAL SESSIONS

Test on Sessions

8 .0 Improving Combusion System Efficiency

9 .0 Boiler/ Steam System Efficiency

10.0 Waste Heat Recovery

Instructions

* You have been given three documents : (1) Questions, (2) Math Problem Solution Form and (3)Answer Sheet.

  Please place your name in English on the indicated line on the first page of each document .

* Perform detailed calculations required to answer math problem on the " Math Problem Solution Form". These calculations will be used to determine partial credit in case you incorrectly answer .

* When you finish turn in all three documents .

Test Points

This test is made up of two parts :

Part I has 18 correct answers each counting four points. Note four points will be deducted for each incorrectly marked answer.

18 x 4 = 72 points

Part II has 7 problems each counting four points. Each part of a problem is counted equally.

7 x 4 = 28 points

Total Test = 100 points

PART I - Check the correct answers

NAME

1. The purpose of mud blowdown is to:

   a. control total dissolved solids
   b. remove material that has settled from the boiler

2. To determine combusion efficiency, one should measure :

   a. oxygen
   b. sulfur dioxide
   c. nitrogen
   d. stack temperature

3. An oversized boiler reduces efficiency compared to a similar, correctly-sized boiler by :

   a. having higher radiation loss
   b. having lower combusion efficiency
   c. having a higher stack temperature

4. Smoke from an oil fired boiler can be caused by :

   a. improper oil temperature
   b. improper oil pressure
   c. more air than required

5. Exhaust gas temperature of a boiler can rise because :

   a. heat transfer surfaces are fouled
   b. load increases
   c. excess air increases

6. The purpose of adding sodium sulfite to feedwater is :

   a. to remove total dissolved solids
   b. to control alkalinity
   c. to remove dissolved oxygen

PART I - Check the correct answers (continued)

7. The purpose of a high-pressure condensate return system is to :

   a. help get condensate back faster
   b. reduce vent loss
   c. improve water quality of condensate

8. The best location for a boiler air intake duct is :

   a. near the boiler room ceiling
   b. on the boiler room floor
   c. outside of the boiler room

9. A boiler cycles on and off. This effect can be reduced by:

   a. increasing boiler pressure
   b. increasing the differential pressure setting
   c. replacing the burner with a smaller one
   d. cutting back on the maximum firing rate of the existing boiler

10. The low water cutoff should be checked by

   a. draining the low water cutoff " leg"
   b. shutting off feedwater

ANSWER SHEET

_____
NAME

Check off correct answers

PART I

1. a. _____
   b. _____

2. a. _____
   b. _____
   c. _____
   d. _____

3. a. _____
   b. _____
   c. _____

4. a. _____
   b. _____
   c. _____

5. a. _____
   b. _____
   c. _____

6. a. _____
   b. _____
   c. _____

7. a. _____
   b. _____
   c. _____

8. a. _____
   b. _____
   c. _____

9. a. _____
   b. _____
   c. _____
   d. _____

10. a. _____
    b. _____

ORGANIZATION FOR ENERGY PLANNING

PLANT ENERGY MANAGER WORKSHOP

MAY 19 - 24 , 1984

MODULE 3 - TECHNICAL SESSIONS

Test on Sessions

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* Perform detailed calculations required to answer math problem on the " Math Problem Solution Form". These calculations will be used to determine partial credit in case you incorrectly answer .

* When you finish turn in all three documents .

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Part I has 18 correct answers each counting four points. Note four points will be deducted for each incorrectly marked answer.

18 x 4 = 72 points

Part II has 7 problems each counting four points. Each part of a problem is counted equally.

7 x 4 = 28 points

Total Test = 100 points

PART II - Math Problems

1. A boiler fired on heavy oil (#6) has a stack temperature of 450°F (232°C), combustion air temperature of 80°F (26.6 °C) and O_2 reading of 9 % . No smoke is observed in flue gas. Determine

   a. % CO_2 in flue gas

   b. combustion efficiency,

2. If the level of O_2 in the boiler (of prob.1) were dropped to 3% without causing smoke, what would be the new combustion efficiency ?

3. If the boiler of problem 1 had a full load radiation loss of 2 % and was operating at 33% of capacity, what would be its boiler efficiency if radiation is neglected ?

4. List the recommended water quality residuals ranges for a saturated steam boiler operating at 10 bar pressure .

Feed water	Boiler Water	Condensate
hardness _____ ppm	sulfite _____ ppm	ph _____
	phosphate _____ ppm	
	Total Dissolved Solids	_____ ppm
	Alkalinity _____ ppm	

5. If an economizer were added to the boiler of problem 1, which dropped stack temperature to 300 °F (149 °C), what would be the percent reduction in fuel used ?

6. For the boiler of problem 1, how many Kg/hr of oil is required to produce 22,000 lb/hr (10,000 Kg/hr) of steam?

   Assume for this problem that the boiler efficiency is 4 percentage points less than combustion efficiency. Assume that feedwater enters the boiler at 100 °C and steam leaves as saturated vapor at 100 °C

PART II - Math Problems (continued)

7. A vent condenser is added to an atmospheric condensate receiver which is venting 40 Kg/hr (88 lbm/hr) of steam at atmospheric pressure . The vent condenser is cooled by feedwater entering at 77 °F (25 °C) at a rate of 100 Kg/hr (22 lbm/hr). What is the exit temperature of the feedwater?

MATH PROBLEM SOLUTION

NAME

PART II

1.

MATH PROBLEM SOLUTION

_____
NAME

4. Feedwater

hardness _____ppm

Boiler Water

sulfite _____ppm

phosphate _____ppm

Total Dissolved Solids _____ppm

Alkalinity _____ppm

Condensate

ph _____

5.

ANSWER SHEET

_____
NAME

PART II

1. a. _____ %

   b. _____ %

2. _____ %

3. _____ %

4. Feedwater hardness _____ ppm

   Boiler water sulfite _____ ppm

   Boiler water phosphate _____ ppm

   Boiler water Total Dissolved Solids _____ ppm

   Alkalinity _____ ppm

   Condensate _____ ph

5. _____ %

6. _____ Kg/hr

7. _____ °C

ORGANIZATION FOR ENERGY PLANNING

PLANT ENERGY MANAGER WORKSHOP

MAY 19 - 31 , 1984

MODULE 3 - TECHNICAL SESSIONS

Test on Sessions

13.0 Process Design for Energy Conservation

14.0 Practical Project Economic Evaluation

Instructions

* Your have been given two documents : (1) Questions and Math Problem Solution Forms (2) Answer Sheet .

  Please place your name in English on the indicated line on the first page of each document.

* Perform detailed calculations required to answer math problem on the same page that the question appears. These calculations will be used to determine partial credit in case you incorrectly answer .

* When you finish turn in both documents .

Test Points

This test is made up of three parts :

Part I a matching test has 6 correct answers each counting two points.

6 x 2 = 12 points

Part II has 8 problems with 17 correct answers each counting two points . Two points will be deducted for each incorrect answer. Do not guess !

17 x 2 = 34 points

Part III has two math problems. Please work out problems on the same sheet problem is given as partial credit will be given. There are 7 correct answers in Part three and all have 8 points credit except problem 16.c which has 6 points credit .

6 x 8 = 48 points

1 x 6 = 6 points

Total Test =100 points

PART I - Matching Test

NAME

Match optimum approach (ΔT - °C) with process condition :

In a waste heat boiler :

Process Condition	(T - °C)
1. Water	a.) 1
2. Air (Atmos. Press.)	b.) 2
	c.) 7
3. Oil (Scentistokes)	d.) 30
	e.) 35

In a feed - effluent exchanger:

4. Water	f.) .5A
	g.) A
5. Air	h.) 2A
	i.) 4A
6. Oil	j.) 8A

Note the following equation for A is :

$$A = (T_{HOT_{IN}} - T_{COLD_{IN}})^{0.5}$$

PART II - Multiple Choice

NAME

Check (x) correct answer or answers on answer sheet. There may be more than one correct answer for each question.

7. ROI is :

a. return on investment
b. well defined
c. easy to calculate
d. can be used as a measure of performance
e. easily understood

8. IRR is :

a. well defined
b. can be used as a measure of performance
c. easy to calculate
d. internal rate of return
e. easily understood

9. Capital is :

a. cost of items with short useful lives
b. cost of items with long useful lives
c. cost of doing business
d. deducted from revenue as spent
e. value for i where NPV = 0

10. Expense is :

a. cost of items with long useful lives
b. deducted from revenue as spent
c. cost of doing business
d. includes cost of energy
e. includes cost of equipment

PART II - Multiple Choice (continued)

11. The preferred factor for judging energy savings is :

a. change in enthalpy
b. equivalent work content
c. none of the above

12. Ratio of annualized cost of power to annualized cost of surface (in a heat exchanger) at the optimum is :

a. 0.1
b. 0.3
c. 0.5
d. 0.7
e. 0.9

13. Optimum tube-side velocity (in a heat exchanger) is :

a. 0.5 m/ Sec.
b. 1 m/ Sec.
c. 1.5 m/ Sec.
d. 2m / Sec.
e. 2.5m/ Sec.
f. 3m/Sec.

(m = Meters)

14. The optimum ΔP for liquids in heat exchangers is :

a. higher than the optimum ΔP for gases
b. lower than the optimum ΔP for gases
c. same as the optimum ΔP for gases

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PART III - Math Problems

NAME

15. The following data is available for a new industrial operation:

Operating Rate = 20 k tonnes / yr.
Selling Price of Product = 0.8 L.E/ kg.
Capital Investment = 20 m L.E
Manufacturing Cost = 0.45 L.E / kg.

(Note: k = 1,000 or 10^3 ; m = 1,000,000 or 10^6)

Compute :

a. annual revenue (L.E/yr)
b. annual cost (L.E/yr)
c. profit (L.E/yr)
d. ROI (Return on Investment - before taxes) as %

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PART III - Math Problems (continued)

6. You must determine whether an electric motor or a steam turbine system is the most economic (ie, least expensive system) for your plant based on the following data:

Energy Required = 1500 HP

Steam Turbine Efficiency = 60 %

Electric Motor Efficiency = 90 %

Investment Equivalent of Steam = 200 L.E/ kBtu/hr

Investment Equivalent of Electric Power = 1000 L.E/ Kw

Installed Cost of a 1500 H.P Steam Turbine = 100,000 L.E

Installed Cost of a 1500 HP Electric Motor = 50,000 L.E

(Note: 1 HP = 2546 Btu/hr ; 1HP = 0.746 Kw)

Compute the following :

a. total cost of turbine (k.L.E)

b. total cost of motor (k.L.E)

c. energy system chosen

ANSWER SHEET

NAME _____

PART I
MATCHING - Place letter in blank

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

PART II
MULTIPLE CHOICE-Mark x for correct answer (s)

7.a. _____
b. _____
c. _____
d. _____
e. _____

8.a. _____
b. _____
c. _____
d. _____
e. _____

9.a. _____
b. _____
c. _____
d. _____
e. _____

10.a. _____
b. _____
c. _____
d. _____
e. _____

11.a. _____
b. _____
c. _____

12.a. _____
b. _____
c. _____
d. _____
e. _____

13.a. _____
b. _____
c. _____
d. _____
e. _____
f. _____

14.a. _____
b. _____
c. _____

PART III - MATH PROBLEMS

15. a. _____ (L.E/yr)
b. _____ (L.E/yr)
c. _____ (L.E/yr)
d. _____ (L.E/yr)

16.a. _____ (k.L.E)
b. _____ (k.L.E)
c. _____

ORGANIZATION FOR ENERGY PLANNING

PLANT ENERGY MANAGER WORKSHOP

MAY 19 - 31, 1984

MODULE 3 - TECHNICAL SESSIONS

Test on Sessions

15.0 Pump Technology

Instructions

* You have been given two documents : (1) Questions and Math Problem Solution Forms (2) Answer Sheet

  Please place your name in English on the indicated line of the first page of each documents .

* Perform detailed calculations required to answer math problem on the same page that the question appears. These calculations will be used to determine partial credit in case you incorrectly answer .

* When you finish turn in both documents .

Test Points

This test is made up of three parts :

Part I a true or false test has 5 problems with 28 correct answers each counting one point .

28 x 1 = 28 points

Part II is a multiple choice test and has six problems and six correct answers each counting two points :

Credit will be assigned as follows :

6 x 2 = 12 points

Part III is a math problem test with 3 problems and 15 correct answers each counting four points

15 x 4 = 60 points

Total Test = 100 points

PART I - True or False Questions

NAME

1. In general what precautions would you take when preparing to install a mechanical seal in a centrifugal pump ? From a to f below indicate true or false .

   a. All pump parts should be clean, especially the bore of the stuffing box, the face of the stuffing box, the shaft or the shaft sleeve surfaces, etc.

   b. The face of the stuffing box should be free of any burrs

   c. All seal parts should be clean and visually checked for defects.

   d. The stationary and rotating seal faces should be checked in flatness using a mono chromatic light .

   e. When installed the face of the stationary seal must be square with the shaft axis, using a dial indicator calibrated in 0.0001 in. or equivalent .

   f. The springs of the rotating member must be fully compressed.

2. What should be considered when designing a pump installation in order to achieve minimum energy consumption ?

   In (a) to (g) indicate true or false .

   a. Will the pump in the system, operate at constant capacity and constant head or over a broad range of head and capacity ?

   b. The pump should be designed with at least 20% excess capacity at the rated head .

   c. Design the system to minimize pump requirements in terms of head, capacity and horsepower .

   d. Operate the pump with throttled discharge rather than on by-pass control or stop-start operation .

   e. Reduce pipe friction loss by using low-pressure-drop valves and minimum number of fittings .

   f. For boiler feed pump operation, for example provide a control valve in the minimum flow by-pass line .

   g. Refer to R.E Dolman article " Twenty techniques for saving energy in pumping operations ".

PART I - True or False Questions (continued)

3. Indicate whether the following affinity laws are true or false .

a. $$\frac{Q_1}{Q_2} = \frac{RPM_1}{RPM_2}$$

b. $$\frac{H_1}{H_2} = \frac{(RPM_1)^2}{(RPM_2)^2}$$

c. $$\frac{BHP_1}{BHP_2} = \left(\frac{RPM_1}{RPM_2}\right)^3$$

d. $$\frac{Q_1}{Q} = \frac{D_2}{D_1}$$

e. $$\frac{H_1}{H_2} = \frac{D_1^2}{D_2^2}$$

f. $$\frac{BHP_1}{BHP_2} = \frac{D_2^3}{D_1^3}$$

PART I - True of False Questions (continued)

4. Consider the following statements

   a. One ft^3 of water at 14.7 PSIG pressure and 60°F is equal to 7.48 gallons

   b. One gallon of water at 14.7 PSIG and 60°F weighs 8.33 LBS.

   c. Water at 14.7 PSIA and 60°F weighs 62.4 LBS.

   d. The pressure exerted equally in all directions at the bottom of a 34 ft. vertical column of water is 14.7 PSIG .

   e. One horsepower is equal to 33,000 ft LBS per minute .

   f. One horsepower is equal to 0.746 KW.

   Indicate which of the above if any, is true, which, if any, is false .

5. Are the following statements true or false ?

   a. $NPSH_r$ is a function of the pump design

   b. $NPSH_a$ is a function of the system in which a pump is installed

   c. Both $NPSH_r$ and $NPSH_a$ vary with flow rate

PART II - Multiple Choice

NAME

1. A system requires a flow of 500 gpm. The system head at this capacity is 100 ft. A tentative pump selcation for these conditions requires 10 ft. $NPSH_R$. However, at the 500 gpm flow rate the system available $NPSH_A$ is only 6 ft. What do you do ?

   a. Select a pump of higher rotative speed .

   b. Select a pump of lower rotative speed .

   c. Modify the system to provide additional $NPSH_A$:

2. Which of the following statements, as they apply to centrifugal pump operation is true

   a. The whp is always greater than the bhp

   b. The whp is always less than the bhp

3. In a pipeline where liquid is flowing, the friction loss varies :

   a. Directly as the velocity

   b. As the square of the velocity

   c. As the velocity cubed

4. At any part in a pipeline where liquid is flowing, the total head is made up of static head plus velocity head .

   a. True

   b. False

PART II - Multiple Choice (continued)

5. The total dynamic head (TDH) of a centrifugal pump is the summation of the static head and the velocity head at the discharge flange less the summation of the static head and the velocity head at the suction flange, all corrected to the centerline of the pump

   a. True

   b. False

6. In order for a centrifugal pump to operate at any fixed capacity,

   a. the $NPSH_r$ must equal the $NPSH_a$

   b. the $NPSH_r$ must exceed the $NPSH_a$

PART III - Math Problems

_____
NAME

1. Provide the metric equivalent

a. 500 gpm _____ m^3/s

b. 100 ft. _____ m

c. 10 ft./sec. _____ m/s

d. 32.17 ft./sec.^{2} _____ m/s^2

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PART III - Math Problems (continued)

2. A centrifugal pump delivers 500 gpm capacity at 100 ft. total dynamic head (TDH) at its best efficiency point (BEP) when operating at 1750 rpm .

   a. What will be the capacity (gpm) and TDH (ft.), at its BEP, when operating at 1450 rpm ?

   b. What will be the capacity (gpm) and TDH (ft.) at its BEP, when operating at 2950 rpm ?

   c. What is the pump specific speed

      1- When operating at 1750 rpm ?

      2- When operating at 1450 rpm ?

      3- When operating at 2950 rpm ?

PART III - Math Problems (continued)

3. A pump with a 13-1/2" diameter impeller running at 1760 rpm delivers 2500 gpm of water against a total dynamic head of 150 ft. with an efficiency of 81 % .

   a. What is the brake horsepower consumed ?

   b. What would be the capacity (gpm), head (ft.) and BHP if the impeller diameter is reduced to 13", and the pump speed increased to 1800 rpm .

PUMP TECHNOLOGY
ANSWER SHEET

_____
NAME

PART I - True or False Questions

Place a T (True) or F (False) in the blank space

1.a. _____
b. _____
c. _____
d. _____
e. _____
f. _____

2.a. _____
b. _____
c. _____
d. _____
e. _____
f. _____
g. _____

3.a. _____
b. _____
c. _____
d. _____
e. _____
f. _____

4.a. _____
b. _____
c. _____
d. _____
e. _____
f. _____

5.a. _____
b. _____
c. _____

PART II - Multiple Choice

Check (x) the correct answe

1.a. _____
b. _____
c. _____

2.a. _____
b. _____

3.a. _____
b. _____
c. _____

4.a. _____
b. _____

5.a. _____
b. _____

6.a. _____
b. _____

PART III - MATH PROBLEMS

1.a. _____ m^3/s
b. _____ m
c. _____ m/s
d. _____ m/s^2

2.a. _____ gpm
_____ ft.
b. _____ gpm
_____ ft.
c.1. _____ rpm
2. _____ rpm
3. _____ rpm

3.a. _____
b. _____ gpm
_____ ft.
_____ BHP

ORGANIZATION FOR ENERGY PLANNING

PLANT ENERGY MANAGER WOEKSHOP

May 19 - 31, 1984

MODULE 3 - TECHNICAL SESSIONS

Test on Sessions

16.0 Compressor Technology

Instructions

* You have been given two documents : (1) Questions and Math Problem Solution Forms (2) Answer Sheet .

  Please place your name in English on the indicated line on the first page of each document .

* Perform detailed calculations required to answer math problem on the same page that the question appears. These calculations will be used to determine partial credit in case you incorrectly answer .

* When you finish turn in both documents .

Test Points

This test is made up of three parts :

Part I a matching test has 16 correct answers each counting two points

16 x 2 = 32 points

Part II has two math problems. Please work out problems on the same sheet problem is given as partial credit will be given .

Credit is assigned as follows :

Problem No. 1 has four parts each with 4 points credit

4 x 4 = 16 points

Problem No. 2 has five parts each with 6 points credit

5 x 6 = 30 points

Part III has two multiple choice problems

Problem No. 1 has 11 points credit

1 x 11 =11 points

Problem No. 2 has 11 points credit

1 x 11 =11 points

Total Test =100 points

PART I - Matching Test

NAME

1. Match items in column B with items in column A. Note there are 5 wrong or extra answers in column B .

1. Centrifugal compressor
2. Shaft horsepower
3. Clearance pocket
4. Isothermal compression
5. Cylinder liner
6. Reciprocating compressor
7. Polytropic compression
8. Liquid injection
9. Non-lube construction
10. Oil seals require a
11. Rod packing
12. Gas leakage seals
13. Adiabatic compression
14. Piston rings
15. Tilting pad
16. Sub-syncronous

A. Inducer vanes
B. Shaft bearings
C. No heat lost or gained in compression
D. Positive displacement compressor
E. Seal oil system
F. Oil whirl vibration
G. Seal leakage along the cylinder bore
H. Flywheel
I. Dynamic compressor
J. Diffuser
K. Compressor volumetric control
L. Labyrinth seals
M. Gas horsepower plus bearing and seal horsepower
N. Carbon or TFE rings
O. Liquid ring compressor
P. Replacable cylinder bore
Q. Constant temperature compression
R. Piston rod gas seal
S. Has a higher discharge temperature than adiabatic compression
T. Water jacket
U. Impeller vanes

PART II - Math Problems

NAME

1. For the following gas composition, determine

   a. the molecular weight (m) of the gas mixture

   b. the density of the mixture (or specific gravity relative to dry air)

   c. the specific heats, c_p and c_v

   d. the ratio $(k-1)/k$ (For use with $[(p_2/p_1)^{\frac{k-1}{k}}-1]$)

Gas Composition for above: Volumetric 15% CO_2; 4% O_2; 81% N_2

Gas	Vol. Fraction	Mol Wt.	c_p *	c_p **
CO_2	0.15	44	0.203	0.8191
O_2	0.04	32	0.217	0.9166
N_2	0.81	28	0.244	1.0393

* U. S. Customary Units, Btu/lbm·°R

** S I Units Kilojoules/kilogram·kelvin

PART II - Math Problems -

Problem (1) - (continued)

2. The gas in problem No.1 is to be compressed in a three (3) stage compressor from an inlet pressure of 14.5 psia (99.97 KPa) and 85 ^{o}F (29.4 ^{o}C) to a discharge pressure of 125 psia (861.85 KPa). The inlet volume is 1500 CFM (0.7079 m^3/s).

   a. Determine the adiabatic discharge temperature of each stage with intercooling to 85 ^{o}F (29.4 ^{o}C) between each stage and a 1.5 psi (10.34 KPa) pressure loss through each intercooler and piping.

      Note: Divide the work equally between the stages. That is; take the cube root of the overall pressure ratio including the interstage pressure loss:-

$$p_2/p_1 \text{ per stage} = \left(\frac{125+3}{14.5}\right)^{1/3}$$

   b. Assume the compressor is a centrifugal compressor with each stage having a polytropic efficiency of 75%. All other data as before.

      1. Calculate the polytropic head per stage
      2. Calculate the polytropic discharge temperature of each stage
      3. Calculate the gas horsepower (kw) per stage
      4. Calculate the overall brake horsepower (kw) assuming the compressor has 5% mechanical losses

PART II - Math Problems

Problem (2) - (continued)

PART III - Multiple Choice

NAME

1. An auxiliary lube oil system for a single line compressor train should include which of the following:-

   a. a single lube oil pump

   b. a main and auxiliary lube oil pump

   c. instrumentation to automatically start the auxiliary oil pump when the lube oil pressure drops below a predetermined low oil pressure.

   d. instrumentation to shut down the main compressor train when the lube oil pressure drops below a predetermined low low oil pressure

2. A centrifugal compressor operates in a stable manner only when the volume throughput is greater than the suge volume.

   a. The required volume can be maintained automatically.

   b. Instrumentation must be incorporated to automatically maintain no less than the minimum flow volume.

   c. The minimum flow volume is always maintained by opening a by-pass.

   d. The minimum flow volume is always maintained by venting to the atmosphere.

Compressor Technology

Answer Sheet

_____

NAME

PART I - Matching Test

Place letter corresponding to correct statement in blank space

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____
15. _____
16. _____

PART II - Math Problems

1.
   a. _____
   b. _____
   c. _____
   d. _____

2.
   a. _____
   b. _____
      1. _____
      2. _____
      3. _____
      4. _____

PART III - Multiple Choice

1.
   a. _____
   b. _____
   c. _____
   d. _____

2.
   a. _____
   b. _____
   c. _____
   d. _____

APPENDIX B

ORGANIZATION FOR ENERGY PLANNING

INDUSTRIAL ENERGY CONSERVATION PROJECT

Application For Participation

Company Name : _____

Address : _____

Telephone : _____

Person to be Contacted : _____

Nature of Company's Business : _____

Products : _____

Production Quantity : _____ , for year 198 ____

1. Please describe briefly the type of processes used :

2. Please specify approximately the annual quantity of energy used :

LPG _____ Mazout _____

Gasoline _____ Electricity _____

Kerosene _____ Other (specify) _____

Data are for year 198 ___

3. Please indicate the energy-using equipment you have (Indicate number) :

Boilers _____

Furnaces _____

Kilns _____

Ovens _____

Electricity Generators _____

Heavy electrical machinery _____

Other (specify) _____

_____

_____

Do you consider your equipment to be : New _____ Moderately aged ____ Old _____

4. Have you already undertaken any energy conservation studies or have you implemented any energy conservation measures ?

Please describe :

5. What do you consider to be your biggest energy problem now ?

EQUIPMENT DATA FORM

NAME OF COMPANY PRODUCTIVE UNIT : DEPARTMENT

				Feed Energy					Produced Energy						Equipment Performance			Date & Specifications		
					Specifications							Rate of Production / hour				Stopage Average /1000 operating hour				
Name and Type	Quantity	Manufacturer	Year of Manu.	Rate of Feed Consumption/ hour	Fuel	Steam	Elec. Current	Pressed Air	Steam	Elec. Current	Pressed Air				Actual Operating Hours / day			Measuring Equipments	Control Equipments	Other Additions
					Kind Pressure Temperature	Pressure Temperature	Volt Amp.	Pressure	Pressure Temperature	Volt Amp.	Pressure	Acc. to Factory guarantee	Actual	Efficiency %		Sudden Stopage %	Periodical Stopage %			

Responsible Manager (Name) : Date :

Position :

Signature

Remarks :

1- Mention units used for the data

2- In (other additions) field; mention reasons of the waster in feed energy and produced energy, if any

Also specifications of supplemental related equipments with respect to energy waste etc.

3- Complete data in other page if necessary

NAME: ROBERT J. LARSON

CURRENT TITLE: Senior Engineering Evaluations Consultant
Corporate Research Laboratories

PRIMARY SPECIALITIES: Economic Evaluations
Chemical Process Design
Distillation
Heat Transfer
Energy Conservation

EDUCATION:

DEGREE(S)	DISCIPLINE	SCHOOL	YEAR
B.S.Ch.E.	Chemical Engineering	Northwestern Univ.	1947

SYNOPSIS OF CAREER:

1982-Present: Senior Engineering Evaluations Consultant engaged in evaluation of current research projects and planning of future research activities and directions.

1981-1982: Engineering Specialist, consulting and problem-solving throughout the company in the areas of Economic Evaluations, Heat Transfer, and Distillation.

1978-1981: Engineering Specialist, engaged in development and introduction of data acquisition, correlation, and presentation techniques and cost engineering methods.

1976-1978: Engineering Superintendent, supervising a group engaged in development of cost engineering and project monitoring techniques.

1970-1976: Engineering Superintendent, supervising a group of engineers engaged in chemical process design and economic analysis activities for a wide variety of clients.

1966-1970: Engineering specialist, process design and economic evaluation for chemical intermediates, polymerization, and chemical fiber manufacturing processes.

1964-1966: Development Manager, directing development of a new system for manufacture of a chemical stretch-fiber.

1962-1964: Plant Manager, directing process development, and plant construction and operation for manufacture of a new chemical fiber.

1960-1962: Senior Design Engineer, engaged in process design for chemical intermediates, polymer, and chemical fiber manufacturing processes.

ROBERT J. LARSON (Con't.)

1956-1960:	Plant Technical Superintendent, supervising a group of engineers engaged in plant process trouble-shooting, product improvement, and start-up of new operating units.
1952-1956:	Plant Manufacturing Superintendent, directing engineers and operators in the operation of a plant unit manufacturing polymer precursors for chemical fibers.
1950-1952:	Process Development Supervisor, supervising the operation of a small scale production unit for the development of polymerization processes and production of "semi-works" quantities of new polymers.
1947-1950:	Research Engineer engaged in "bench-scale" and pilot plant development of processes for chemical intermediates and polymers.

Teaches Project Financial Analysis within his company, in Continuing Education courses for the American Institute of Chemical Engineers, and at the graduate and undergraduate level in universities.

Lectures extensively on Project Economic Analysis, alternate identification and assessment, and energy conservation at technical seminars and professional society meetings.

RESUME
Revised - November 1979

DAVID FAIRFIELD DYER

Professor, Department of Mechanical Engineering
School of Engineering
Auburn University
Auburn, Alabama 36830

Date and Place of Birth . . . . . [redacted]

Marital Status . . . . . Married, 3 children

EDUCATIONAL BACKGROUND

NSF Postdoctoral Study, Imperial College, University of London, 1966-67

Ph.D., Mechanical Engineering, Georgia Institute of Technology, 1965

M.S.M.E., Mechanical Engineering, Georgia Institute of Technology, 1964

B.S.M.E., Mechanical Engineering, University of Tennessee, 1962

ACADEMIC EXPERIENCE

Undergraduate Teaching Aid, Department of Mechanical Engineering, University of Tennessee, 1961-1962.

Teaching Assistant, School of Mechanical Engineering, Georgia Institute of Technology, 1963-1965.

Research Assistant, School of Mechanical Engineering, Georgia Institute of Technology, 1964-1965.

Assistant Professor, Department of Mechanical Engineering, Auburn University, 1965-1969 (on leave June 1966-August 1967).

Associate Professor, Department of Mechanical Engineering, Auburn University, 1969-1977 (on leave August 1972-December 1973).

Professor, Department of Mechanical Engineering, Auburn University, 1977-present.

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INDUSTRIAL - GOVERNMENT EXPERIENCE

Co-op Engineer, ARO, Incorporated, Arnold Air Force Station, Tennessee, alternate quarters, 1958-1961.

Thermal Design Engineer, ARO, Incorporated, Arnold Air Force Station, Tennessee, Summers 1962-1963.

Research Engineer, ARO, Incorporated, Arnold Air Force Station, Tennessee, Summer 1967.

Liaision Scientist, Office of Naval Research, London, August 1972-December 1973.

Project Engineer, FMTS, Incorporated, London, Summer 1974.

ADMINISTRATIVE EXPERIENCE

Project and Co-Project Leader on Industrial and Governmental Supported Research Projects Exceeding $3,000,000 in value over last ten years.

Director, Alabama Energy Extension Service, 1977-1979.

EXTENSION EXPERIENCE

Development and Presentation of Courses

"Recent Advances in Calculation of Separated Flows", Auburn University Engineering Extension, Auburn, May 1968.

"Industrial Energy Conservation", Auburn University Engineering Extension, Birmingham, February 1974.

"Industrial Energy Conservation", Louisiana State University Engineering Extension, Baton Rouge, Louisiana, March 1974.

"Industrial Energy Conservation for Managers", Auburn University Engineering Extension, Birmingham, September 1974.

"Industrial Energy Conservation", Wisconsin University Engineering Extension, Madison, Wisconsin, October 1974.

"Energy Systems", NASA/Huntsville, Alabama, January 1975.

"Boiler Efficiency Improvement", Sponsored by the Federal Energy Administration, Presented at six locations in the State of Alabama, June, July, August 1975.

"Energy Conservation for Industrial Plants and Facilities", Auburn University Engineering Extension, Birmingham, Alabama, October 1975.

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"Boiler Efficiency Improvement Seminar", Auburn University Engineering Extension Service, Rock Hill, South Carolina, December 10-11, 1975.

"Analysis of Power Plant Cooling Systems", Auburn University Engineering Extension Service, Auburn, Alabama, February 16-19, 1976.

"Improving Boiler Efficiency", North Carolina State University, Industrial Extension Service, Raleigh, N.C., March 25-26, 1976.

"Energy Systems", Auburn University Engineering Extension Service, Birmingham Office, NASA/Huntsville, Huntsville, Alabama, March 16-17, 1976.

"Boiler Efficiency Improvement Seminar", Auburn University Engineering Extension Service, Rockhill, S.C., September 15-16, 1976.

"Energy Conservation in Industrial Plants and Facilities", Auburn University Engineering Extension Service, Birmingham Office, October 19-20, 1976.

"Boiler Efficiency Improvement", Auburn University Engineering Extension Service, Huntsville, Alabama, January 12-13, 1977.

"Improving the Efficiency and Safety of Boilers and Systems Using Steam", Auburn University Engineering Extension Service for West Point Pepperell, August 1977.

"Energy Conservation, Industrial Plants and Facilities", Auburn University Engineering Extension Service, Mobile, Alabama, August 15-16, 1977.

"Boiler Certification", Auburn University Engineering Extension, Huntsville, Alabama, for the U.S. Army, Two 40-hour Short Courses, March-August 1977.

"Industrial Plant Boilers - Measuring and Improving Efficiency", Cleveland Engineering Society, Cleveland, Ohio, August 15-16, 1977.

"Energy Conservation for Industrial Plants and Facilities", Auburn University Engineering Extension Service, Birmingham, Alabama, October 12-13, 1977.

"Industrial Plant Boilers - Measuring and Improving Efficiency", University of Wisconsin Engineering Extension, Madison, Wisconsin, March 28-29, 1977; March 30-31, 1977; June 13-14, 1977; September 7-8, 1977; September 9-10, 1977; November 21-22, 1977; November 10-11, 1979.

"Boiler Efficiency Improvement", Auburn University Engineering Extension Service and Alabama Development Office Energy Management Board, Auburn, Alabama, December 8-10, 1977, Dothan, Alabama; January 10-12, 1978, Huntsville, Alabama; January 17-19, 1978, Auburn, Alabama; July 24-25, 1979, Birmingham, Alabama; August 1-2, 1979, Mobile, Alabama; October 16-17, 1979, Huntsville, Alabama.

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"Industrial Boiler Plants - Measuring and Improving Efficiency", North Carolina State University Extension Service, Raleigh, North Carolina, February 1-2, 1978.

"Boiler Efficiency Improvement", Ball State University and Auburn University Engineering Extension Service, Muncie, Indiana, April 11-12, 1978.

"Boiler Efficiency Improvement Institute", Atlanta, Georgia, August 30-31, 1978; Memphis, Tennessee, September 27-28, 1978; Houston, Texas, October 24-25, 1978; Cleveland, Ohio, November 20-21, 1978; Buffalo, New York, December 6-7, 1978; Chicago, Illinois, December 12-13, 1978; Atlanta, Georgia, December 19-20, 1978; Pittsburgh, Pennsylvania, February 27-28, 1979; Charolette, North Carolina, March 27-28, 1979; Orlando, Florida, April 11-12, 1979; Dallas, Texas, May 1-2, 1979; Los Angeles, California, June 11-12, 1979; Los Angeles, California, June 13-14, 1979; Boston, Massachusetts, June 18, 1979; Pittsburgh, Pennsylvania, June 28-29, 1979; Utica, New York, July 17-18, 1979; Albany, New York, July 19-20, 1979; Rochester, New York, August 7-8, 1979; Buffalo, New York, August 9-10, 1979; Long Island, New York, August 21-22, 1979; Staten Island, New York, August 23-24, 1979; Binghampton, New York, September 10-11, 1979; Rockland County, September 12-13, 1979; Syracuse, New York, September 14, 1979; Manhattan, New York, September 24-25, 1979; Syracuse, New York, October 23-24, 1979; Atlanta, Georgia, October 30, 1979; Madison, Wisconsin, November 12-13, 1979; Colorado Springs, Colorado, November 14, 1979; Chicago, Illinois, November 15, 1979.

"Hospital Boiler Efficiency Improvement", Hospital Council of Western, Pennsylvania, Pittsburgh, Pennsylvania, September 6-7, 1978.

"Industrial Boiler Efficiency Improvement", University of Massachusetts, Amherst, Massachusetts, October 30-31, 1978.

"Industrial Boiler Efficiency Improvement", Mobile, Alabama, May 30-31, 1978; Montgomery, Alabama, June 7-8, 1978; Jacksonville, Alabama, August 16-17, 1978; Birmingham, Alabama, October 10-11, 1978; Birmingham, Alabama, October 18-19, 1978; Sheffield, Alabama, November 1-2, 1978.

"Boiler/Water Heater Efficiency Improvement", Alabama Energy Extension Service, Birmingham, Alabama, April 19, 1978; Decatur, Alabama, March 15, 1978; Mobile, Alabama, March 9, 1978; Montgomery, Alabama, February 10, 1978; Evergreen, Alabama, May 26, 1978; Scottsboro, Alabama, June 20, 1978; Jacksonville, Alabama, June 21, 1978; Florence, Alabama, July 26, 1978; Huntsville, Alabama, July 27, 1978; Montgomery, Alabama, August 9, 1978; Birmingham, Alabama, August 15, 1978; Tuscaloosa, Alabama, September 12, 1978; Auburn, Alabama, October 3, 1978; Montgomery, Alabama, October 4, 1978; Troy, Alabama, November 9, 1978; Dothan, Alabama, November 10, 1978; Ozark, Alabama, May 23, 1979; Montgomery, Alabama, May 30, 1979; Tri-City, Alabama, July 26, 1979; Birmingham, Alabama, July 31, 1979; Phenix City, Alabama, September 26, 1979; Tuscaloosa, Alabama, November 20, 1979.

CONSULTING EXPERIENCE

Served as Consultant to:

ARO, Incorporated, Tullahoma, Tennessee, 196[illegible]-1970: [Numerical Fluid Mechanics[

CMI Systems, Chattanooga, Tennessee, 1970-1972: [Design of Energy Recovery System]

Rahm and Haas, Huntsville, Alabama, 1968: [Solid Rockets]

FMTS, Waverly, Alabama, 1974/Present: [Numerical Fluid Mechanics]

E[illegible], Auburn, Alabama, 1975/Present: [Energy Studies]

AMCO, Montgomery, Alabama, 1978: [Boiler Tests]

Price-Waterhouse, Wasnington, D.C., 1976: [Boiler Efficiency Codes]

Martin Industries, Huntsville, Alabama, 1976: [Performance Testing of Heating Equipment]

Abbott Labs, Chicago, Illinois, 1977: [Boiler Efficiency]

Atlanta Stove Works, Atlanta, 1977: [Stove Efficiency]

Nabisco, Inc., Englewood, New Jersey, 1979: [Boiler Efficiency]

Bristol Myers, Syracuse, New York, 1979: [Boiler Efficiency]

SPONSORED RESEARCH EXPERIENCE

Project Leader, NSF Grant GK1606, "Pressure Drop in a Liquid Nitrogen Cold Trap," September 1967 - September 1968.

Co-Principal Investigator, AMC C1326, "Hypersonic Radiative Flows," Army Missile Command, 1967-1969.

Co-Project Leader, Research Grant-In-Aid Project 156-8, "Investigation of Flame Phenomena in an Oxy-hydrogen Rocket Motor," Auburn University, 1968-1969.

Co-Principal Investigator, AMC 1818, "Hypersonic Radiative Flows," Army Missile Command, AMC C1326, 1970-1971.

SPONSORED RESEARCH EXPERIENCE (CONTINUED)

Project Leader, ME-42, "Freeze Drying of Particle Beds," Auburn University Engineering Experiment Station, 1970-1971.

Co-Project Leader, A-026-ALA, "Reducing Thermal Pollution Through Interstellar Radiation," Water Resources Research Institute, Auburn University, 1971-1972.

Co-Project Leader, Contract N00014-72-C-0177, "Performance of Gas Augmented Waterjet Propulsion System:, Office of Naval Research/ Naval Ship Systems Command, March 1972-July 1973.

Co-Project Leader, Contract N00014-73-A0061-0001, "Investigation of the Design Needs for Submarines of the Future," Office of Naval Research, September 1972-September 1973

Co-Project Leader, Contract A-031-ALA, "Analysis and Design of an Interstellar Radiator System," Water Resources Research Institute, July 1972-July 1973.

Co-Project Leader, Electric Power Research Institute (EPRI-321), "Comparison of Performance, Economics and Reliability of Phased-Cooled with Cooling Towers and Coolings Pond," September 1974-December 1975.

Co-Project Leader, "Evaluation of Techniques to Predict Heat Fluxes, Pressure Drops and Leakages in Steam Generators for the Breeder Reactor Program," General Electric Company, Contract GE-190 ME, September 1974-July 1975.

Co-Project Leader, "Improving Operating Efficiency of Steam Generating Boilers," Contract No. Co-04-50100-00 with Federal Energy Agency, February 1975-December 1976.

Co-Project Leader, "Air-Augmented Waterject Propulsion," Office of Naval Research, Contract No. N00014-75-C-0936, June 1975-December 1976.

Co-Project Director, "Feasibility Study of Combined Dry Cooling Tower and Phased Cooling Systems, Battelle Northwest Lab, Contract BSA-994, June 1975.

Co-Project Leader and Co-Principal Investigator, National Science Foundation, Contract No. LC03995, "Development of Method to Aid in Minimizing Energy Consumption in Pulp and Paper Plants," March 1975/Present.

Project Leader, Alabama Energy Management Board, Contract #422136, 1977.

SPONSORED RESEARCH EXPERIENCE (CONTINUED)

Co-Project Leader, Department of Energy, Contract No. EC-77-S-05-5552, "Improving the Efficiency, Safety, and Utility of Wood Burning Units," September 1977/Present.

Co-Principal Investigator, Alabama Energy Management Board (DOE), Contract No. 4-22131, "Developing and Testing Methods to Perform Energy Audits in Industrial Plants and Facilities," June 1978/ Present.

Project Leader, "Energy Savings Associated with use of Daytime Shutoff of Cooling Systems for Homes," AEMB, Contract ADO-AU-X996, August/ September 1978.

Co-Project Leader, Fireplace Institute, "Efficiency and Output Rating of Home Heating Woodburning Units Using Calorimeter Room," Contract #4-20199, April 1979/April 1981.

Co-Project Leader, Fireplace Institute, Contract No. 4-20199, "Development and Construction of Calorimeter Room to Test Woodburning Units," March 1978/Present.

Co-Project Leader, Monsanto Research Corporation, "Pollution From Home Heating Woodburning Units", February/August 1979.

Project Leader, Vega Industries, "Pyrotechnic Effects on Flamability", October 1979/October 1980.

Co-Project Leader, National Bureau of Standards, "Safety Aspects of Insert Fireplaces in Zero-Clearance Fireplaces", December 1979/ December 1980.

REFERRED PUBLICATIONS

"A Standard for Vapor Pressure Measurement at Low Pressures," Vacuum, 14, (1964), 395, [co-authored with J. E. Sunderland].

"Bulk and Diffusion Transport in the Region between Molecular and Viscous Flow," International Journal of Heat and Mass Transfer, 9, (1966), 519-522, [co-authored with J. E. Sunderland].

"Equilibrium Vapor Pressure of Frozen Bovine Muscle," Journal of Food Science, 31, 2, (1966), 196-201, [co-authored with J. E. Sunderland].

"Transient Temperature Distribution During Sublimation Dehydration," ASME Journal of Heat Transfer, 89, C, 1 (February 1967), 109-110, [co-authored with J. E. Sunderland].

REFERRED PUBLICATIONS (CONTINUED)

"Total Pressure Drop Across a Cold Trap in Low Vacuum Application," British Journal of Applied Physics, 18, 3 (1967), 297-308, [co-authored with J. E. Sunderland].

"Bulk and Diffusion Transport of Gases at Non-Uniform Pressures," Transactions of the Faraday Society, 63, (1967), 573-378.

"A Mathematical Model for Deposition From Turbulent Flows," ASME Journal of Engineering for Power, 90, A2 (April 1968), 164-170, [co-authored with J. Broadway, R. I. Vachon and H. Zallen].

"Heat and Mass Transfer Mechanisms in Sublimation Dehydration," Transactions of ASME, Journal of Heat Transfer, 90, C, 4 (November 1968), 379-384, [co-authored with J. E. Sunderland].

"The Role of Convection in Drying," Journal of Chemical Engineering Science, 23, (1968), 965-970, [co-authored with J. E. Sunderland].

"Quasi-Steady Compressible Flow with Heat Transfer in Accelerating Nozzles and Ducts," Journal of Spacecraft and Rockets, 6, 3, (March 1969), 308-311, [co-authored with R. I. Vachon and W. Chen].

"The Influence of Varying Interface Temperature on Freeze-Drying," Proceedings of International Institute of Refrigeration, (1969). [co-authored with J. E. Sunderland]. Presented at the International Institute of Refrigeration, Lausanne, Switzerland, June 1969.

"A Numerical Solution for the Single-Screw Extrusion of a Polymer Melt," AIChE Journal, 15, 6, 823-838, (1969).

"A Sublimation Dehydration of Particles," Proceedings of the 1970 Southeastern Seminar on Thermal Science, Raleigh, North Carolina, April 1970.

"Comparisons of Theory and Experiment for Turbulent Boundary Layers on Simple Shapes at Hypersonic Conditions," Proceedings of the 1970 Heat Transfer and Fluid Mechanics Institute, 1970, 168-188, [co-authored with A. W. Mayne].

"The Pressure Distribution in a Liquid-Nitrogen Cold Trap," Advances in Cryogenic Engineering, 16, (1970), 268-276, Presented at Cryogenic Engineering Conference, Boulder, Colorado, June 1970.

"Freeze-Drying of Spheres and Cylinders," ASME Journal of Heat Transfer, [co-authored with C. C. Cox].

"Freeze-Drying of Bodies Subject to Radiation Boundary Conditions," Transactions of ASME, Journal of Heat Transfer, 93, C, 4, 426-431, November 1971, [co-authored with J. E. Sunderland].

REFERRED PUBLICATIONS (CONTINUED)

"Application of the Patankar-Spalding Finite Difference Procedure to Turbulent Radiating Boundary Layer Flow," International Journal of Heat and Mass Transfer, 14, (1971), 667-672, [co-authored with J. M. Elliott, R. I. Vachon, and J. R. Dunn].

"An Experimental Study of Particle Freeze-Drying," Proceedings of the XIII International Congress of Refrigeration (1972), [co-authored with Leon Hardin].

"Thrust of an Air-Augmented Waterjet," AIAA Journal of Hydronautics, Vol. 7, No. 2, April 1973, 64-71, [co-authored with R. G. Amos and G. Maples].

"Convective Heat Transfer from a Rotating Inner Sphere to a Stationary Outer Sphere," Transactions of ASME, Journal of Heat Transfer, 95, C, 4, (November 1973), [co-authored with G. Maples and A. Askin].

"Heat and Mass Transfer in Beds of Particles Undergoing Sublimation Dehydration," Transactions of ASME, Journal of Heat Transfer, 95, C, 4, (November 1973), 516-520, [co-authored with Leon Hardin].

"Numerical Solutions of the Integro-differential Equations of High-Speed Radiating Boundary Layers," International Journal of Heat and Mass Transfer, 16, 8, (August 1973), 1649-1651, [co-authored with J. M. Elliott, R. I. Vachon and J. R. Dunn].

"Application of Phased-Cooling to a Once-Through Cooling System," ASME Journal of Engineering for Power, 97, A, 1 (January 1975), 117-124, [co-authored with J. MacFarlane and G. Maples].

"Thrust of an Air Augmented Waterjet with a Converging-Diverging Nozzle," AIAA Journal of Hydronautics, Vol. 9, No. 4, October 1975, [co-authored with T. T. Maxwell and G. Maples].

"Flow through an Elastic Orifice in Subirrigation," Proceedings of the 12th Southeastern Seminar on Thermal Science (June 1976), p. 171-178, [co-authored with G. Maples and L. Hardin].

"Solution Technique for Equilibrium Chemistry of Hydrogen - Oxygen Systems," AIAA Journal, Vol. 14, No. 11, November 1976 [co-authored with G. Maples].

"Performance of Gas-Augmented Waterjet Propulsion System," ASME Marine Propulsion, OED-Vol. 2, pp. 129-150, 1976 [co-authored with J. F. Stansell and G. Maples].

"Safety, Efficiency, Output and Utility Testing, Product Development and Basic Research on Woodburning Units and Accessories at the Auburn Woodburning Laboratory," Proceedings of the Wood Energy Institute III, April 1978 (co-authored with T. T. Maxwell and Glennon Maples).

"Controlling Excess Air For Boiler Efficiency," Heating/Piping/Air Conditioning, November 1978 (co-authored with Glennon Maples, T. T. Maxwell and M. T. Jasper).

DAVID F. DYER (CONTINUED)

REFERRED PUBLICATIONS (CONTINUED)

"Measuring the Efficiency and Heat Output of Residential Wood Heating Appliances", The Wood Energy Institute, March 1979 [co-authored with T. T. Maxwell and G. Maples].

"Studies of Creosote and Chimneys at the Auburn Woodburning Laboratory", The Wood Energy Institute, September 1979 [T. T. Maxwell and G. Maples].

"Woodburning Short Course Handbook", Auburn University Engineering Extension Service, Auburn, Alabama, July 10-11, 1979 [co-authored with T. T. Maxwell, G. Maples, F. Myers, J. Hoyle, and J. Shelton].

"Results of Six Tests to Assess the Accuracy of Flue Loss Testing Methods Versus the Calorimeter Test Procedure", Report to the Fireplace Institute, February 7, 1979 [co-authored with T. M. Pruitt and T. T. Maxwell].

"Mass Injection & Radiative & Convective Heat Transfer in High-Speed Turbulent Flow", Indian Journal of Technology, December, 1976 (co-authored with D.Y. Goswami, R.L. Vachon, J.M. Elliott, & J.R. Dunn).

TEXTBOOKS

Boiler Efficiency Improvement, Copyright by Massachusetts Institute of Technology - 1976 [co-authored with G. Maples and J. C. Maxwell, Jr.].

Fuel Oil Manual for Boiler Operation, 1979 [co-authored with G. Maples and David M. Hall].

Water Manual for Boiler Operation, 1979 [co-authored with G. Maples and David M. Hall].

Measuring and Improving the Efficiency of Boilers (Operator Manual), 1979 [co-authored with G. Maples].

MANUAL

"Measuring and Improving the Efficiency of Boilers", FEA Contract No. FEA-CO-04-50110-00, Washington, D.C., November 1976, [co-authored with G. Maples, J. C. Maxwell, Jr., D. Pride, and W. G. Dickie, Jr.]

ESN ARTICLES

(The following articles were published by the Office of Naval Research - London (ONRL) in the European Scientific Notes which is distributed to 20,000 top scientists and engineers in the U. S. These articles were reviewed by the Editoral staff of ONRL).

"Recent Developments at the Von Karman Institute for Fluid Dynamics," Vol. 26, p. 319, 1972.

DAVID F. DYER (CONTINUED)

ESN ARTICLES (CONTINUED)

"International Council of Aeronautical Sciences Conference," Vol. 25 p. 322, 1972.

"Mechanics at the University of Glasgow, Vol. 26, p. 331, 1972.

"Applied Math in Fluid Mechanics at Bristol University," Vol. 27, p. 14, 1973.

"Fluid Mechanics at the Israel Institute of Technology, Vol. 27, p. 140, 1973.

"Fluid Mechanics Research at the DFVLR Institute for Theoretical Gas Dynamics, Vol. 27, p. 142, 1973.

Rolls-Royce 'Re-invents' the Wheel and A New Fuel System," Vol. 27, p. 61, 1973.

Paris Conference on Magneto-Hydrodynamics, Vol. 27, p. 80, 1973.

Freeze-Drying at Edwards High Vacuum, Vol. 27, P. 108, 1973.

Design and Inventions Lab, Vol. 27, p. 144, 1973.

Mechanical Engineering at Liverpool University, Vol. 27, p. 176, 1973.

Oil-Free Centrifugal Compressors for Cryogenic Refrigeration, Vol. 27, p. 201, 1973.

A Visit to the University College of Ireland (Eire), Vol. 27, p. 229, 1973.

Heat and Mass Transfer at ETH, Zurich, Vol. 27, p. 258, 1973.

Heat Transfer Seminar, Vol. 27, p. 258, 1973.

Fluid Mechanics at Brown-Boveri Research Center, Vol. 27, p. 281, 1973.

The National Engineering Laboratory, Vol. 27, p. 282, 1973.

The Chamber of Mines in South African Research, Vol. 27, p. 312, 1973.

South African Council for Scientific and Industrial Research, Vol. 27, p. 313, 1973.

The Universities in the Cape Region of South Africa, Vol. 28, p. 40, 1974.

Fluid Mechanic Research in Scandinavia, Vol. 28, p. 40, 1974.

The University of Witwatersrand, Vol. 28, p. 10, 1974.

Engineering Education at the University of Niarobi, Vol. 28, p. 12, 1974.

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ONR REPORTS

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Fluid Mechanics and Finite Elements, R-21-72, December 1972.

Numerical Calculations of Viscous Fluid Problems at Imperial College, London, R-2-73, March 1973.

Report on the Sixth International Conference on Fluid Sealing, Munich, C-15-73, July 1973.

MHD for Power Generation - The View of a Chosen Few, C-10-73, April 1973.

Jet Pumps and Ejectors - Application of Liquid/Two-Phase Ejection in Desalination, C-6-73, February 1973.

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"A Discussion of Solution Techniques for the Conservation Equations Applicable to Blast Environmental Effects on Intercept Vehicles," Report II, AMC Contract DAA H01-67-C1326, October 1967, [co-authored with J. M. Elliott, R. I. Vachon, J. R. Dunn, and G. Maples].

"Coupled Boundary Analyses and Inviscid Flow Properties Behind Shocks for Blast Environmental Effects on Hypersonic Vehicles," Report III, AMC Contract DAA H01-67=C1326, Engineering Experiment Station, Auburn University, January 1968, [co-authored with J. R. Dunn, R. I. Vachon J. M. Elliott and G. Maples].

"Inclusion of a Thermal Radiation Source Term in the Patankar-Spalding Boundary Layer Analysis for Hypersonic Flow." Report IV, AMC Contract DAA H01-67-C1326, May 1968, [co-authored with J. M. Elliott, R. I. Vachon, and J. R. Dunn].

"Boundary Layer Analysis for Blast and Environmental Effects on Hypersonic Interceptors," Report V, AMC Contract DAA H01-67=C1326, September 1968, [co-authored with R. I. Vachon, J. R. Dunn, G. Maples, J. M. Elliott, and H. G. Whitley].

"Discussion of Approaches to Analysis Techniques for Blast Environmental Effects on Interceptors," Report I, AMC Contract DAA H01-69-C1818, Engineering Experiment Station, Auburn University, September 1969, [co-authored with J. R. Dunn, R. I. Vachon, and J. M. Elliott].

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CONTRACT REPORTS (CONTINUED)

"Development of a Computer-Aided Conceptual Submarine Design Evaluation Tool, ONR Contract N00014-73-A-0061-0001, November 1973, [co-authored with A. Cotney and G. Maples].

"Mass Flow Distribution Analysis for Steam Generator Economizer," Reece Engineering Associates (for Combustion Engineering), Report No. 2-2, June 1974, [co-authored with R. A. Young and J. W. Reece].

"Feasibility Study of Combined Dry Cooling Tower, Phased Cooling System," Battelle Northwest Laboratory, June 1975, [co-authored with G. Carroll and G. Maples].

"Comparison of Boiling Heat Transfer Correlations for LMFBR Evaporator and Superheater," General Electric Contract No. 190-C5H10G-X, November 1975, [co-authored with P. Blaise, D. Pride and G. Maples].

"Hydrogen Injection into a Supersonic Stream," NASA Technical Report, (in press) 1975, [co-authored with D. B. Spalding and G. Maples].

"Comparison of Performance and Economics of Phased Cooling Systems with Conventional Cooling Systems," Electric Power Research Institute Contract ME 321, January 1976, [co-authored with G. Carroll and G. Maples].

"Program for Improving Boiler Efficiency," an interim report submitted to Federal Energy Administration, Washington, D.C., April 19, 1976, [co-authored with G. Maples, J. Wilbanks, H. T. Cansler, J. C. Maxwell, Jr., and D. Pride].

"Performance of Air-augmented Waterjet Thrusters," Final Report, Office of Naval Research, Contract N00014-75-C-0936, November 1976 [co-authored with G. Maples, H. T. Cansler, and J. C. Maxwell, Jr.].

"Development of Method to Aid in Minimizing Energy Consumption of Pulp and Paper Plants," Quarterly Report, NSF Contract LC03995, August 1976.

"Development of Method to Aid in Minimizing Energy Consumption in Pulp and Paper Plants," Second Quarterly Report, NSF Contract LC03995, October 1977, [co-authored with T. T. Maxwell, G. Moore and G. Maples].

"Development of Method to Aid in Minimizing Energy Consumption of Pulp and Paper Plants", Final Report, NSF Contract LC03995, September 1979, [co-authored with G. Moore, P. A. Barrett, M. T. Jasper, T. T. Maxwell, D. F. Dyer, and G. Maples].

"Energy Savings Associated with Use of Day-Time Shutoff of Cooling Systems for Homes," Alabama Energy Management Board, Contract No. ADO-AU-X996, January 1978 [co-authored with T. Pruitt and G. Maples].

CONTRACT REPORTS (CONTINUED)

"Efficiency and Capacity Certification Testing of Cross-Flow, Mechanical Draft Wet Cooling Tower - Per ASME Testing Standard," Plantation Mechanical Corporation, Montgomery, Alabama, August 1978, [co-authored with G. Maples].

"Efficiency and Capacity Certification Testing of Fire-Tube Boiler-Per ASME Testing Standards," AMCO, Montgomery, Alabama, January 1978, [co-authored with G. Maples].

"Maintenance Manual - BOSS4D Computer Code," Ballistic Missile Defense Systems Command, Huntsville, Alabama, January 1978 [co-authored with S. Elghobashi, A. Thyagaraja, D. B. Spalding and G. Maples].

"User Manual - BOSS4D Computer Code," Ballistic Missile Defense Systems Command, Huntsville, Alabama, January 1978 [co-authored with S. Elghobashi, A. Thyagaraja, D. B. Spalding and G. Maples].

"Improving the Efficiency, Safety and Utility of Woodburning Units," Quarterly Report WB-5, Department of Energy, Contract No. ERDA-EC-77-S-05-5552, December, 1978 [co-authored with G. Maples, T.T. Maxwell, I.D. Cooley, L.A. Woodsen, O.A. Badr, T.M. Pruitt, H. Siefien, R.G. Kain and H. Vakili].

"Improving the Efficiency, Safety and Utility of Woodburning Units, Quarterly Report WB-6, Department of Energy, Contract No. DE-AS-05-77-ET-11288, March 1979 [co-authored with G. Maples, T.T. Maxwell, I.D. Cooley, O.A. Badr, C.B. Somerset, J.H. Meighan, T.M. Pruitt, S.J. Juger, J.M. Gudino, H. Siefien, H.M. Aly, T.L. Hughes, D.R. Aiken].

"Improving the Efficiency, Safety and Utility of Woodburning Units," Quarterly Report WB-7, Department of Energy, Contract No. DE-AS05-77-ET-11288, June 1979 [co-authored with G. Maples, T.T. Maxwell, I.D. Cooley, O.A. Badr, C.B. Somerset, J.H. Meighan, T.M. Pruitt, S.J. Juger, J.H. Gudino, H. Siefien, H.M. Aly, T.L. Hughes, D.R. Aiken].

"Design Handbook for Residential Woodburning Equipment," Special Report, Department of Energy, Contract No. DE-AS05-77ET-11288, July 1979 [co-authored with T.T. Maxwell, G. Maples, and T.M. Pruitt].

"Improving the Efficiency, Safety and Utility of Woodburning Units - Special Creosote Report," Department of Energy, Contract No. DE-AS05-77-ET-11288, December 1979 [co-authored with G. Maples, T.T. Maxwell and J. Juger].

"Development of Method to Aid in Minimizing Energy Consumption of Pulp and Paper Plants." Final Report, NSF Contract LC03995, September 1979 [co-authored with G. Maples, T.T. Maxwell, and G. Moore].

CONTRACT REPORTS (CONTINUED)

"Improving the Efficiency, Safety, and Utility of Woodburning Units," Quarterly Report WB-1, Department of Energy, Contract No. ERDA-EC-77-S-05-5552, December 1978 [co-authored with G. Maples, I.D. Cooley, O.A. Badr, N.J. Stringfellow, C.W. Robinson, and T.T. Maxwell].

"Improving the Efficiency Safety, and Utility of Woodburning Units," Quarterly Report WB-2, Department of Energy, Contract No. ERDA-EC 77-S-05-5552, April 1978 [co-authored with G. Maples, I.D. Cooley, O. A. Badr, N.J. Stringfellow, A. Quam, G.G. Barksdale, and T.T. Maxwell].

"Development of Method to Aid in Minimizing Energy Consumption of Pulp and Paper Plants," Quarterly Report, NSF Contract LC03995, November 1977 [co-authored with G.V. Moore, P.A. Barrett, G. Maples, and T.T. Maxwell].

"Boiler Efficiency Improvement Program for Industry in Alabama," Alabama Energy Management Board (DOE), Contract No. 4-22136, Quarterly Reports 1,2,3,4, and 5, 1978 and Quarterly Reports 6 and 7, 1979 [co-authored with G. Maples, T.T. Maxwell, J.R. Wilbanks, and E. Waldroup].

"Boiler/Water-Heater Efficiency Improvement Program in Alabama for Commercial, Governmental and Institutional Boilers," Quarterly Reports 1,2,3,4,5,6,7, and 8, Alabama Energy Extension Service, Contract No. 4-20184, 1978 [co-authored with J.R. Wilbanks, E. Waldroup, F.A. Jones, J.K. Mims, G. Maples, and T.T. Maxwell].

"Improving the Efficiency, Safety and Utility of Woodburning Units," Quarterly Report WB-3, Department of Energy, Contract No. ERDA-EC-77-S-05-5552, June 1978 [co-authored with G. Maples, T. T. Maxwell, I.D. Cooley, O.A. Badr, N.J. Stringfellow, G. Barksdale, and L.J. Gordon].

"Improving the Efficiency, Safety and Utility of Woodburning Units," Quarterly Report WB-4 Volumes I, II, and III, Department of Energy, Contract No. ERDA-EC-77-S-05-5552, September 1978 [co-authored with G. Maples, T.T. Maxwell, I.D. Cooley, O.A. Badr, G.A. White, N.J. Stringfellow, T. Pruitt, G. Barksdale, H. Siefien, A.E. white, II, and H.W. Polinitz, III].

"Boiler/Water-Heater Efficiency Improvement forCommercial, Institutional and Small Industrial Sectors," Final Report, Contract No. EC-77-G-01-5091, March 1980 [co-authored with G. Maples, T.T. Maxwell, J.R. Wilbanks, Kevin Mims, Tommy Burch, Edward Waldroup].

"Improving the Efficiency of Industrial Boilers," Alabama Energy Management Board, Contract No. AEMB 207 and 205, Quarterly Reports, 1978 and 1979 [co-authored with G. Maples, Kevin Mims, and T.T. Maxwell].

PRESENTED PAPERS

"Heat and Mass Transfer Mechanisms in Sublimation Dehydration," ASME Winter Annual Meeting, Pittsburgh, November 1967.

"The Influence of Varying Interface Temperature on Freeze-Drying," International Congress of Refrigeration, Lausanne, Switzerland, June 1969.

"Sublimation Dehydration of Particles," Southeastern Seminar on Thermal Science, Raleigh, North Carolina, April 1970.

"Comparison of Theory and Experiment for Turbulent Boundary Layers on Simple Shapes at Hypersonic Conditions," 1970 Heat Transfer and Fluid Mechanics Institute at U.S. Naval Postgraduate School, Monterey, California, June 1970.

"The Pressure Distribution in Liquid Nitrogen Cold Trap," 1970 Cryogenic Engineering Conference, Boulder, Colorado, June 1970.

"Freeze-Drying of Bodies Subject to Radiation Boundary Conditions," ASME Heat Transfer Conference, Tulsa, Oklahoma, August 1971.

"Performance of Gas-Augmented Waterjet Propulsion System," ASME Winter Annual Meeting, December 1976.

INVITED LECTURES, SEMINARS AND TECHNICAL BRIEFINGS

Prediction of Pressure Drop in a Cryogenic Cold Trap, Rice University, Houston, March 1965.

Numerical Analysis, Tennessee Technological University, September 1968.

Use of Film Theory to Predict Mass Transfer in a Solid Rocket and Motor, Rahm & Haas, Huntsville, Alabama, 1968.

Numerical Analysis for Solving Separated Flows, Southeastern Seminar on Thermal Science, Gainesville, Florida 1969.

Prediction of Radiation in Hypersonic Flows, Southeastern Seminar on Thermal Science, Cookeville, Tennessee, 1972.

Hypersonic Radiative Flow, University of Achen, Achen, Germany, February 1973.

Combined Forced and Diffusion Flux, University of Witwatersrand, Johannesburg, South Africa, November 1973.

INVITED LECTURES, SEMINARS AND TECHNICAL BRIEFINGS (CONTINUED

Novel Advances in Two-Phase Propulsion, Rolls-Royce Co., Conventry, England, October 1973.

Research Interest of ONR, Technion, Hiafa, Israel, April 1973.

Freeze-Drying of Particle Beds, Irish Sugar Corporation, Carlow, Ireland, June 1973.

Novel Propulsion Ideas, Battelle Laboratories, Geneva, Switzerland.

Energy Conservation in United States, Imperial College, London, England, December 1974.

An Energy Conservation Program for Industry, Federal Energy Administration, March 1975.

Recent Advances in Energy Conservation, Stanford University, Stanford, California, April 1975.

Process Energy Savings, Clemson University, Clemson, S.C., April 1975.

Turbulent Boundary Layer Predictions, NASA/Langley Research Center, Hampton, Virginia, September 1975.

Energy Conservation - Some Success Stories, United States Department of Commerce, Washington, January 1976.

A Boiler Efficiency Improvement Program, FEA, Washington, August 1976.

"Improving the Efficiency of Generating and Using Steam", West Point Pepperell, December 1, 1977.

The Energy Situation, League of Women Voters, Auburn, January 1978.

The Alabama Energy Extension Service, Food and Energy Council, August 1978, Louisville, Kentucky.

"Performance Testing of Wood Heating Equipment", The Fireplace Institute, March 1979, Palm Springs, California.

"Improving Boiler Efficiency", Roses (Growers), Inc., November 1979, Colorado Springs, Colorado.

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DAVID F. DYER (CONTINUED)

SCIENTIFIC AND PROFESSIONAL ORGANIZATION

American Society of Mechanical Engineers

Registered Professional Engineer - State of Alabama #10868

PATENT

"Dryer with Low Temperature Heat Recovery System," U.S. Patent #4,026,035 May 31, 1977, (co-authored with G. Maples).

HONORARY SOCIETIES

Society of the Sigma Xi
Phi Kappa Phi
Tau Beta Pi
Pi Tau Sigma

HONORS AND AWARDS

Nominated by Auburn University for ASEE Outstanding Research Award, 1969.

Guest of Westinghouse "Careers in Marketing Seminar and Workshop," Pittsburgh, 1968.

National Science Foundation Research Initiation Grant GK1606, September 1967.

National Science Foundation Postdoctoral Fellowship, June 1966.

Selected for ONR/London Liaision Scientist.

President, Boykin/Drake PTA, 1979-1980.

DAVID F. DYER (CONTINUED)

COMMITTEES

Member Ad Hoc Committee for Study of Pre-Engineering Curriculum

Chairman, Engineering School Self-Study Committee - Graduate Program 1972

Member, Thermal Science Curriculum Committee, 1968/1977

Chairman, Thermal Science Curriculum Committe, 1975/1977

Member, University Self-Study Committee - Research Program, 1972

Chairman, Engineering School Self Study Committee for Graduate Program, 1972

Co-chairperson, University Ad Hoc Committee on Energy Conservation, 1976

Member, University Committee on Engineering Experiment Station, 1978

Chairman, Mechanical Engineering Committee on Graduate Program 1978

Member, Graduate Steering Committee 1978/Present

Member, ASHRAE Standard Development Committee for Measuring Performance of Wood Heating Equipment, 1979/Present

Member, Engineering Committee, The Fireplace Institute, 1979/Present

REVIEWER

ASME Journal of Heat Transfer

ASME Journal of Engineering Power

International Journal of Heat and Mass Transfer

AIAA Journal

Journal of Food Science

Applied Mechanics Reviews

National Bureau of Standards (Energy Related Inventions)

SECURITY CLEARANCE

Secret, 1967/Present

BIOGRAPHICAL SKETCH

WAYNE L. STEBBINS

SENIOR ELECTRICAL PROJECT ENGINEER

POWER AND CONTROLS GROUP

CELANESE FIBERS OPERATIONS

ROCK HILL, S. C.

Wayne Stebbins was born and reared in Wisconsin and graduated in 1965 from Michigan Tech in Houghton, Michigan with a BSEE degree in the power option. After three years as an officer in the U. S. Navy, Wayne joined Fiber Industries, Inc., at their Shelby, N. C. plant as a Project Engineer. In 1972, he transferred to FII Major Engineering in Charlotte, N. C., where he was appointed Senior Staff Engineer, involved in power distribution projects, utilities testing programs and energy management.

In 1978, he transferred to the FII Greenville plant to head up the plant-wide energy management program, and in 1981 assumed the additional duties of Utilities Superintendent.

In 1982, Wayne transferred to Celanese Fibers Operations, Rock Hill, S. C., as Area Supervisor of Utilities Services. Responsibilities included operations and maintenance of the plant-wide water and waste treatment facilities and all compressed air and HVAC systems.

In 1984, Wayne transferred to the Power and Controls group in Project Engineering, where he is responsible for major process and energy management projects involving electrical power, controls, instrumentation and computers.

Wayne is a senior member of the IEEE and has authored and co-authored a variety of magazine articles and IEEE papers on reliability, power system monitoring and energy management. Wayne is a nationally recognized expert in the fields of electrical power distribution and energy management. He is currently a guest lecturer at both the University of Wisconsin and at Virginia Polytechnic Institute, in their very successful four-week energy management courses.

1984 NATIONAL PLANT ENGINEERING & MAINTENANCE CONFERENCE

Advance Program Highlights

General Session Presentation by GE's James A. Baker, Executive Vice President and Sector Executive, Technical Systems

Silicon Meets Smokestack: America Wins!

. . . if the engineers who know the score on the factory floor continue to remain silent in the face of obsolescence and inefficiency in their plants, they will become accomplices in their own destruction by foreign competition. *page 4*

Special Session by Michael Hora, Vice President, A. T. Kearney, Inc.

Too Bad!...They Thought Technology Was the Answer *page 4*

An Operating Policy Seminar

Brings together responsible plant and maintenance personnel for an open and frank exchange of concepts and a solicitation of solutions to persistent operational problems. *page 6*

Maintenance Management

An On-Line Maintenance Management Control System *page 8*

Formalized Preventive Maintenance Programs and Overmaintenance *page 8*

Maintenance — A Hidden Corporate Strategic Resource *page 9*

Modernizing Training for the Skilled and Unskilled to Repair New Technology Equipment *page 9*

Value of a User Designed Computerized Maintenance Control System *page 10*

Planning & Administration

Good Uses for Microcomputers in the Plant *page 4*

New Ways for Training and Upgrading in Maintenance *page 4*

Control of Maintenance Scheduling, Forecasting and Budgeting *page 5*

Written Presentations — How to Write Them *page 5*

Managing the High Technology Function *page 5*

What Management is Looking for in the Engineering Executive *page 6*

Organizing for High Technology Plants *page 6*

Getting More Growth with Less Management *page 7*

Energy Management & Conservation

New Technologies and Equipment *page 11*

Energy Management Workshop — Useful Energy Conservation Measures *page 11*

Material Handling; Instrumentation & Controls; Pollution & the Environment

Is AS/RS Dead? *page 13*

Computerizing Predictive Maintenance Data *page 13*

Incineration/Heat Recovery Installations *page 14*

SPECIAL SHORT COURSES

Computerized Maintenance Management Systems *page 17*

Managing a Preventive Maintenance Program *page 16*

Personal Computer Operation for Engineers *page 20*

Basic Microprocessor Course *page 19*

Using the Failure Event to Establish Zero Maintenance *page 15*

Micro-Computer Software and Applications *page 17*

Microprocessor-Based Equipment Maintenance *page 18*

Preventive Maintenance and Troubleshooting on Robotics *page 15*

An Introduction to the "Basic" Programming Language *page 20*

Managing Energy as a Permanent Program *page 18*

Others . . .

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Thursday Morning, March 29, 1984
10:30 a.m. – 12:00 noon

Session P2.17

Cases of Failure Due to Maintenance (Round Table)

(Presented in cooperation with the American Society of Mechanical Engineers – Design Engineering Division)

Three cases will be presented and reviewed in a round table discussion — One, a specific example of design deficiencies which made maintenance difficult and resulted in failures; Two, a failure which resulted from actions of maintenance personnel who were ignorant of the potential consequences of certain maintenance actions; Three, the case of a wire rope sling which failed because of maintenance problems.

Chairman: Charles O. Smith, ASME
Professor of Engineering
Rose-Hulman Institute of Technology
Terre Haute, IN

Speaker/
Leaders: Thomas F. Talbot, ASME
Mechanical Engineering
University of Alabama at Birmingham
Birmingham, AL

Leo C. Peters, ASME
Mechanical Engineering
Iowa State University
Ames, IA

John F. Radavich, ASME
Purdue University
W. Lafayette, IN

Thursday Morning, March 29, 1984
10:30 a.m. – 12:00 noon

Session P2.18

How to Evaluate the Remaining Life of Industrial Water Tube Boilers

(Presented in cooperation with the American Society of Mechanical Engineers)

It is possible for the owners of industrial water tube boilers to establish a trend of depletion within pressure retaining components which will result in an accurate representation of the units' remaining useful life. Through visual inspection and ultrasonic and metallurgical testing, plus some knowledge of boiler construction and A.S.M.E. code applications, experienced personnel are able to eliminate costly down time and successfully allocate funds for repair or replacement as well as routine maintenance activity.

This session will cover the specific details of the inspection activity and result correlation [illegible] engineering personnel with an [illegible] condition and future expectations [illegible]ers.

Robert [illegible], ASME
Project Manager
Technical Services Division
The Hartford Steam Boiler Inspection
and Insurance Co.
Hartford, CT

[illegible]

Monday Morning, March 26, 1984
9:00 – 11:00 a.m.

Session P3.1

New Technologies and Equipment

a. The Programmable Electric Motor and Improving the Energy Efficiency Ratio (EER) of Heating and Air Conditioning

Programmable electric motors with built-in electronic controls, save energy by increasing or decreasing the amount of current introduced to the motor. In other control situations where outside conditions dictate a need for more and precise speed changes, the controls can be tied into an independent microprocessor-based controller. The new units will eliminate process control valves, dampers in pumps and fans. Payback will vary according to application.

Steven Riedel
Engineering Manager
Specialty Motors Department
General Motors Company
Fort Wayne, IN

Additional speaker to be announced

b. Air Jets – A New Way to Overcome Ventilation and Air Distribution Problems

The pluses and minuses of existing technology in industrial facilities to meet air ventilation, distribution, heating and cooling requirements and problems, and the usage of energy to meet these requirements will be openly discussed. These technologies include cold air makeup fans with inflatable polyethylene supply ductwork, small fans on top of vertical duct blowing air to the floor, infrared heating, high volume/low pressure recirculation systems and ceiling fans.

A description as well as the advantages and disadvantages of air jet technology will be offered. This includes the theory of air jet nozzle operation, the equipment required for an air jet system, how the system solves ventilation and distribution requirements, how to calculate energy savings, how to recognize good applications for this type technology and applications where this type of technology cannot be used.

Roger H. Lamar, P.E., ASME
Group Leader, HVAC Systems Engineer
The Bahnson Company
A Division of Flakt, Inc.
Winston-Salem, NC

Monday Morning, March 26, 1984
10:30 a.m. – 12:00 noon

Session P3.2

Aggressive Energy Plans in Progress

a. Integrating EM Programs and Personnel into Daily Operations

Industry in many regions is emerging from the recent business recession in a much leaner mode, ready to take on both foreign and domestic competition. Through the elimination of unprofitable product lines, a trimmed down staff, and other cost cutting measures, our industry is viewing the mid-80s as a period of stability and returning profits. One of the cost cutting areas is energy management programs. Energy is now viewed as a raw material, to be managed along with labor and other costs. The current philosophy is: If a company is to continue to operate, and jobs need to be maintained, then energy management must be an *integrated* part of daily operations. Various counsel and direction will be offered in the session on how to keep energy concepts and programs in motion and effective under the continuing *integration* process.

Wayne L. Stebbins
Area Supervisor
Utilities Services
Celanese Fibers Operations
Rock Hill, SC

b. A Plan of Survival in Energy Conservation

After considering the cost of energy as just a fixed expense for years, Duriron saw how the increasing energy costs were taking a larger and larger bite of its profits. Programs were instituted to determine in exact terms where the energy was being used, what the cost of that energy was, and what could be done to reduce and avoid these costs. The plans involved the participation of almost everyone in the manufacturing operation and included implementation of methods for controlling and reporting the use of energy. The result was a substantial cost avoidance and more efficient use of energy.

Jerry B. Wilkey
Plant Engineer
Durco Foundry Division
The Duriron Company, Inc.
Dayton, OH

Monday Afternoon, March 26, 1984
3:00 – 5:00 p.m.

Session P3.3

Energy Management Workshop – Useful Energy Conservation Measures

This will be a two hour concentrated workshop designed to provide the attendees with a series of workable low and no-cost energy conservation measures and concepts that will prove to be immediately useful and rewarding. Presented by an instructor with fifteen years of industrial experience, heavily in energy management, the hands-on topics will include:

- Outlining the differences between power (rate of doing work) and energy (the quantity of work) with practical examples
- Developing MBTU values for fuel and electricity
- Generating values in the plant for W-year and P-year, and designating when these values need to be used
- Calculating refrigeration tons and determining chiller performance efficiency

OVER

Thursday Morning, March 29, 1984
10:30 a.m. – 12:00 noon

Session P2.17

Cases of Failure Due to Maintenance (Round Table)

(Presented in cooperation with the American Society of Mechanical Engineers – Design Engineering Division)

Three cases will be presented and reviewed in a round table discussion — One, a specific example of design deficiencies which made maintenance difficult and resulted in failures; Two, a failure which resulted from actions of maintenance personnel who were ignorant of the potential consequences of certain maintenance actions; Three, the case of a wire rope sling which failed because of maintenance problems.

Chairman: Charles O. Smith, ASME
Professor of Engineering
Rose-Hulman Institute of Technology
Terre Haute, IN

Speaker/Leaders: Thomas F. Talbot, ASME
Mechanical Engineering
University of Alabama at Birmingham
Birmingham, AL

Leo C. Peters, ASME
Mechanical Engineering
Iowa State University
Ames, IA

John F. Radavich, ASME
Purdue University
W. Lafayette, IN

Thursday Morning, March 29, 1984
10:30 a.m. – 12:00 noon

Session P2.18

How to Evaluate the Remaining Life of Industrial Water Tube Boilers

(Presented in cooperation with the American Society of Mechanical Engineers)

It is possible for the owners of industrial water tube boilers to establish a trend of depletion within pressure retaining components which will result in an accurate representation of the units' remaining useful life. Through visual inspection and ultrasonic and metallurgical testing, plus some knowledge of boiler construction and A.S.M.E. code applications, experienced personnel are able to eliminate costly down time and successfully allocate funds for repair or replacement as well as routine maintenance activity.

This session will cover the specific details of the inspection activity and result correlation needed to provide plant engineering personnel with an accurate representation of the existing condition and future expectations of industrial water tube boilers.

Robert E. Trombley, ASME
Project Manager
Technical Services Division
The Hartford Steam Boiler Inspection and Insurance Co.
Hartford, CT

[illegible]

Monday Morning, March 26, 1984
9:00 – 11:00 a.m.

Session P3.1

New Technologies and Equipment

a. The Programmable Electric Motor and Improving the Energy Efficiency Ratio (EER) of Heating and Air Conditioning

Programmable electric motors with built-in electronic controls, save energy by increasing or decreasing the amount of current introduced to the motor. In other control situations where outside conditions dictate a need for more and precise speed changes, the controls can be tied into an independent microprocessor-based controller. The new units will eliminate process control valves, dampers in pumps and fans. Payback will vary according to application.

Steven Riedel
Engineering Manager
Specialty Motors Department
General Motors Company
Fort Wayne, IN

Additional speaker to be announced

b. Air Jets – A New Way to Overcome Ventilation and Air Distribution Problems

The pluses and minuses of existing technology in industrial facilities to meet air ventilation, distribution, heating and cooling requirements and problems and the usage of energy to meet these requirements will be openly discussed. These technologies include cold air makeup fans with inflatable polyethylene supply ductwork, small fans on top of vertical duct blowing air to the floor, infrared heating, high volume/low pressure recirculation systems and ceiling fans.

A description as well as the advantages and disadvantages of air jet technology will be offered. This includes the theory of air jet nozzle operation, the equipment required for an air jet system, how the system solves ventilation and distribution requirements, how to calculate energy savings, how to recognize good applications for this type technology and applications where this type of technology cannot be used.

Roger H. Lamar, P.E., ASME
Group Leader, HVAC Systems Engineer
The Babinson Company
A Division of Flakt, Inc.
Winston-Salem, NC

Monday Morning, March 26, 1984
10:30 a.m. – 12:00 noon

Session P3.2

Aggressive Energy Plans in Progress

a. Integrating EM Programs and Personnel into Daily Operations

Industry in many regions is emerging from the recent business recession in a much leaner mode, ready to take on both foreign and domestic competition. Through the elimination of unprofitable product lines, a trimmed down staff, and other cost cutting measures, our industry is viewing the mid-80s as a period of stability and returning profits. One of the cost cutting areas is energy management programs. Energy is now viewed as a raw material, to be managed along with labor and other costs. The current philosophy is: If a company is to continue to operate, and jobs need to be maintained, then energy management must be an *integrated* part of daily operations. Various counsel and direction will be offered in the session on how to keep energy concepts and programs in motion and effective under the continuing *integration* process.

Wayne L. Stebbins
Area Supervisor
Utilities Services
Celanese Fibers Operations
Rock Hill, SC

b. A Plan of Survival in Energy Conservation

After considering the cost of energy as just a fixed expense for years, Duriron saw how the increasing energy costs were taking a larger and larger bite of its profits. Programs were instituted to determine in exact terms where the energy was being used, what the cost of that energy was, and what could be done to reduce and avoid these costs. The plans involved the participation of almost everyone in the manufacturing operation and included implementation of methods for controlling and reporting the use of energy. The result was a substantial cost avoidance and more efficient use of energy.

Jerry B. Wilkey
Plant Engineer
Durco Foundry Division
The Duriron Company, Inc.
Dayton, OH

Monday Afternoon, March 26, 1984
3:00 – 5:00 p.m.

Session P3.3

Energy Management Workshop – Useful Energy Conservation Measures

This will be a two hour concentrated workshop designed to provide the attendees with a series of workable low and no-cost energy conservation measures and concepts that will prove to be immediately useful and rewarding. Presented by an instructor with fifteen years of industrial experience, heavily in energy management, the hands-on topics will include:

- Outlining the differences between power (rate of doing work) and energy (the quantity of work) with practical examples
- Developing MBTU values for fuel and electricity
- Generating values in the plant for W-year and P-year, and designating when these values need to be used
- Calculating refrigeration tons and determining chiller performance efficiency

OVER
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- Identifying sources of information for establishing up-to-date energy metering and reporting systems
- Listing of vendors who have established proven track records for performance and competitive prices

A workshop highlight will be the availability to the attendees of technical specification and prices on proven energy management equipment and support devices, some of which will be featured at the concurrent National Plant Engineering & Maintenance Exhibits.

Wayne L. Stebbins
Area Supervisor
Utilities Services
Celanese Fibers Operations
Rock Hill, SC

Tuesday Morning, March 27, 1984
10:30 a.m. – 12:00 noon

Session P3.4

Using Calculations to Determine Energy Analysis, HVAC Design and Steam Generation from Waste

a. Calculator Program to Determine Steam Generation for a Waste Heat Boiler

A program was developed for the TI59 to provide a fairly accurate estimate of steam generation, feedwater, make-up water and feedwater heating requirements for a waste heat boiler system. Equations for enthalpy of the steam and of the gas stream are included within the program. The only inputs required are steam pressure, gas flow (pounds per hour and temperature), blowdown requirements, condensate return fraction and temperature, raw water temperature and boiler efficiency — the program calculates steam and water flows, temperatures, heat generation and efficiency. Results are printed on a PC-100C printer or without a printer, they can be accessed from memory.

Calvin R. Brunner, P.E.
Chief Mechanical Engineer
Malcolm Pirnie, Inc.
White Plains, NY

b. The Use of Personal Computers for Energy Calculations and HVAC System Design

General principles for building energy analysis calculations will be given first, followed by the description of several private sector and public domain computer programs that are available both in the main frame and microcomputer. The unique role that the microcomputer can play to assist the use of comprehensive and main frame energy calculations will be elaborated. Simplifying procedures suitable for microcomputer calculations, such as ASHRAE TC 4.7 method, and the variable base degree-day method, will be described in detail with respect to their approaches, applications and accuracies.

For the HVAC design calculations, commonly used subroutines for psychrometrics, solar heat gain, pipe heat transfer, heating/cooling loads, will be discussed.

Dr. Tamami Kusuda
Acting Chief
Building Physics Division
Center for Building Technology
National Engineering Laboratory
U.S. Department of Commerce
National Bureau of Standards
Washington, DC

Tuesday Afternoon, March 27, 1984
2:00 – 5:00 p.m.

Session P3.5

Ways That Distributed Direct Digital Control (DDDC) Building Automation Systems Can Improve Plant Service, Maintenance and Equipment Longevity (Panel)

An end-user, a manufacturer and a consultant will offer different and very worthwhile viewpoints on how DDDC's can improve internal plant operations and service, and extend equipment life. Here are some of the specifics to be covered in the session —

- Practical end-user's capability for integrating direct digital control into building automation in their maintenance programs
- Training improvements, back-up services, the high level of accuracy in monitoring
- Equipment operating costs and services maintenance costs – the need to analyze
- Device accuracy and redundancy – what is "safe"?
- Software, the use of canned, customized or field programs, or combinations
- Involvement by service and maintenance people
- Benefits of the systems

Panelists:

Phil Simpson
Physical Plant Operations and Energy Manager
Furman University
Greenville, SC

James W. Gartner
BioniControl Corp. of America (BCA)
Cincinnati, OH

Al Butkus
Partner
Grumman and Butkus Consulting Engineers
Evanston, IL

Tuesday Afternoon, March 27, 1984
2:00 – 5:00 p.m.

Session P3.6

Plant HVAC and Temperature Control Systems – Economic and Operational Benefits of Hands-On Training

In today's plant, training is the most under-used means of productivity improvement and cost control, particularly with the HVAC staff. These professionals have specialized training needs. They work with sophisticated equipment in an environment of technological change. Microprocessors and electronics are common in plant HVAC control systems.

Software-based central control systems are used to better operate environmental systems and control energy use. Direct digital control is bringing new approaches to temperature control systems. Many operating engineers need help with existing pneumatic control systems. Proper hands-on training promptly translates into improved operational practices which deliver economic returns far exceeding costs, and can contribute immensely to the personnel side of plant management.

Tim Kennedy
Manager, Customer Training – Honeywell
and
Grant Norris
Manager
Customer Training Service
Honeywell Inc.
Minneapolis, MN

Wednesday Morning, March 28, 1984
9:00 – 10:30 a.m.

Session P3.7

The Benefits of Converting All Reciprocating and AC Systems to One Large 2000 Centrifugal System

An engineering and life cycle cost analysis resulted in installing two 1000-ton centrifugal compressors to replace 50 individual aged reciprocating systems. Implementation of a separate heat recovery concept will enable conserving compressor heat of rejection saving $200,000 annually in process steam heating in addition to $200,000 savings from motor electrical efficiency. Also, in addition, improved reliability and reduced maintenance costs will be achieved from converting to centrifugal style machines. Future plans include controlling the total system with a newly installed energy management system.

The entire plan was computer-modeled showing simulations in the 100–30% load range. These results dictated a control strategy for optimum system performance, power consumption and heat recovery use. Project completion is scheduled for mid 1984 with start of the initial phase by December 1983. The overall plan will save $400,000 annually in energy costs.

Stephen T. Dwyer
Manager-Facilities Engineering
and
Vince Bongio
Plant Engineer
General Electric Company
Syracuse, NY

DEVELOPING AND IMPLEMENTING AN EFFECTIVE ENERGY MANAGEMENT PROGRAM

One of Four Energy Management Workshops

February 20-24, 1984

Revised

This workshop provides you with the keys to successful energy management:

- extensive opportunities to learn from experienced energy managers
- commercial and industrial EM organization case studies
- methods to identify barriers to effective energy management
- proven means for overcoming these barriers

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#483
Developing and Implementing an Effective Energy Management Program
February 20-24, 1984

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Developing and Implementing an Effective Energy Management Program
February 20-24, 1984

Learn the keys to success from effective energy managers in business and industry.

Workshop Objective: Successful energy managers are reducing their firm's energy usage indices by 50 percent within a few years. To do this yourself, you must have a well-organized EM program. You must know the strategies, tactics and specific tools which allow you to assure reliable energy supplies and efficient use in your facilities.

This five-day course will teach you how to:

- identify your organizations critical needs
- organize a successful energy management program to meet your needs
- identify barriers to [illegible] and develop solutions
- utilize methods for [illegible] groups and committees
- incorporate energy into your strategic planning process

Who Will Benefit: The Energy Management Program will benefit management and technical personnel with responsibilities in energy supply use and conservation. Most of the 500 students attending in the past six years have been plant and facility engineers, consulting engineers, or corporate energy managers. Others have included state and federal government and military facility engineers.

Workshop Setting: In a small class—of no more than thirty energy managers—you will discuss each topic with practicing energy managers and energy consultants. Instructors expect you to be ready to discuss energy management in your facilities. This allows you and the other energy managers to compare situations, approaches, and successes.

To augment your discussion, please bring data and supporting material on your energy use, your EM program and your situation.

Also bring a pocket calculator and be prepared to take notes.

Energy Management Manual: You will receive an extensive set of notes. They will support your learning and serve as a reference when you return to work.

Energy Management Diploma Program: This workshop is one of four courses providing comprehensive coverage of the broad range of responsibilities involved in energy management. Qualified individuals completing all courses and an exam may earn a diploma. Some topics in this updated series have been moved to different courses. Please contact the program director if you are interested in the diploma or need details of the changes.

Experienced Program Faculty

. . . drawn from business, industry, government, and universities

Richard H. Cooper, Energy Planning Manager, R. J. Reynolds Industries, Inc., Winston-Salem, North Carolina.

Richard Dahnke, Director of Energy & Engineering, Schreier Malting Company, Sheboygan, Wisconsin

Charles E. Dorgan, Associate Professor; Director, Energy Technology Center, Department of Engineering & Applied Science, University of Wisconsin-Extension, Madison, Wisconsin.

Sandra Gill, Management Consultant, PMR Associates, San Jose, California.

John C. Jenkins, Program Director, Department of Engineering & Applied Science, University of Wisconsin-Extension, Madison, Wisconsin.

Wayne L. Stebbins, Senior Staff Engineer/Energy Management, Fiber Industries, Inc., Greenville, South Carolina.

John S. Steinhart, Professor, Department of Geology and Geophysics, University of Wisconsin-Madison, Madison, Wisconsin.

Jerry D. Wood, Energy Manager, Dayco Corporation, Dayton, Ohio.

outline inside . . .

Developing and Implementing an Effective Energy Management Program
February 20-24, 1984

Outline

Energy Management Organization and the Energy Manager
- Organizational structure
- Goals
- Responsibilities

Charles E. Dorgan

Identifying Your Energy Management Structure—Workshop

Charles E. Dorgan

Developing Effective Energy Management Programs
- Identifying barriers (workshop)
- Developing solutions
  - Problem-solving and decision-making strategies
  - Organizational structures

Sandra Gill

Profile of Today's Energy Coordinator
- Strategy
- Concerns
- Environment
- Tools

Jerry D. Wood

Petroleum Resources
- Why light distillates are critical
- The U.S. and world situation
- The OPEC viewpoint

John S. Steinhart

Energy Managers Responsibilities—Workshop
- First steps
- Developing an EM plan
- Defining what EM will do
- Staff needs
- EM manuals
- Short, medium, and long-range goals
- Using consultants

Charles E. Dorgan and John C. Jenkins

The EM Program at Deere and Company
- Key elements
- Typical projects
- Program results
- Strengths and potential weaknesses

Douglas F. Darby

Energy Resources
- The problem is not over
- What you need to know
- Review of current estimates and forecasts
- Why there will be energy managers in 2020 A.D.

John C. Jenkins

Justifying and Selling EM Programs
- Identifying what you have to offer
- Describing the benefits of EM in terms others will buy

Charles E. Dorgan

Commercial Facility EM Program Case Study
- Philosophy
- Implementation
- Reporting consumption and progress
- Follow-up

(Speaker to be Announced)

Energy Strategic Planning
- Components of a strategic plan
- A successful corporate program
- Developing key issues—workshop
- Strategic planning within the EM department

Richard H. Cooper, Jr.

A Corporate Tuning-Operations-Maintenance Program
- Identifying TOM opportunities
- Coordinating TOM with energy surveys
- Correcting energy inefficiencies
- Determining the economics of TOM
- Using project summary reports

Richard H. Cooper, Jr.

Energy Cost and Availability—Workshop
- Identifying important factors
- Projecting effects on costs and availability

John C. Jenkins and Charles E. Dorgan

Organization and Implementation of a Corporate EM Program
- Basic program organization
- Review of current equipment available
- Techniques to employ
- Pitfalls to avoid
- Evaluating vendor's claims
- Role of the plant energy coordinator (an integrated approach to plant engineering)
- Evaluating a plant's energy management attitude

Wayne L. Stebbins

Utility Monitoring and Reporting Systems—(MRS)
- Evolution of an MRS
- Establishing and justifying the MRS
- Scoring the results
- Practical examples

Wayne L. Stebbins

Typical Daily Schedule

7:45 a.m.	Coffee, juice, donuts and discussion
8:00 - Noon	Lecture, Workshop (with a mid-morning discussion and refreshment break)
12:00 - 1:00	Lunch (provided at Lowell Hall cafeteria)
1:00 - 5:00	Lecture/Workshop (with two afternoon discussion and refreshment breaks)

ENERGY MANAGEMENT DIPLOMA SERIES

Sixth Year

AN ORGANIZED APPROACH TO MANAGING ENERGY
April 9-13, 1984

DEVELOPING A COST EFFECTIVE ENERGY PROJECT INVENTORY
May 21-25, 1984

The two programs presented here are the first of four in our Energy Management Diploma series. This program is now in its sixth year. It has been updated this year to incorporate subjects to meet the latest identified needs of energy management.

There is emphasis on strategic planning, computers, economic analysis, and developing a priority list of energy projects.

Studies have shown that there are substantial remaining opportunities for investment in energy conservation projects, but the competition for funding is also greater. Come learn tried and proven techniques that can greatly enhance your energy management effort.

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LOCATION: Donaldson Brown Center for Continuing Education
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THE COURSE

This course was originally entitled, "The Role of the Energy Manager" and was the second in the four week series. We have restructured it this year, given it a new title, and placed it at the beginning.

The course now includes a step by step procedure for organizing an EM program, successful energy managers discussing what works for them, three sections on computers -- controlling, data acquisition, and P.C. computers for managing energy -- and developing a strategic plan.

Workshop activities are a major part of the program so you can share experiences with others in the class. It is an intensive course, and when you leave you will have had the opportunity to develop your own program plan all the way from basic organizational structure to strategic planning.

COURSE STAFF

GERHARD BEYER, Professor, Chemical Engineering Department, Virginia Tech, Blacksburg, VA

JOHN COOPER, Energy Manager, Miles Laboratories, Elkhart, IN

RICHARD H. COOPER, JR., Manager, Business Planning, R. J. Reynolds Industries, Winston-Salem, NC

WILLIAM H. MASHBURN, Associate Professor, Mechnical Engineering Department, Virginia Tech, Blacksburg, VA

WAYNE L. STEBBINS, Area Supervisor, Utilities Services, Celanese Fiber Company, Rock Hill, SC

JERRY WOOD, Corporate Energy Manager, Dayco Corporation, Dayton, OH

KENNETH WOOLDRIDGE, Coordinator of Human Resources Development, Virginia Tech, Blacksburg, VA

DONALD LENIO, Vice President, Operations, Moses Taylor Hospital, Scranton, PA

ROBERT DELLINGER, Electrical Engineer, Physical Plant Department, Virginia Tech, Blacksburg, VA

***

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COURSE OUTLINE

STEPS IN DEVELOPING AN ENERGY MANAGEMENT PROGRAM - William Mashburn
- Situation Reporting
- Organization
- Budget
- Audits
- Economic Analysis
- Selling the Program
- Using Consultants
- Educational Goals
- Strategic Planning

GROUP DYNAMICS - Kenneth Wooldridge
- Identifying Barriers
- Workshop Problem Solving

PROFILE OF AN ESTABLISHED PROGRAM - Jerry D. Wood
- Organization
- Strategy
- Successful Projects
- Reporting

PROFILE OF A NEW CORPORATE PROGRAM - John Cooper
- Organization
- Strategy
- Reporting
- Successful Projects

EM COMPUTER SELECTION PROCESS - Donald Lenio
- Defining Needs
- Vendor Selection
- Installation
- Follow-up

PERSONAL COMPUTER FOR DATA ACQUISITION - Robert Dellinger
- KW-HR
- Demand
- Facility Tour
- Degree Days
- Steam Flow

PERSONAL COMPUTER FOR REPORTING - Gerhard Beyer
- Spread Sheet
- File Systems
- Word Processing
- Hands on Experience

ENERGY STRATEGIC PLANNING - Richard H. Cooper, Jr.
- Components of a Strategic Plan
- A Successful Corporate Program
- Developing Key Issues Workshop

A CORPORATE TURNING-OPERATIONS-MAINTENANCE PROGRAM - Richard H. Cooper, Jr.
- Identifying TOM Opportunities
- Coordinating with Energy Surveys
- Economics of TOM

ORGANIZATION AND IMPLEMENTATION OF EM - Wayne L. Stebbins
- Basic Organization
- Role of the Plant Energy Coordinator
- Successful Projects

UTILITY MONITORING AND REPORTING - Wayne L. Stebbins
- Evolution of MRS
- Establishing and Justifying the MRS
- Practical Examples

INFORMATION SOURCES - William H. Mashburn
- Publications
- Associations
- People

ROUND ROBIN WORKSHOPS - William H. Mashburn
- Successful Projects
- Problem Solutions

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THE ENERGY MANAGEMENT DIPLOMA PROGRAM

There are four courses available to those wishing further training in energy management. These are:

- EM1 - An Organized Approach to Managing Energy
- EM2 - Developing a Cost Effective Energy Project Inventory
- EM3 - Energy Systems
- EM4 - Energy Design and Analysis

While each week is designed to meet specific needs, all four are coordinated to provide a complete training program in energy management. For those wishing recognition for their effort, a framed diploma is presented upon completion of all four courses and a comprehensive exam.

Attendees in the past have included both technical and non-technical people. They have represented industry, government, hospitals, colleges and universities, consulting firms, and some individuals have come seeking a career change.

Association of Energy Engineers Certification Program

This four week program will prepare you for the AEE certification exam. In cooperation with the AEE, we will be offering that exam at the end of the fourth week. This does not replace our diploma exam but is a further service we will be offering to professionals in the field.

For Your Planning

EM3 - ENERGY SYSTEMS - September 24-28, 1984

EM4 - ENERGY DESIGN AND ANALYSIS - October 22-26, 1984

EMP + EMF PAPERS + WORKSHOP

There is a 5% discount if you sign up for two of the courses and a 10% discount for all four.

ENROLLMENT: Either mail the registration form or phone the Registration Office (703-961-5182) before the program date. If by mail, be sure you have confirmation before coming to the program. Registration in advance is required.

FEE COVERS: Notebooks, program materials, texts, one scheduled dinner each week, and break refreshments. Lodging and other meals are not included.

FOR FURTHER INFORMATION CONTACT:
Professor William H. Mashburn
Mechanical Engineering Department
Virginia Tech
Blacksburg, VA 24061
Phone - (703) 961-6684

TRANSPORTATION: Virginia Tech is accessible by air, rail, and bus transportation as well as by automobile. The nearest commercial airport is [illegible]ke's Woodrum Field which is approximately 40 miles a[illegible] limousine and taxi services are available at [illegible]rt as well as three major car rental services.

REFUND: If a program is cancelled, we will refund your fee. If you have to cancel, you must notify us two weeks before a starting date to be entitled to a full refund.

CALL FOR NAMES OF PERSONS IN YOUR AREA WHO HAVE TAKEN THESE COURSES

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LARRY P. KOSKAN
VICE PRESIDENT
INDUSTRIAL DIVISION RESEARCH

January 17, 1984

Mr. Wayne Stebbins
4312 Inwood Drive
Rock Hill, SC 29730

Dear Wayne:

We are looking forward to your presentation to our Research managers on January 27. We seem to have trouble reaching each other, but I am glad you and Melissa were able to iron out the details of your trip.

Arrangements have been made with American Limousine Service to bring you to our Technical Center. When you pick up your baggage, go to the Suburban Livery Counter located between the United and Britt baggage areas. American Limousine is located at the far right of the counter as you face it. Let them know you have a reservation, and they will have a limo ready.

You will be staying at the Sheraton near our facility the night of the 27th. They have a limo service that will take care of getting you back to O'Hare on Saturday.

I would like to confirm that we will be paying you a fee of $500 for your presentation as well as reimbursing you for your expenses. We will send you a check for the total amount upon receipt of a statement of expenses.

I am looking forward to seeing you, Wayne. In the meantime, if you have any questions, please feel free to call me.

Sincerely,

Larry

Larry P. Koskan, Vice President
Industrial Division Research

mjr

DAILY NEWS RECORD, October 23, 1981

Energy Management Cuts Fiber Firm's Costs $3M

BY STU CAMPBELL

GREENVILLE, S.C. — Energy management and audit programs are two methods being increasingly employed in the textile industry to lower operating costs and increase productivity, according to speakers addressing an energy management and conservation seminar at Textile Hall this week in conjunction with the 1982 Fiber Producers Conference.

W.L. Stebbins of Fiber Industries, session chairman, outlined a nine-point energy management program initiated nine years ago at Fiber Industries' four manufacturing operations in the Carolinas, which have reduced energy consumption by more than 30 per cent.

Stebbins said the projected electricity cost for its plants this year is $22 million. That price tag would have been $35 million without the energy management program, he said.

"In some product lines, the cost of energy is second only to raw materials in terms of cost per pound of final product, and is ahead of labor and capital," he said. "With monthly electric bills of more than $500,000 a plant, even a small reduction in kilowatt demand results in a substantial savings."

The nine points outlined in the Fiber Industries' program are:

- Obtain total management commitment.
- obtain employee cooperation through educational effort.
- make appropriate energy surveys. (an audit may help)
- analyze survey results.
- set conservation goals
- develop reporting formay.
- implement engineering changes.
- provide necessary equipment.
- monitor results.

Stebbins said assigning an energy coordinator at each plant is a key ingredient in any management program. He stressed that continued on-site participation is essential for the success of this kind of program.

Monitoring monthly energy costs and forecasting consumption and resulting dollar variances are prominent features of a successful energy management program. He cautioned that once a commitment is made, it must be an on-going involvement although the cost of the program will decrease as the program becomes more effective.

One of the initial phases of the energy management program is the use of an energy audit, which can reduce over-all energy expenses by as much as 20 per cent, according to W.P. Smith, an executive with Badische Corp.

He said that textiles and other industries have increased their demand for these services in the past few years on one of three levels or degrees.

The first is a walk-through audit, which generally costs about $3,500 and focuses on major energy supplies and demands. He said this kind of audit generally accounts for about 70 per cent of the total energy situation in a plant.

The second, or short, audit reviews about 85 per cent of the total energy picture and costs about $12,500. It goes beyond quantitative estimates of costs and savings and includes engineering recommendations as well as more specific projects and priorities.

The third, or full, audit costs about $100,000 and analyzes about 95 per cent of the total energy pattern in a plant. It offers a complete long-range plan for not only curbing rising energy costs, but actually reducing energy expenses from the level maintained at the time of the audit.

Paybacks on energy audits are usually realized within a few months, according to Smith. "First year return on audit expenses is typically two to five times the cost of the audit," he said. Most firms employing energy audit services experience annual electrical bills of between $500,000 and $10 million.

SOLE SOURCE JUSTIFICATION

Exclusive Capability

Rather than designing a course from scratch, given the time constraints involved in developing and presenting this course, it was preferable to access industrial experts that could bring with them existing course structures and materials that could be modified to the Egyptian situation. The courses taught by Mr. Stebbins at Virginia Polytechnic Institute, the University of Wisconsin and annual Plant Engineering and Maintenance conferences sponsored by the American Society of Mechanical Engineers meet this criteria. The organizations listed in Attachment 2 were solicited for recommendations for courses and instructors. Mr. Stebbbins was the sole expert in his area that was recommended and was willing to participate in the overseas assignment.

Mr. Stebbins has extensive industrial experience as director of energy management activities for Celanese Fibers Company. Since 1972 he has held increasingly responsible positions with FII dealing with major process and energy management projects involving electrical power, controls, instrumentation and computers. He is a nationally recognized expert in the fields of electrical power distribution and energy management. He has done pioneering, innovative work for his company, Celanese Fiber, in defining the role of the plant energy manager. The actualization of this has been in the development of an industrial energy management program, which includes development and administration of energy monitoring and reporting systems for a number of Celanese Fiber plants. He lectures on these subjects at two major universities. The content of these courses (see attached course descriptions) are precisely what are required for ANL's Egyptian Plant Energy Manager's Workshop. The combination of Mr. Stebbins academic background, nationally recognized industrial experience and training expertise make him uniquely qualified to undertake the tasks delineated in this scope of work.

Resume attached.

BIOGRAPHY - CHARLES J. B. MITCHELL

B.S. in M.E. from Rutgers University.

Taught freshman mathematics at Rutgers Evening College during the war years.

Went to work for DeLaval Turbine Company from college. Started as Test Engineer and was finally promoted to Chief Test Engineer. During this time became involved in production and special testing of pumps, compressors, turbines, gears, etc. Transferred to Turbine Department with responsibility for single stage and small multistage turbines.

Joined Du Pont's Engineering Department, Engineering Service Division, in 1952. Retired as Principal Consultant in 1976. During entire Du Pont career worked as Pump Consultant and as Turbomachinery Consultant, was involved with many design and operating problems with pumps, compressors, turbines, etc. To date I have been involved with turbomachinery in all of Du Pont's single line plants.

Since retirement upon request, worked for brief periods as a consultant for the following:

Du Pont Engineering Department (1977, 1978)
Wilmington, Delaware 19898

Arco Chemical Company (1977)
1500 Market Street
Philadelphia, PA 19101

The firm of Dermot Reddy (1978)
140 Cedar Street
New York, N. Y. 10006

ASME Lecturer (1979)
Houston, TX

Jaeco Pump Company (1979)
West Conshohocken, PA 19428

Stearns Roger Corporation (1981)
Denver Company

Midwest Research Institute and Messaglia, Newstrom, Bredson Corporation (1982, 1983)
Kansas City, Missouri

Rewrote and updated Section 6, Chemical Engineers Handbook (6th Edition), McGraw-Hill Publishing Company, to be published in 1984.

Is presenting, with a colleague, a two-day course in AIChE's Continuing Education Program, entitled "Compressors for Chemical Processes". This course is being presented three times each in 1983 and 1984.

ERNEST KNEALE DOCKSTADER
ENGINEERING CONSULTANT
COMPRESSORS & TURBOMACHINERY

226 BUCK TOE HILLS ROAD
KENNETT SQUARE, PA. 19348

215-444-3647
PROFESSIONAL ENGINEER

PROFESSIONAL RECORD

Personal

Born [redacted]

Education	Tufts College	1934	BS in ME
	Massachusetts Institute of Technology	1935	MS in ME
	Continued Education Certificates		

Married
Wife Margaret
Children Four, married

Employment

1935-1936	U. S. Government, Panama Canal - Engineer
1936-1937	Mass. Inst. of Technology - Instructor
1937-1941	Babcock & Wilcox Co., Boiler Manufacturer Standards and Design Engineer
1941-1948	E. I.du Pont de Nemours & Co., Chemicals Industrial Engineer - Plastics, Textile Fibers and Heavy Chemicals Manufacture
1948-1963	E. I. du Pont du Nemours & Co. Mechanical Design Engineer Chemical Plant Process Engineer
1963-1977	E. I. du Pont de Nemours & Co. Supervising Engineer - Compressors and Pumps
1977-	Private Business - Consultant

Professional

Professional Engineer- New York - No. 019926
Pennsylvania - No. PE-031959-E

American Society of Mechanical Engineers - Life Member

American Institute of Chemical Engineers - Member

EXPERIENCE (Continued)

Plant Engineering

Design and operation of chemical process plants

Design of pressure vessels, columns, towers, evaporators, heat exchangers, and other unit process equipment

Safety audit and fault-tree analysis

Atomic engineering - Remote control processing

Very high pressure technology for polymer manufacture

Compressor Engineering

Compressors for air, syn gas, charge gas, corrosive gases

Compressors with shaft seals for hazardous gases

Reciprocating compressors - Lube or non-lube design
Single stage and multi-stage units to 6,000 hp

Centrifugal and axial flow compressor trains to 50,000 hp

Blowers and fans of all sizes

Compressors for high temperature or cryogenic service, for reactor recycling, off-gas recovery, and environmental containment

Specifications for compressors and auxiliaries, piping, lube and seal oil facilities, and instrumentation

Instructions for operation, start-up and maintenance

Driver selection and specification - Motor, Turbine, Engine

Pump Engineering

Centrifugal pumps - Single impeller, multi-stage, deep well

Positive displacement pumps - Gear, Screw, Plunger type

Designs for mixed flow, low NPSH, utility or chemical use

Mechanical seal requirements and flush systems

Pump standardization - Selection for power conservation

Drivers and hydraulic turbines for power recovery

EXPERIENCE (Continued)

Quality and Reliability Assurance

Design and engineering audit

Appraisal of vendor quality control programs

Evaluation of manufacturing deviations

Review of materials of construction

Impact of off-specification operation during start-up, process upsets or at partial load on equipment selection and performance

Rotor dynamic analysis and stability criteria

Vibration measurement on test stand and in field

Performance testing and certification

CLIENTS

US Steel Corporation,
USS Chemicals Division
Houston, Texas

FirstMiss, Inc.

E. I. duPont de Nemours & Co.

Rohm & Hass, Houston, Texas

Container Corporation of America

Sinclair Oil Company

DeLaval Turbine Corporation

General Electric Company

Caltex Petroleum Corporation

L O F Plastics

Airco, Inc.

Interpro Contractors, Ltd.

Koppers Company (Baltimore)

.M.-5:00 P.M.

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of class participation

. $525 to non-members. An
site registration. See page 63.

AIChE Today Series

Atlanta, Houston Anaheim

COMPRESSORS FOR CHEMICAL PROCESSES

Atlanta, Wednesday and Thursday, March 14-15, 1984

Houston, Friday and Saturday, April 6-7, 1984

Anaheim, Wednesday and Thursday, May 23-24, 1984

This course presents the recognized technical theories and engineering principles required for compressor equipment application. The course provides guidelines to the engineer for selection and installation of compressors for specific chemical processes.

Compressor types utilized in chemical service will be described and their performance characteristics defined. The designs necessary for reliable operation as related to mechanical details, rotor stability and shaft sealing will be reviewed. Process control and compressor instrumentation will be discussed with emphasis on safe and economic operation.

FOR WHOM INTENDED

The course is directed to process engineers responsible for supervision of design, construction and operation of compressor facilities

LECTURERS

E. Kneale Dockstader maintains a consulting service in compressor engineering. He was with E. I. du Pont de Nemours & Co. for 37 years in the Engineering Department with field assignments and project management experience. He was section supervisor for 17 years having responsibility for new chemical compressors on diverse applications in industrial plants. He was engaged in specifications, purchase, installation, start-up and maintenance of all types of compressors; ranging from units for process development to large turbocompressor trains for ammonia, nitric acid, methanol, ethylene and polyethylene. These were in-house designed or contract plants with compression facilities purchased from world-wide sources. His work included technical investigations and failure analyses with coordination of specialists in vibration, stress analysis, metalurgical determination, and redesign of equipment to obtain reliable compression systems. He holds a B.S.M.E. from Tufts College and a M.S.M.E. from Massachusetts Institute of Technology.

Charles J.B. Mitchell received his B.S.M.E. from Rutgers University. He went to work for DeLaval Turbine Co. directly from college. He started as Test Engineer and was finally promoted to Chief Test Engineer. During this time he became involved in production and special testing of pumps, compressors, turbines, gears, etc. He transferred to the Turbine Department with responsibility for single-stage and small multistage turbines. He joined Du Pont's Engineering Department, Engineering Service Division, in 1952 and retired as Principal Consultant in 1976. During his Du Pont career he worked as Pump Consultant and as Turbomachinery Consultant and was involved with many design

and operating problems with pumps, compressors, turbines, e
He was involved with turbomachinery in all of Du Pont's sing
line plants.

SCHEDULE

- **First and Second Day— 9:00A.M.-5:00P.M.**

I. Introduction
- A. Compressors in the chemical process industry
- B. Engineering requirements

II. Gas Compression Fundamentals
- A. Adiabatic, isothermal, real gas
- B. Positive displacement compression
- C. Dynamic compression

III. Basic Data, Flow Sheets, Diagrams
- A. Design and off-point operation
- B. Logic analysis, fault-tree analysis
- C. Process data: Accuracy, contaminates, condensibles

IV. Compressor Selection - Overview
- A. Overview
- B. Capacity charts

V. Centrifugal Compressors
- A. Performance
- B. Arrangement
- C. Mechanical design
- D. Controls and monitoring
- E. Auxiliaries
- F. Applications

VI. Axial Flow Compressors
- A. Performance
- B. Mechanical design
- C. Controls and monitoring
- D. Auxiliaries
- E. Applications

VII. Reciprocating Compressors
- A. Performance
- B. Mechanical design
- C. Auxiliaries
- D. Applications

VIII. Compressor Drives
- A. Motor
- B. Turbine
- C. Engine

IX. Miscellaneous Types of Compressors
- A. Lobe
- B. Diaphram
- C. Helical screw
- D. Sliding vane
- E. Liquid Ring

X. Advances in Compressor Engineering

XI. Expanders for Power Recovery (Refrigeration)

XII. Compressor Auxiliary Systems
- A. Oil Systems: lube oil, seal oil, pumps, coolers
- B. Controls: instrumentation, interlocks
- C. Gearing

XIII. Compression Area
- A. Equipment arrangement: access for operation m nance
- B. Structure: outdoor, indoor, platform, foundation

XIV. Procurement
- A. Listing qualified vendors
- B. Specification writing, national standards
- C. Order Control: scheduling, coordination, design a
- D. Compressor Testing: vendor/field

XV. Construction
- A. Coordination with engineering
- B. Equipment inspection and acceptance

XVI. Training of Personnel
- A. Operating instructions/maintenance instructions

XVII. Commissioning
- A. Check-out
- B. Dummy run (preprocess)
- C. Start-up (process)

XVIII. Trouble Shooting

REGISTRATION LIMIT: 50 persons
FEE: $450 to members of AIChE; $525 to non-memb
additional $25 will be charged for on-site registration. See p

RESUME
Revised - November 1979

DAVID FAIRFIELD DYER

Professor, Department of Mechanical Engineering
School of Engineering
Auburn University
Auburn, Alabama 36830

Date and Place of Birth . . . . . [redacted]

Marital Status . . . . . Married, 3 children

EDUCATIONAL BACKGROUND

NSF Postdoctoral Study, Imperial College, University of London, 1966-67

Ph.D., Mechanical Engineering, Georgia Institute of Technology, 1965

M.S.M.E., Mechanical Engineering, Georgia Institute of Technology, 1964

B.S.M.E., Mechanical Engineering, University of Tennessee, 1962

ACADEMIC EXPERIENCE

Undergraduate Teaching Aid, Department of Mechanical Engineering, University of Tennessee, 1961-1962.

Teaching Assistant, School of Mechanical Engineering, Georgia Institute of Technology, 1963-1965.

Research Assistant, School of Mechanical Engineering, Georgia Institute of Technology, 1964-1965.

Assistant Professor, Department of Mechanical Engineering, Auburn University, 1965-1969 (on leave June 1966-August 1967).

Associate Professor, Department of Mechanical Engineering, Auburn University, 1969-1977 (on leave August 1972-December 1973).

Professor, Department of Mechanical Engineering, Auburn University, 1977-present.

INDUSTRIAL - GOVERNMENT EXPERIENCE

Co-op Engineer, ARO, Incorporated, Arnold Air Force Station, Tennessee, alternate quarters, 1958-1961.

Thermal Design Engineer, ARO, Incorporated, Arnold Air Force Station, Tennessee, Summers 1962-1963.

Research Engineer, ARO, Incorporated, Arnold Air Force Station, Tennessee, Summer 1967.

Liaision Scientist, Office of Naval Research, London, August 1972-December 1973.

Project Engineer, FMTS, Incorporated, London, Summer 1974.

ADMINISTRATIVE EXPERIENCE

Project and Co-Project Leader on Industrial and Governmental Supported Research Projects Exceeding $3,000,000 in value over last ten years.

Director, Alabama Energy Extension Service, 1977-1979.

EXTENSION EXPERIENCE

Development and Presentation of Courses

"Recent Advances in Calculation of Separated Flows", Auburn University Engineering Extension, Auburn, May 1968.

"Industrial Energy Conservation", Auburn University Engineering Extension, Birmingham, February 1974.

"Industrial Energy Conservation", Louisiana State University Engineering Extension, Baton Rouge, Louisiana, March 1974.

"Industrial Energy Conservation for Managers", Auburn University Engineering Extension, Birmingham, September 1974.

"Industrial Energy Conservation", Wisconsin University Engineering Extension, Madison, Wisconsin, October 1974.

"Energy Systems", NASA/Huntsville, Alabama, January 1975.

"Boiler Efficiency Improvement", Sponsored by the Federal Energy Administration, Presented at six locations in the State of Alabama, June, July, August 1975.

"Energy Conservation for Industrial Plants and Facilities", Auburn University Engineering Extension, Birmingham, Alabama, October 1975.

"Boiler Efficiency Improvement Seminar", Auburn University Engineering Extension Service, Rock Hill, South Carolina, December 10-11, 1975.

"Analysis of Power Plant Cooling Systems", Auburn University Engineering Extension Service, Auburn, Alabama, February 16-19, 1976.

"Improving Boiler Efficiency", North Carolina State University, Industrial Extension Service, Raleigh, N.C., March 25-26, 1976.

"Energy Systems", Auburn University Engineering Extension Service, Birmingham Office, NASA/Huntsville, Huntsville, Alabama, March 16-17, 1976.

"Boiler Efficiency Improvement Seminar", Auburn University Engineering Extension Service, Rockhill, S.C., September 15-16, 1976.

"Energy Conservation in Industrial Plants and Facilities", Auburn University Engineering Extension Service, Birmingham Office, October 19-20, 1976.

"Boiler Efficiency Improvement", Auburn University Engineering Extension Service, Huntsville, Alabama, January 12-13, 1977.

"Improving the Efficiency and Safety of Boilers and Systems Using Steam", Auburn University Engineering Extension Service for West Point Pepperell, August 1977.

"Energy Conservation, Industrial Plants and Facilities", Auburn University Engineering Extension Service, Mobile, Alabama, August 15-16, 1977.

"Boiler Certification", Auburn University Engineering Extension, Huntsville, Alabama, for the U.S. Army, Two 40-hour Short Courses, March-August 1977.

"Industrial Plant Boilers - Measuring and Improving Efficiency", Cleveland Engineering Society, Cleveland, Ohio, August 15-16, 1977.

"Energy Conservation for Industrial Plants and Facilities", Auburn University Engineering Extension Service, Birmingham, Alabama, October 12-13, 1977.

"Industrial Plant Boilers - Measuring and Improving Efficiency", University of Wisconsin Engineering Extension, Madison, Wisconsin, March 28-29, 1977; March 30-31, 1977; June 13-14, 1977, September 7-8, 1977; September 9-10, 1977; November 21-22, 1977; November 10-11, 1979.

"Boiler Efficiency Improvement", Auburn University Engineering Extension Service and Alabama Development Office Energy Management Board, Auburn, Alabama, December 8-10, 1977, Dothan, Alabama; January 10-12, 1978, Huntsville, Alabama; January 17-19, 1978, Auburn, Alabama; July 24-25, 1979, Birmingham, Alabama; August 1-2, 1979, Mobile, Alabama; October 16-17, 1979, Huntsville, Alabama.

"Industrial Boiler Plants - Measuring and Improving Efficiency", North Carolina State University Extension Service, Raleigh, North Carolina, February 1-2, 1978.

"Boiler Efficiency Improvement", Ball State University and Auburn University Engineering Extension Service, Muncie, Indiana, April 11-12, 1978.

"Boiler Efficiency Improvement Institute", Atlanta, Georgia, August 30-31, 1978; Memphis, Tennessee, September 27-28, 1978; Houston, Texas, October 24-25, 1978; Cleveland, Ohio, November 20-21, 1978; Buffalo, New York, December 6-7, 1978; Chicago, Illinois, December 12-13, 1978; Atlanta, Georgia, December 19-20, 1978; Pittsburgh, Pennsylvania, February 27-28, 1979; Charoletta, North Carolina, March 27-28, 1979; Orlando, Florida, April 11-12, 1979; Dallas, Texas, May 1-2, 1979; Los Angeles, California, June 11-12, 1979; Los Angeles, California, June 13-14, 1979; Boston, Massachusetts, June 18, 1979; Pittsburgh, Pennsylvania, June 28-29, 1979; Utica, New York, July 17-18, 1979; Albany, New York, July 19-20, 1979; Rochester, New York, August 7-8, 1979; Buffalo, New York, August 9-10, 1979; Long Island, New York, August 21-22, 1979; Staten Island, New York, August 23-24, 1979; Binghampton, New York, September 10-11, 1979; Rockland County, September 12-13, 1979; Syracuse, New York, September 14, 1979; Manhattan, New York, September 24-25, 1979; Syracuse, New York, October 23-24, 1979; Atlanta, Georgia, October 30, 1979; Madison, Wisconsin, November 12-13, 1979; Colorado Springs, Colorado, November 14, 1979; Chicago, Illinois, November 15, 1979.

"Hospital Boiler Efficiency Improvement", Hospital Council of Western, Pennsylvania, Pittsburgh, Pennsylvania, September 6-7, 1978.

"Industrial Boiler Efficiency Improvement", University of Massachusetts, Amherst, Massachusetts, October 30-31, 1978.

"Industrial Boiler Efficiency Improvement", Mobile, Alabama, May 30-31, 1978; Montgomery, Alabama, June 7-8, 1978; Jacksonville, Alabama, August 16-17, 1978; Birmingham, Alabama, October 10-11, 1978; Birmingham, Alabama, October 18-19, 1978; Sheffield, Alabama, November 1-2, 1978.

"Boiler/Water Heater Efficiency Improvement", Alabama Energy Extension Service, Birmingham, Alabama, April 19, 1978; Decatur, Alabama, March 15, 1978; Mobile, Alabama, March 9, 1978; Montgomery, Alabama, February 10, 1978; Evergreen, Alabama, May 26, 1978; Scottsboro, Alabama, June 20, 1978; Jacksonville, Alabama, June 21, 1978; Florence, Alabama, July 25, 1978; Huntsville, Alabama, July 27, 1978; Montgomery, Alabama, August 9, 1978; Birmingham, Alabama, August 15, 1978; Tuscaloosa, Alabama, September 12, 1978; Auburn, Alabama, October 3, 1978; Montgomery, Alabama, October 4, 1978; Troy, Alabama, November 9, 1978; Dothan, Alabama, November 10, 1978; Ozark, Alabama, May 23, 1979; Montgomery, Alabama, May 30, 1979; Tri-City, Alabama, July 26, 1979; Birmingham, Alabama, July 31, 1979; Phenix City, Alabama, September 25, 1979; Tuscaloosa, Alabama, November 20, 1979.

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CONSULTING EXPERIENCE

Served as Consultant to:

ARO, Incorporated, Tullahoma, Tennessee, 1968-1970: [Numerical Fluid Mechanics[

CMI Systems, Chattanooga, Tennessee, 1970-1972: [Design of Energy Recovery System]

Rahm and Haas, Huntsville, Alabama, 1968: [Solid Rockets]

FMTS, Waverly, Alabama, 1974/Present: [Numerical Fluid Mechanics]

ESI, Auburn, Alabama, 1975/Present: [Energy Studies]

AMCO, Montgomery, Alabama, 1978: [Boiler Tests]

Price-Waterhouse, Washington, D.C., 1976: [Boiler Efficiency Codes]

Martin Industries, Huntsville, Alabama, 1976: [Performance Testing of Heating Equipment]

Abbott Labs, Chicago, Illinois, 1977: [Boiler Efficiency]

Atlanta Stove Works, Atlanta, 1977: [Stove Efficiency]

Nabisco, Inc., Englewood, New Jersey, 1979: [Boiler Efficiency]

Bristol Myers, Syracuse, New York, 1979: [Boiler Efficiency]

SPONSORED RESEARCH EXPERIENCE

Project Leader, NSF Grant GK1606, "Pressure Drop in a Liquid Nitrogen Cold Trap," September 1967 - September 1968.

Co-Principal Investigator, AMC C1326, "Hypersonic Radiative Flows," Army Missile Command, 1967-1969.

Co-Project Leader, Research Grant-in-Aid Project 156-8, "Investigation of Flame Phenomena in an Oxy-hydrogen Rocket Motor," Auburn University, 1968-1969.

Co-Principal Investigator, AMC 1818, "Hypersonic Radiative Flows," Army Missile Command, AMC C1326, 1970-1971.

SPONSORED RESEARCH EXPERIENCE (CONTINUED)

Project Leader, ME-42, "Freeze Drying of Particle Beds," Auburn University Engineering Experiment Station, 1970-1971.

Co-Project Leader, A-025-ALA, "Reducing Thermal Pollution Through Interstellar Radiation," Water Resources Research Institute, Auburn University, 1971-1972.

Co-Project Leader, Contract N00014-72-C-0177, "Performance of Gas Augmented Waterjet Propulsion System:, Office of Naval Research/ Naval Ship Systems Command, March 1972-July 1973.

Co-Project Leader, Contract N00014-73-A0061-0001, "Investigation of the Design Needs for Submarines of the Future," Office of Naval Research, September 1972-September 1973

Co-Project Leader, Contract A-031-ALA, "Analysis and Design of an Interstellar Radiator System," Water Resources Research Institute, July 1972-July 1973.

Co-Project Leader, Electric Power Research Institute (EPRI-321), "Comparison of Performance, Economics and Reliability of Phased-Cooled with Cooling Towers and Coolings Pond," September 1974-December 1975.

Co-Project Leader, "Evaluation of Techniques to Predict Heat Fluxes, Pressure Drops and Leakages in Steam Generators for the Breeder Reactor Program," General Electric Company, Contract GE-190 ME, September 1974-July 1975.

Co-Project Leader, "Improving Operating Efficiency of Steam Generating Boilers," Contract No. Co-04-50100-00 with Federal Energy Agency, February 1975-December 1976.

Co-Project Leader, "Air-Augmented Waterject Propulsion," Office of Naval Research, Contract No. N00014-75-C-0936, June 1975-December 1976.

Co-Project Director, "Feasibility Study of Combined Dry Cooling Tower and Phased Cooling Systems, Battelle Northwest Lab, Contract BSA-994, June 1975.

Co-Project Leader and Co-Principal Investigator, National Science Foundation, Contract No. LC03995, "Development of Method to Aid in Minimizing Energy Consumption in Pulp and Paper Plants," March 1975/Present.

Project Leader, Alabama Energy Management Board, Contract #422136, 1977.

SPONSORED RESEARCH EXPERIENCE (CONTINUED)

Co-Project Leader, Department of Energy, Contract No. EC-77-S-05-5552, "Improving the Efficiency, Safety, and Utility of Wood Burning Units," September 1977/Present.

Co-Principal Investigator, Alabama Energy Management Board (DOE), Contract No. 4-22131, "Developing and Testing Methods to Perform Energy Audits in Industrial Plants and Facilities," June 1978/ Present.

Project Leader, "Energy Savings Associated with use of Daytime Shutoff of Cooling Systems for Homes," AEMB, Contract ADO-AU-X996, August/ September 1978.

Co-Project Leader, Fireplace Institute, "Efficiency and Output Rating of Home Heating Woodburning Units Using Calorimeter Room," Contract #4-20199, April 1979/April 1981.

Co-Project Leader, Fireplace Institute, Contract No. 4-20199, "Development and Construction of Calorimeter Room to Test Woodburning Units," March 1978/Present.

Co-Project Leader, Monsanto Research Corporation, "Pollution From Home Heating Woodburning Units", February/August 1979.

Project Leader, Vega Industries, "Pyrotechnic Effects on Flamability", October 1979/October 1980.

Co-Project Leader, National Bureau of Standards, "Safety Aspects of Insert Fireplaces in Zero-Clearance Fireplaces", December 1979/ December 1980.

REFERRED PUBLICATIONS

"A Standard for Vapor Pressure Measurement at Low Pressures," Vacuum, 14, (1964), 395, [co-authored with J. E. Sunderland].

"Bulk and Diffusion Transport in the Region between Molecular and Viscous Flow," International Journal of Heat and Mass Transfer, 9, (1966), 519-522, [co-authored with J. E. Sunderland].

"Equilibrium Vapor Pressure of Frozen Bovine Muscle," Journal of Food Science, 31, 2, (1966), 196-201, [co-authored with J. E. Sunderland].

"Transient Temperature Distribution During Sublimation Dehydration," ASME Journal of Heat Transfer, 89, C, 1 (February 1967), 109-110, [co-authored with J. E. Sunderland].

REFERRED PUBLICATIONS (CONTINUED)

"Total Pressure Drop Across a Cold Trap in Low Vacuum Application," British Journal of Applied Physics, 18, 3 (1967), 297-308, [co-authored with J. E. Sunderland].

"Bulk and Diffusion Transport of Gases at Non-Uniform Pressures," Transactions of the Faraday Society, 63, (1967), 573-378.

"A Mathematical Model for Deposition From Turbulent Flows," ASME Journal of Engineering for Power, 90, A2 (April 1968), 164-170, [co-authored with J. Broadway, R. I. Vachon and H. Zallen].

"Heat and Mass Transfer Mechanisms in Sublimation Dehydration," Transactions of ASME, Journal of Heat Transfer, 90, C, 4 (November 1968), 379-384, [co-authored with J. E. Sunderland].

"The Role of Convection in Drying," Journal of Chemical Engineering Science, 23, (1968), 965-970, [co-authored with J. E. Sunderland].

"Quasi-Steady Compressible Flow with Heat Transfer in Accelerating Nozzles and Ducts," Journal of Spacecraft and Rockets, 6, 3, (March 1969), 308-311, [co-authored with R. I. Vachon and W. Chen].

"The Influence of Varying Interface Temperature on Freeze-Drying," Proceedings of International Institute of Refrigeration, (1969). [co-authored with J. E. Sunderland]. Presented at the International Institute of Refrigeration, Lausanne, Switzerland, June 1969.

"A Numerical Solution for the Single-Screw Extrusion of a Polymer Melt," AIChE Journal, 15, 6, 823-838, (1969).

"A Sublimation Dehydration of Particles," Proceedings of the 1970 Southeastern Seminar on Thermal Science, Raleigh, North Carolina, April 1970.

"Comparisons of Theory and Experiment for Turbulent Boundary Layers on Simple Shapes at Hypersonic Conditions," Proceedings of the 1970 Heat Transfer and Fluid Mechanics Institute, 1970, 168-188, [co-authored with A. W. Mayne].

"The Pressure Distribution in a Liquid-Nitrogen Cold Trap," Advances in Cryogenic Engineering, 16, (1970), 268-276, Presented at Cryogenic Engineering Conference, Boulder, Colorado, June 1970.

"Freeze-Drying of Spheres and Cylinders," ASME Journal of Heat Transfer, [co-authored with C. C. Cox].

"Freeze-Drying of Bodies Subject to Radiation Boundary Conditions," Transactions of ASME, Journal of Heat Transfer, 93, C, 4, 426-431, November 1971, [co-authored with J. E. Sunderland].

REFERRED PUBLICATIONS (CONTINUED)

"Application of the Patankar-Spalding Finite Difference Procedure to Turbulent Radiating Boundary Layer Flow," International Journal of Heat and Mass Transfer, 14, (1971), 667-672, [co-authored with J. M. Elliott, R. I. Vachon, and J. R. Dunn].

"An Experimental Study of Particle Freeze-Drying," Proceedings of the XIII International Congress of Refrigeration (1972), [co-authored with Leon Hardin].

"Thrust of an Air-Augmented Waterjet," AIAA Journal of Hydronautics, Vol. 7, No. 2, April 1973, 64-71, [co-authored with R. G. Amos and G. Maples].

"Convective Heat Transfer from a Rotating Inner Sphere to a Stationary Outer Sphere," Transactions of ASME, Journal of Heat Transfer, 95, C, 4, (November 1973), [co-authored with G. Maples and A. Askin].

"Heat and Mass Transfer in Beds of Particles Undergoing Sublimation Dehydration," Transactions of ASME, Journal of Heat Transfer, 95, C, 4, (November 1973), 516-520, [co-authored with Leon Hardin].

"Numerical Solutions of the Integro-differential Equations of High-Speed Radiating Boundary Layers," International Journal of Heat and Mass Transfer, 16, 8, (August 1973), 1649-1651, [co-authored with J. M. Elliott, R. I. Vachon and J. R. Dunn].

"Application of Phased-Cooling to a Once-Through Cooling System," ASME Journal of Engineering for Power, 97, A, 1 (January 1975), 117-124, [co-authored with J. MacFarlane and G. Maples].

"Thrust of an Air Augmented Waterjet with a Converging-Diverging Nozzle," AIAA Journal of Hydronautics, Vol. 9, No. 4, October 1975, [co-authored with T. T. Maxwell and G. Maples].

"Flow through an Elastic Orifice in Subirrigation," Proceedings of the 12th Southeastern Seminar on Thermal Science (June 1976), p. 171-178, [co-authored with G. Maples and L. Hardin].

"Solution Technique for Equilibrium Chemistry of Hydrogen - Oxygen Systems," AIAA Journal, Vol. 14, No. 11, November 1976 [co-authored with G. Maples].

"Performance of Gas-Augmented Waterjet Propulsion System," ASME Marine Propulsion, OED-Vol. 2, pp. 129-150, 1976 [co-authored with J. F. Stansell and G. Maples].

"Safety, Efficiency, Output and Utility Testing, Product Development and Basic Research on Woodburning Units and Accessories at the Auburn Woodburning Laboratory," Proceedings of the Wood Energy Institute III, April 1978 (co-authored with T. T. Maxwell and Glennon Maples).

"Controlling Excess Air For Boiler Efficiency," Heating/Piping/Air Conditioning, November 1978 (co-authored with Glennon Maples, T. T. Maxwell and M. T. Jasper).

REFERRED PUBLICATIONS (CONTINUED)

"Measuring the Efficiency and Heat Output of Residential Wood Heating Appliances", The Wood Energy Institute, March 1979 [co-authored with T. T. Maxwell and G. Maples].

"Studies of Creosote and Chimneys at the Auburn Woodburning Laboratory", The Wood Energy Institute, September 1979 [T. T. Maxwell and G. Maples].

"Woodburning Short Course Handbook", Auburn University Engineering Extension Service, Auburn, Alabama, July 10-11, 1979 [co-authored with T. T. Maxwell, G. Maples, F. Myers, J. Hoyle, and J. Shelton].

"Results of Six Tests to Assess the Accuracy of Flue Loss Testing Methods Versus the Calorimeter Test Procedure", Report to the Fireplace Institute, February 7, 1979 [co-authored with T. M. Pruitt and T. T. Maxwell].

"Mass Injection & Radiative & Convective Heat Transfer in High-Speed Turbulent Flow", Indian Journal of Technology, December, 1976 (co-authored with D.Y. Goswami, R.L. Vachon, J.M. Elliott, & J.R. Dunn).

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Fuel Oil Manual for Boiler Operation, 1979 [co-authored with G. Maples and David M. Hall].

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Measuring and Improving the Efficiency of Boilers (Operator Manual), 1979 [co-authored with G. Maples].

MANUAL

"Measuring and Improving the Efficiency of Boilers", FEA Contract No. FEA-CO-04-50110-00, Washington, D.C., November 1976, [co-authored with G. Maples, J. C. Maxwell, Jr., D. Pride, and W. G. Dickie, Jr.]

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(The following articles were published by the Office of Naval Research - London (ONRL) in the European Scientific Notes which is distributed to 20,000 top scientists and engineers in the U. S. These articles were reviewed by the Editoral staff of ONRL).

"Recent Developments at the Von Karman Institute for Fluid Dynamics," Vol. 26, p. 319, 1972.

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"International Council of Aeronautical Sciences Conference," Vol. 25 p. 322, 1972.

"Mechanics at the University of Glasgow, Vol. 25, p. 331, 1972.

"Applied Math in Fluid Mechanics at Bristol University," Vol. 27, p. 14, 1973.

"Fluid Mechanics at the Israel Institute of Technology, Vol. 27, p. 140, 1973.

"Fluid Mechanics Research at the DFVLR Institute for Theoretical Gas Dynamics, Vol. 27, p. 142, 1973.

Rolls-Royce 'Re-invents' the Wheel and A New Fuel System," Vol. 27, p. 61, 1973.

Paris Conference on Magneto-Hydrodynamics, Vol. 27, p. 80, 1973.

Freeze-Drying at Edwards High Vacuum, Vol. 27, P. 108, 1973.

Design and Inventions Lab, Vol. 27, p. 144, 1973.

Mechanical Engineering at Liverpool University, Vol. 27, p. 176, 1973.

Oil-Free Centrifugal Compressors for Cryogenic Refrigeration, Vol. 27, p. 201, 1973.

A Visit to the University College of Ireland (Eire), Vol. 27, p. 229, 1973.

Heat and Mass Transfer at ETH, Zurich, Vol. 27, p. 258, 1973.

Heat Transfer Seminar, Vol. 27, p. 258, 1973.

Fluid Mechanics at Brown-Boveri Research Center, Vol. 27, p. 281, 1973.

The National Engineering Laboratory, Vol. 27, p. 282, 1973.

The Chamber of Mines in South African Research, Vol. 27, p. 312, 1973.

South African Council for Scientific and Industrial Research, Vol. 27, p. 313, 1973.

The Universities in the Cape Region of South Africa, Vol. 28, p. 40, 1974.

Fluid Mechanic Research in Scandinavia, Vol. 28, p. 40, 1974.

The University of Witwatersrand, Vol. 28, p. 10, 1974.

Engineering Education at the University of Niarobi, Vol. 28, p. 12, 1974.

SASOL - South Africa's Answer to the Energy Crisis, Vol. 28, p. 13, 1974.

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Fluid Mechanics and Finite Elements, R-21-72, December 1972.

Numerical Calculations of Viscous Fluid Problems at Imperial College, London, R-2-73, March 1973.

Report on the Sixth International Conference on Fluid Sealing, Munich, C-15-73, July 1973.

MHD for Power Generation - The View of a Chosen Few, C-10-73, April 1973.

Jet Pumps and Ejectors - Application of Liquid/Two-Phase Ejection in Desalination, C-6-73, February 1973.

CONTRACT REPORTS

"A Discussion of Solution Techniques for the Conservation Equations Applicable to Blast Environmental Effects on Intercept Vehicles," Report II, AMC Contract DAA H01-67-C1326, October 1967, [co-authored with J. M. Elliott, R. I. Vachon, J. R. Dunn, and G. Maples].

"Coupled Boundary Analyses and Inviscid Flow Properties Behind Shocks for Blast Environmental Effects on Hypersonic Vehicles," Report III, AMC Contract DAA H01-67=C1326, Engineering Experiment Station, Auburn University, January 1968, [co-authored with J. R. Dunn, R. I. Vachon J. M. Elliott and G. Maples].

"Inclusion of a Thermal Radiation Source Term in the Patankar-Spalding Boundary Layer Analysis for Hypersonic Flow," Report IV, AMC Contract DAA H01-67-C1326, May 1968, [co-authored with J. M. Elliott, R. I. Vachon, and J. R. Dunn].

"Boundary Layer Analysis for Blast and Environmental Effects on Hypersonic Interceptors," Report V, AMC Contract DAA H01-67=C1326, September 1968, [co-authored with R. I. Vachon, J. R. Dunn, G. Maples, J. M. Elliott, and H. G. Whitley].

"Discussion of Approaches to Analysis Techniques for Blast Environmental Effects on Interceptors," Report I, AMC Contract DAA H01-69-C1818, Engineering Experiment Station, Auburn University, September 1969, [co-authored with J. R. Dunn, R. I. Vachon, and J. M. Elliott].

"Performance of Gas-Augmented Waterjet Propulsion System," ONR Contract N00014-72-C-0177, September 1973, [co-authored with T. Maxwell, J. F. Stansell and G. Maples].

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"Development of a Computer-Aided Conceptual Submarine Design Evaluation Tool, ONR Contract N00014-73-A-0061-0001, November 1973, [co-authored with A. Cotney and G. Maples].

"Mass Flow Distribution Analysis for Steam Generator Economizer," Reece Engineering Associates (for Combustion Engineering), Report No. 2-2, June 1974, [co-authored with R. A. Young and J. W. Reece].

"Feasibility Study of Combined Dry Cooling Tower, Phased Cooling System," Battelle Northwest Laboratory, June 1975, [co-authored with G. Carroll and G. Maples].

"Comparison of Boiling Heat Transfer Correlations for LMFBR Evaporator and Superheater," General Electric Contract No. 190-C5H10G-X, November 1975, [co-authored with P. Blaise, D. Pride and G. Maples].

"Hydrogen Injection into a Supersonic Stream," NASA Technical Report, (in press) 1975, [co-authored with D. B. Spalding and G. Maples].

"Comparison of Performance and Economics of Phased Cooling Systems with Conventional Cooling Systems," Electric Power Research Institute Contract ME 321, January 1976, [co-authored with G. Carroll and G. Maples].

"Program for Improving Boiler Efficiency," an interim report submitted to Federal Energy Administration, Washington, D.C., April 19, 1976, [co-authored with G. Maples, J. Wilbanks, H. T. Cansler, J. C. Maxwell, Jr., and D. Pride].

"Performance of Air-augmented Waterjet Thrusters," Final Report, Office of Naval Research, Contract N00014-75-C-0936, November 1976 [co-authored with G. Maples, H. T. Cansler, and J. C. Maxwell, Jr.].

"Development of Method to Aid in Minimizing Energy Consumption of Pulp and Paper Plants," Quarterly Report, NSF Contract LC03995, August 1976.

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"Development of Method to Aid in Minimizing Energy Consumption of Pulp and Paper Plants", Final Report, NSF Contract LC03995, September 1979, [co-authored with G. Moore, P. A. Barrett, M. T. Jasper, T. T. Maxwell, D. F. Dyer, and G. Maples].

"Energy Savings Associated with Use of Day-Time Shutoff of Cooling Systems for Homes," Alabama Energy Management Board, Contract No. ADO-AU-X996, January 1978 [co-authored with T. Pruitt and G. Maples].

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"Maintenance Manual - BOSS4D Computer Code," Ballistic Missile Defense Systems Command, Huntsville, Alabama, January 1978 [co-authored with S. Elghobashi, A. Thyagaraja, D. B. Spalding and G. Maples].

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"Improving the Efficiency, Safety and Utility of Woodburning Units," Quarterly Report WB-5, Department of Energy, Contract No. ERDA-EC-77-S-05-5552, December, 1978 [co-authored with G. Maples, T.T. Maxwell, I.D. Cooley, L.A. Woodsen, O.A. Badr, T.M. Pruitt, H. Siefien, R.G. Kain and H. Vakili].

"Improving the Efficiency, Safety and Utility of Woodburning Units, Quarterly Report WB-6, Department of Energy, Contract No. DE-AS-05-77-ET-11288, March 1979 [co-authored with G. Maples, T.T. Maxwell, I.D. Cooley, O.A. Badr, C.B. Somerset, J.H. Meighan, T.M. Pruitt, S.J. Juger, J.M. Gudino, H. Siefien, H.M. Aly, T.L. Hughes, D.R. Aiken].

"Improving the Efficiency, Safety and Utility of Woodburning Units," Quarterly Report WB-7, Department of Energy, Contract No. DE-AS05-77-ET-11288, June 1979 [co-authored with G. Maples, T.T. Maxwell, I.D. Cooley, O.A. Badr, C.B. Somerset, J.H. Meighan, T.M. Pruitt, S.J. Juger, J.H. Gudino, H. Siefien, H.M. Aly, T.L. Hughes, D.R. Aiken].

"Design Handbook for Residential Woodburning Equipment," Special Report, Department of Energy, Contract No. DE-AS05-77ET-11288, July 1979 [co-authored with T.T. Maxwell, G. Maples, and T.M. Pruitt].

"Improving the Efficiency, Safety and Utility of Woodburning Units - Special Creosote Report," Department of Energy, Contract No. DE-AS05-77-ET-11288, December 1979 [co-authored with G. Maples, T.T. Maxwell and J. Juger].

"Development of Method to Aid in Minimizing Energy Consumption of Pulp and Paper Plants." Final Report, NSF Contract LC03995, September 1979 [co-authored with G. Maples, T.T. Maxwell, and G. Moore].

"Improving the Efficiency, Safety, and Utility of Woodburning Units," Quarterly Report WB-1, Department of Energy, Contract No. ERDA-EC-77-S-05-5552, December 1978 [co-authored with G. Maples, I.D. Cooley, O.A. Badr, N.J. Stringrellow, C.W. Robinson, and T.T. Maxwell].

"Improving the Efficiency Safety, and Utility of Woodburning Units," Quarterly Report WB-2, Department of Energy, Contract No. ERDA-EC 77-S-05-5552, April 1978 [co-authored with G. Maples, I.D. Cooley, O. A. Badr, N.J. Stringfellow, A. Quam, G.G. Barksdale, and T.T. Maxwell].

"Development of Method to Aid in Minimizing Energy Consumption of Pulp and Paper Plants," Quarterly Report, NSF Contract LC03995, November 1977 [co-authored with G.V. Moore, P.A. Barrett, G. Maples, and T.T. Maxwell].

"Boiler Efficiency Improvement Program for Industry in Alabama," Alabama Energy Management Board (DOE), Contract No. 4-22136, Quarterly Reports 1,2,3,4, and 5, 1978 and Quarterly Reports 6 and 7, 1979 [co-authored with G. Maples, T.T. Maxwell, J.R. Wilbanks, and E. Waldroup].

"Boiler/Water-Heater Efficiency Improvement Program in Alabama for Commercial, Governmental and Institutional Boilers," Quarterly Reports 1,2,3,4,5,6,7, and 8, Alabama Energy Extension Service, Contract No. 4-20184, 1978 [co-authored with J.R. Wilbanks, E. Waldroup, F.A. Jones, J.K. Mims, G. Maples, and T.T. Maxwell].

"Improving the Efficiency, Safety and Utility of Woodburning Units," Quarterly Report WB-3, Department of Energy, Contract No. ERDA-EC-77-S-05-5552, June 1978 [co-authored with G. Maples, T. T. Maxwell, I.D. Cooley, O.A. Badr, N.J. Stringfellow, G. Barksdale, and L.J. Gordon].

"Improving the Efficiency, Safety and Utility of Woodburning Units," Quarterly Report WB-4 Volumes I, II, and III, Department of Energy, Contract No. ERDA-EC-77-S-05-5552, September 1978 [co-authored with G. Maples, T.T. Maxwell, I.D. Cooley, O.A. Badr, G.A. White, N.J. Stringfellow, T. Pruitt, G. Barksdale, H. Siefien, A.E. white, II, and H.W. Polinitz, III].

"Boiler/Water-Heater Efficiency Improvement forCommercial, Institutional and Small Industrial Sectors," Final Report, Contract No. EC-77-G-01-5091, March 1980 [co-authored with G. Maples, T.T. Maxwell, J.R. Wilbanks, Kevin Mims, Tommy Burch, Edward Waldroup].

"Improving the Efficiency of Industrial Boilers," Alabama Energy Management Board, Contract No. AEMB 207 and 205, Quarterly Reports, 1978 and 1979 [co-authored with G. Maples, Kevin Mims, and T.T. Maxwell].

PRESENTED PAPERS

"Heat and Mass Transfer Mechanisms in Sublimation Dehydration," ASME Winter Annual Meeting, Pittsburgh, November 1967.

"The Influence of Varying Interface Temperature on Freeze-Drying," International Congress of Refrigeration, Lausanne, Switzerland, June 1969.

"Sublimation Dehydration of Particles," Southeastern Seminar on Thermal Science, Raleigh, North Carolina, April 1970.

"Comparison of Theory and Experiment for Turbulent Boundary Layers on Simple Shapes at Hypersonic Conditions," 1970 Heat Transfer and Fluid Mechanics Institute at U.S. Naval Postgraduate School, Monterey, California, June 1970.

"The Pressure Distribution in Liquid Nitrogen Cold Trap," 1970 Cryogenic Engineering Conference, Boulder, Colorado, June 1970.

"Freeze-Drying of Bodies Subject to Radiation Boundary Conditions," ASME Heat Transfer Conference, Tulsa, Oklahoma, August 1971.

"Performance of Gas-Augmented Waterjet Propulsion System," ASME Winter Annual Meeting, December 1976.

INVITED LECTURES, SEMINARS AND TECHNICAL BRIEFINGS

Prediction of Pressure Drop in a Cryogenic Cold Trap, Rice University, Houston, March 1965.

Numerical Analysis, Tennessee Technological University, September 1968.

Use of Film Theory to Predict Mass Transfer in a Solid Rocket and Motor, Rahm & Haas, Huntsville, Alabama, 1968.

Numerical Analysis for Solving Separated Flows, Southeastern Seminar on Thermal Science, Gainesville, Florida 1969.

Prediction of Radiation in Hypersonic Flows, Southeastern Seminar on Thermal Science, Cookeville, Tennessee, 1972.

Hypersonic Radiative Flow, University of Achen, Achen, Germany, February 1973.

Combined Forced and Diffusion Flux, University of Witwatersrand, Johannesburg, South Africa, November 1973.

INVITED LECTURES, SEMINARS AND TECHNICAL BRIEFINGS (CONTINUED

Novel Advances in Two-Phase Propulsion, Rolls-Royce Co., Conventry, England, October 1973.

Research Interest of ONR, Technion, Hiafa, Israel, April 1973.

Freeze-Drying of Particle Beds, Irish Sugar Corporation, Carlow, Ireland, June 1973.

Novel Propulsion Ideas, Battelle Laboratories, Geneva, Switzerland.

Energy Conservation in United States, Imperial College, London, England, December 1974.

An Energy Conservation Program for Industry, Federal Energy Administration, March 1975.

Recent Advances in Energy Conservation, Stanford University, Stanford, California, April 1975.

Process Energy Savings, Clemson University, Clemson, S.C., April 1975.

Turbulent Boundary Layer Predictions, NASA/Langley Research Center, Hampton, Virginia, September 1975.

Energy Conservation - Some Success Stories, United States Department of Commerce, Washington, January 1976.

A Boiler Efficiency Improvement Program, FEA, Washington, August 1976.

"Improving the Efficiency of Generating and Using Steam", West Point Pepperell, December 1, 1977.

The Energy Situation, League of Women Voters, Auburn, January 1978.

The Alabama Energy Extension Service, Food and Energy Council, August 1978, Louisville, Kentucky.

"Performance Testing of Wood Heating Equipment", The Fireplace Institute, March 1979, Palm Springs, California.

"Improving Boiler Efficiency", Roses (Growers), Inc., November 1979, Colorado Springs, Colorado.

DAVID F. DYER (CONTINUED)

SCIENTIFIC AND PROFESSIONAL ORGANIZATION

American Society of Mechanical Engineers

Registered Professional Engineer - State of Alabama #10868

PATENT

"Dryer with Low Temperature Heat Recovery System," U.S. Patent #4,026,035 May 31, 1977, (co-authored with G. Maples).

HONORARY SOCIETIES

Society of the Sigma Xi
Phi Kappa Phi
Tau Beta Pi
Pi Tau Sigma

HONORS AND AWARDS

Nominated by Auburn University for ASEE Outstanding Research Award, 1969.

Guest of Westinghouse "Careers in Marketing Seminar and Workshop," Pittsburgh, 1968.

National Science Foundation Research Initiation Grant GK1606, September 1967.

National Science Foundation Postdoctoral Fellowship, June 1966.

Selected for ONR/London Liaision Scientist.

President, Boykin/Drake PTA, 1979-1980.

DAVID F. DYER (CONTINUED)

COMMITTEES

Member Ad Hoc Committee for Study of Pre-Engineering Curriculum

Chairman, Engineering School Self-Study Committee - Graduate Program 1972

Member, Thermal Science Curriculum Committee, 1968/1977

Chairman, Thermal Science Curriculum Committe, 1975/1977

Member, University Self-Study Committee - Research Program, 1972

Chairman, Engineering School Self Study Committee for Graduate Program, 197

Co-chairperson, University Ad Hoc Committee on Energy Conservation, 1975

Member, University Committee on Engineering Experiment Station, 1978

Chairman, Mechanical Engineering Committee on Graduate Program 1978

Member, Graduate Steering Committee 1978/Present

Member, ASHRAE Standard Development Committee for Measuring Performance of Wood Heating Equipment, 1979/Present

Member, Engineering Committee, The Fireplace Institute, 1979/Present

REVIEWER

ASME Journal of Heat Transfer

ASME Journal of Engineering Power

International Journal of Heat and Mass Transfer

AIAA Journal

Journal of Food Science

Applied Mechanics Reviews

National Bureau of Standards (Energy Related Inventions)

SECURITY CLEARANCE

Secret, 1967/Present

TEXT AND COURSE MATERIALS USED FOR PLANT ENERGY MANAGER WORKSHOP (MAY 19-21, CAIRO) AND RETAINED BY OEP AND TRAINEES

- Advisory on Rotor Dynamics - CAGI (55 copies)
- Thermo Electron Mechan. Vapor Recompression System (21 copies)
- Electrical Power Meas. Handbook - YEW (55 copies)
- Fundamentals of Flow Metering TDS 3031 - Rosemount (55 copies)
- Sample pipe markers (150)
- Dranetz User's Guide for Series 808 Electric Power/Demand Analyzer (5 copies)
- Brady Signmark Division Catalog (4 copies)
- Rotary Positive Displacement Compressors - Louis Allis (50 copies)
- Gestra Condensate Manual (4 copies)
- Cardboard Steam Loss Calculator - Furmanite (58 copies)
- Leak Sealing Catalog - Furmanite (4 copies)
- Yewflow Vortex Flowmeter Bulletin (3 copies)
- Model YFCT Flow Computing Totalizer Bulletin (4 copies)
- Speed Measuring Instruments - Biddle (5 copies)
- Testing and Measuring Instruments for the Professional - AEMC (4 copies)
- Series 808 Electric Power/Demand Analyzer (4 copies)
- Power Factor Measurement - Power Factor Correction Catalog (4 copies)
- Energy Conservation Tech. Bulletins (55 copies - 1 sheet ea.)
- Reprint - Which Flexible Coupling - 71/72 Power Transmission & Bearing Handbook (48 copies)
- Hydraulically Fitted Hubs, Mounting and Dismounting Procedures - Koppers (48 copies)
- Hydraulically Fitted Hubs, Theory and Practice - Koppes (48 copies)
- Maintenance Management - Rev. Ed., Lawrence Mann, Jr. - 2 copies

TEXT AND COURSE MATERIAL - continued

- o Analog Control Techniques and Tuning - Babcock & Wilcox (55 copies)
- o Engineering and Product Applications Handbook, Bulletin K-20 (55 copies)
- o Dwyer Control and Gages Catalog (5 copies)
- o Energy-Conserving Technologies for Industry, ANL/CNSV-TM-129 (2 copies)
- o Sulzer Centrifugal Compressor Catalog (43 copies)
- o Errata sheet for Course Sessions 4.0, 5.0 and 6.0 (65 copies)
- o Nashua Thermal Transparencies TF-30 (1 box/100)
- o Faber Castell Overhead projection markers (2 doz. assorted colors)
- o Course Outlines (55 copies)
- o Test for Course Sessions 4.0, 5.0 and 6.0 (55 copies)
- o Collection of bound notes for sessions 4.0, 5.0, 7.0 (55 copies)
- o Textbook "Energy Conservation Program Guide for Industry and Commerce (EPIC)"
- *o Westinghouse Watt/Hour Meter with 6" fan blade and small 115V electric motor (1)
- o Dresser Clark Bulletin #336, "Multistage Centrifugal Compressors" (45 copies)
- o Dresser Clark Bulletin #343, "Balance/Opposed Reciprocating Compressors" (45 copies)
- o AIChe Handbooks - 55 copies each as follows:

  "Compressors for Chemical Processes"
  "Pump Technology"
  "Process Design for Energy Conservation"

- o Textbook, "Plant Design and Economics for Chemical Engineer" (55 copies)
- o Workbook, "Steam Efficiency Improvement" by David Dyer (55 copies)
- o Workbook, "Boiler Efficiency Improvement" by David Dyer (55 copies)

*Personal property of Instructor used for demonstration purposes

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APPENDIX

3.8.1-4

PLANT ENERGY MANAGER

WORKSHOP II PROPOSAL

ARGONNE NATIONAL LABORATORY
9700 South Cass Avenue, Argonne, Illinois 60439
Telephone 312/972-3727

March 12, 1985

Dr. Hussein Abdallah
Organization for Energy Planning
1 Aisha Taymouria
Garden City, Cairo
Egypt

Dear Dr. Abdallah:

As you requested, I have asked Marshall to arrange for a second plant energy manager workshop to be held in early May before Ramadon.

Enclosed you will find a course outline prepared by Marshall Monarch for the Second Plant Energy Manager Workshop to be held in the Cairo area from May 4 through May 16. Although Marshall believes the first workshop to be a complete success, he has made some changes based on the learning experience that should make this second workshop even more meaningful.

The basic change for this second workshop involves spending more time on the more important subjects. This change also involves using fewer instructors, thereby providing better continuity in the flow of information. It appeared disconcerting to the attendees to have five different instructors during a two-week period, perhaps due to the adjustment in their accent and English usage.

The specific changes Marshall has made for OEP involvement are as follows:

- Provided for an OEP staff member to discuss the OEP Industrial Energy Conservation Program,
- Provided for an OEP staff member to discuss the current activity of OEP in energy audits, and
- Provided for an OEP staff member to explain the overview and orientation of the workshop.

The above sessions give OEP high visability in all aspects of the industrial energy conservation program. Marshall will be available to provide assistance, as a silent partner, in the preparation of the session material.

The specific changes Marshall has made regarding the U.S. instructors are as follows:

- Dr. David Dyer has been retained to deal with combustion and steam systems. His course received the highest marks from Marshall and

the plant energy managers. He is given an extra day to present his material, based on previous attendee comments.

- Mr. Wayne Stebbins, Plant Energy Coordinator for Celanese Fibers Operations, has been retained. He had only 1-1/2 days of instruction last May which was a common complaint of the attendees. He will now be instructing for three days, adding to the fundamental instruction of what a plant energy manager is and what he/she does. As an electrical power engineer, Wayne will also speak on what to do to save energy during power disturbences based on his experience and papers he has presented at technical sessions.

- The discussion of preventative maintenance has been expanded considerably. Sol Cordaro will give a three-day presentation on this very important topic. Mr. Cordaro has a prepared workshop course in this area and has developed his own workshop manual that is well received in the U.S. Enclosed you will find some background information on Mr. Cordaro.

- Instructor R. J. Larson who presented material on Energy Conservation and Economics has been dropped because the material was too difficult for most of the trainees to absorb in the short period of instruction.

- Instructors C. Mitchell and E. Dockstader were dropped, again because the material was too specialized for most of the plant energy managers to grasp during the short period of instruction.

I trust that you will find this workshop agenda satisfactory. The schedule that has been developed cannot be changed for May. It took Marshall some time to get people on board to fill a continuous schedule of two weeks. Even so, at the date of this letter, extension of our PASA is unclear, and without a timely extension of this agreement we cannot process the procurement paperwork to contract with the three instructors. These contracts must go out as a Sole Source Contract (as opposed to a solicitation for an RFP as in the case of Foster Wheeler) that involves a considerable amount of paperwork to justify not going through the usual process.

Also enclosed you will find Marshall's estimate of the cost of the workshop based on effort, travel and text material. If you have any problem with the schedule or anticipated cost of the course, please let me have a cable as soon as possible.

Sincerely,

Thomas

Thomas D. Wolsko
Energy and Environmental Systems Division

TDW:bf
Enclosures

PLANT ENERGY MANAGER WORKSHOP
May . 1985
Cairo, Egypt

TIME	MAY 4	MAY 5
9:00-10:10	MOD. 1 - Energy Conservation Policy Review 1.0 Opening Remarks (to be designated by OEP)	MOD. 2 - Combustion System Efficiency (Dr. David Dyer) 1.0 Fundamentals of Combustion
10:10-10:25	Break	Break
10:25-11:35	2.0 OEP Mission for Energy Conservation (Dr. Hussein Abdallah)	2.0 Tuning Boiler, Oven, Furnace and Dryer Burners for Maximum Efficiency
11:35 11:50	Break	Break
11:50-1:00	3.0 OEP Industrial Energy Conservation Program (OEP staff member)	2.0 Continued 3.0 Workshop on Case Studies Examples and Student Exercises
1:00-3:00	Lunch	Lunch
3:00-4:30	4.0 OEP Industrial Survey and Audit Program Activity (OEP staff member)	3.0 continued
4:30-5:00	Break	Break
5:00-6:30	5.0 Workshop Overview and Orientation (OEP staff member)	3.0 continued 4.0 Highlight Review of Material for Exam

PLANT ENERGY MANAGER WORKSHOP
May 1985
Cairo, Egypt

TIME	MAY 6	MAY 7
9:00-10:10	MOD. 3 Boiler System Efficiency (Dr. David Dyer) 1.0 Introduction	MOD. 3 - continued 6.0 Importance of Water Quality - Theory/Practice in Treatment and Testing
10:10-10:25	Break	Break
10:25-11:35	2.0 Specific Methods to Improve Boiler Efficiency - 25 Ways to Reduce Fuel Cost	7.0 Operation/Maintenance for Boiler/Steam Systems - Checklist of Actions for Efficiency and Safety 8.0 Waste Heat Recovery
11:35 11:50	Break	Break
11:50-1:00	3.0 Measurement of Boiler Performance - Direct and Indirect Methods	9.0 Boiler Controls/Burners 10.0 Management of Boiler Efficiency Program
1:00-3:00	Lunch	Lunch
3:00-4:30	4.0 Workshop on Case Studies, Examples and Student Exercises	11.0 Workshop on Case Studies, Examples and Student Exercises
4:30-5:00	Break	Break
5:00-6:30	4.0 continued 5.0 Highlight Review of Material for Exam	11.0 continued 12.0 Highlight Review of Material for Exam

PLANT ENERGY MANAGER WORKSHOP
May . 1985
Cairo, Egypt

TIME	MAY 10	MAY 11
9:00-10:10	OFF	MOD.5 Energy Conservation Program & Management (W. Stebbins) 1.0 U.S. Perspective on Industrial Energy Conservation Program
10:10-10:25	Break	Break
10:25-11:35	OFF	2.0 U.S. Perspective on Role of Industrial Plant Energy Manager
11:35 11:50	Break	Break
11:50-1:00	OFF	3.0 Establishment of Positive Energy Manager Attitudes
1:00-3:00		Lunch
3:00-4:30	OFF	4.0 Workshop on Case Studies, Examples and Student Exercises
4:30-5:00	Break	Break
5:00-6:30	OFF	4.0 continued 5.0 Highlight Review of Material for Exam

PLANT ENERGY MANAGER WORKSHOP
May 1985
Cairo, Egypt

TIME	MAY 8	MAY 9
9:00-10:10	MOD 4. Steam Systems (Dr. David Dyer) 1.0 Design of New Steam Systems and Retrofit of Existing Systems	MOD. 5 Boiler Field Demonstration Case Study and Exam Review (Dr. David Dyer) 1.0 Boiler Field Demonstration 2.0 Case Study and Exam Review
10:10-10:25	Break	Break
10:25-11:35	2.0 Philosophy of Steam System Process, Efficiency Improvement and Heat Recovery	1.0 continued 2.0 continued
11:35 11:50	Break	Break
11:50-1:00	3.0 Condensate Return System - Steam Traps, High Pressure Condensate Return and Waste Heat Recovery	1.0 continued 2.0 continued
1:00-3:00	Lunch	Lunch
3:00-4:30	4.0 Workshop on Case Studies, Examples and Student Exercises	3.0 Exam for Mod. 2, 3, and 4
4:30-5:00	Break	Break
5:00-6:30	4.0 continued 5.0 Highlight Review of Material for Exam	4.0 Exam Review

PLANT ENERGY MANAGER WORKSHOP
May . 1985
Cairo, Egypt

TIME	MAY 14	MAY 15
9:00-10:10	MOD. 8 Anticipative Maintenance (Sal Cordaro) 1.0 Anticipative Maintenance -- A Technological Approach to Maintenance	MOD. 8 Continued 6.0 Vibration Analysis 7.0 The "Shock Pulse" Method for Rolling Element Bearing
10:10-10:25	Break	Break
10:25-11:35	2.0 The Nature of Failures	8.0 Other Predictive Maintenance Techniques
11:35 11:50	Break	Break
11:50-1:00	3.0 The Elements of Anticipative Maintenance	9.0 Establishing an Effective Preventive Maintenance Program
1:00-3:00	Lunch	Lunch
3:00-4:30	3.0 (continued) 4.0 SOAP and Other Contaminant Monitoring Techniques	9.0 (continued)
4:30-5:00	Break	Break
5:00-6:30	5.0 Highlight Review of Material for Exam	10.0 Highlight Review of Material for Exam

PLANT ENERGY MANAGER WORKSHOP
May 1985
Cairo, Egypt

TIME	MAY 12	MAY 13
9:00-10:10	MOD. 6 Industrial Energy Monitoring and Reporting Systems (W. Stebbins) 1.0 Energy Monitoring and Reporting System (EMR) Overview	MOD. 7 Industrial Power Line Disturbances (W. Stebbins) 1.0 Identification of Types of Power Disturbances
10:10-10:25	Break	Break
10:25-11:35	2.0 Setting Up a Plant EMR System	2.0 Procedures for Orderly Shutdown of Process Equipment during Power Disturbance
11:35 11:50	Break	Break
11:50-1:00	2.0 continued	3.0 Equipment Currently Available to Minimize Power Line Disturbance Impact
1:00-3:00	Lunch	Lunch
3:00-4:30	3.0 Workshop on Case Studies, Examples and Student Exercises	4.0 Exam for MOD. 5, 6 and 7
4:30-5:00	Break	Break
5:00-6:30	3.0 continued 4.0 Highlight Review of Material for Exam	5.0 Exam Review

SEMINAR INFORMATION

The Industrial Extension Service and the Division for Lifelong Education of North Carolina State University are pleased of offer this seminar as part of their responsibility to improve North Carolina's industrial capacity through technical education.

SEMINAR SCHEDULE - Registration will be held from 8:30 to 9:00 a.m. with class from 9:00 a.m. to 5:00 p.m. each day. Registration and class sessions will be conducted at the North Carolina State University McKimmon Center, corner of Western Boulevard and Gorman Street, Raleigh, N.C., telephone (919) 737-2261. Free parking is available at the seminar site.

HOTEL ACCOMMODATIONS - Nearby accommodations to the campus are: the Quality Inn Mission Valley, Avent Ferry Road, (919) 828-3173; the Velvet Cloak Inn, 1505 Hillsborough Street, (919) 828-0333; and the Raleigh Hilton, 1707 Hillsborough Street, (919) 828-0311. Please make your reservation direct with one of the above or any other facility of your choice. All are within proximity to the campus, but not within walking distance of the McKimmon Center.

CONTINUING EDUCATION UNITS (CEUs) - Individuals satisfactorily completing this course will be awarded 0.7 CEUs for each day of instruction. To receive CEUs, a minimum of 80 percent of entire course attendance is required. The CEU is a nationally recognized uniform unit of measurement designed to permanently record an individual's non-credit continuing education accomplishments in increments of 1 CEU per 10 contact hours of instruction. A record of CEUs earned may be obtained 30 days after a program completion date by writing the Registrar, Box 7313, NCSU, Raleigh, NC 27695-7313. This request must include Social Security Number.

ON-SITE PRESENTATION - This course can be made available to your organization for an on-site presentation, or customized for your special needs. For further information about the content of this course, please contact Charles Cooper, NCSU, School of Engineering, Box 7902, Raleigh, NC 27695-7902, or phone (919) 737-2356.

REGISTRATION FEE: $540.00 per person

The registration fee includes attendance, luncheons, coffee breaks, necessary supplies and a manual on preventive maintenance. Lodging is not included in the fee. A 10% team discount is extended to companies having three or more persons attend. Foreign registration fees must be paid by Official Bank Check or money order payable in U.S.A. dollars. Telephone Alice [illegible] (919) 737-2261 for

ABOUT THE INSTRUCTOR

Mr. Salvatore T. Cordaro, President of CORD ASSOCIATES, a management consulting firm specializing in maintenance, is considered a highly qualified authority on the organization and application of the maintenance function in industry. He is an experienced manager having worked twenty-two years in chemical manufacturing operations, plant maintenance and engineering. For a number of years he was an internal consultant on the corporate staff of Air Products and Chemicals Corporation where he was able to develop and apply many of the state-of-the-art techniques he currently teaches and recommends to his clients.

Mr. Cordaro is a graduate of the New York State Maritime College and the Polytechnic Institute of New York where he earned his Bachelor of Chemical Engineering degree. He has completed graduate level training in Business Management at New York University's Graduate School of Business Administration and The Polytechnic Institute.

Mr. Cordaro has worked much of his career as a maintenance management consultant and has been very active in seminar presentations on the most current concepts and techniques. He has been a lecturer for the North Carolina State University Division for Lifelong Education since 1978, has written several maintenance management texts and in addition, has presented several papers at regional and national Plant Engineering and Maintenance Conferences.

Advance Registration Form

ANTICIPATIVE MAINTENANCE: A Total Approach to Preventive Maintenance, Predictive Maintenance and Other Techniques

North Carolina State University, Jane S. McKimmon Center, Raleigh, North Carolina

February 12-13, 1985

PROGRAM NUMBER 0913-385-1

SOC. SEC. NO. (1-9)		DATE
NAME (11-49)		
FIRM/ORG. (11-49)		
TITLE (11-49)		

FEE: $540.00 - Check must accompany registration.

Telephone _____

Signature _____

Make checks payable to: NORTH CAROLINA STATE UNIVERSITY

Mail to: NORTH CAROLINA STATE UNIVERSITY
Division for Lifelong Education
Box 7401

PLANT ENERGY MANAGER WORKSHOP
May . 1985
Cairo, Egypt

TIME	MAY 16	
9:00-10:10	MOD. 8 continued 11.0 The Corrective Maintenance Approach	
10:10-10:25	Break	Break
10:25-11:35	12.0 Establishing Equipment Records -- A Prerequisite to Anticipative Maintenance	
11:35 11:50	Break	Break
11:50-1:00	13.0 The Anticipative Maintenance Organization	
1:00-3:00	Lunch	Lunch
3:00-4:30	14.0 Exam for MOD. 8	
4:30-5:00	Break	Break
5:00-6:30	15.0 Exam Review	

RESUME

S. T. CORDARO

Mr. Salvatore T. Cordaro, President of CORD ASSOCIATES, a management consulting firm specializing in maintenance, is considered a highly qualified authority on the organization and application of the maintenance function in industry. He is an experienced manager having worked twenty-two years in chemical manufacturing operations, plant maintenance and engineering. For a number of years he was an internal consultant on the corporate staff of Air Products and Chemicals Corporation where he was able to develop and apply many of the state-of-the-art techniques he currently teaches and recommends to his clients.

Mr. Cordaro is a graduate of the New York State Maritime College and the Polytechnic Institute of New York where he earned his Bachelor of Chemical Engineering degree. He has completed graduate level training in Business Management at New York University's Graduate School of Business Administration and The Polytechnic Institute.

Mr. Cordaro has worked much of his career as a maintenance management consultant and has been very active in seminar presentations on the most current concepts and techniques. He has been a lecturer for the North Carolina State University Division for Lifelong Education since 1978, and the Pennsylvania State University Continuing Education System since 1982. He has presented a number of papers at regional and national Plant Engineering & Maintenance Conference since 1979 and has written a number of texts used in his seminar programs.

INSTRUCTOR DATA

Instructor	Address and Phone No.	Passport No.	Itinerary Dates				
			Departure USA	Arrived Cairo	Orientation	Class Instruction	Departure Cairo
David Dyer	Boiler Efficiency Institute, P.O. Box 2255 Auburn, AL 36830 (205)826-4575		May 3, 1984	May 4, 1984	-	May 5,6,7,8,9 (5 days)	May 10
Wayne Stebbins	[redacted] work (803)329-6016		May 8	May 9	May 10	May 11,12,13	May 14
Sal Cordaro	Cord Associates 922 N. 26th St. Allentown, PA 18104 (215)433-5020		May 11	May 12	May 13	May 14,15,16	May 17

INSTRUCTOR COST WORKSHEET I

	Effort Days				
Instructor	Travel	Orientation	Course Preparation	Course Instruction	Total
David Dyer	2	1	5	5	13
Wayne Stebbins	2	1	3	3	9
Sal Cordaro	2	1	3	3	9

INSTRUCTOR COST WORKSHEET II

Instructor	No. Effort Days	Effort Cost $270/day	Per Diem Days	Per Diem Cost $30/day	Hotel Days	Hotel[a] Cost $60/day	Air Fare Cost[a] ($)
David Dyer	13	3510	8	240	7	420	2000
Wayne Stebbins	9	2430	6	180	5	300	2000
Sal Cordaro	9	2430	6	180	5	300	2000
Total	31	8370	20	600	17	1020	6000

Notes: [a]Estimated cost.

WORKSHOP TEXT MATERIAL COSTS

Instructor	Textbook Information	Cost $/Copy	No. Copies	Shipping Cost[d] ($)	Total Cost ($)
David Dyer	Boiler Efficiency Improvement[a]	20	60		1200
	Steam Efficiency Improvement[b]	9	60		540
	Energy Conservation Program Guide[c]	7.50	60		450
				1,000	1,000
	Subtotal				3,190
Sal Cordaro	Anticipated Maintenance. A Maintenance Concept for the 80s.	14	~~60~~ 55		840
				300	300
	Subtotal				1,140
Wayne Stebbins	Session papers, reproduced at ANL.		60		
	Subtotal			100	160
	TOTAL				4,490

Notes: [a]60 copies delivered to OEP for May 1984 Workshop.

[b]60 copies delivered to OEP for May 1984 Workshop.

[c]55 copies delivered to OEP for May 1984 Workshop.

[d]Estimate based on 1984 costs.

INSTRUCTOR COSTS

Instructor	Effort	Hotel[a]	Per Diem	Airfare[b]	Visa	Transport[b]	Misc.[b]	Total Cost
David Dyer	3510	420	240	2000	10	50	20	6250
Wayne Stebbins	2430	300	180	2000	10	50	20	4990
Sal Cordaro	2430	300	180	2000	10	50	20	4990
Subtotal	8370	1020	600	6000	30	150	60	16,230
Total Text Materials								4,490
Total								20,720

Notes: [a]Estimate based on 60 $/night.

[b]Estimate.

FOSTER WHEELER ENERGY CORPORATION

110 SOUTH ORANGE AVENUE · LIVINGSTON, NEW JERSEY 07039 · PHONE 201-533-1100

December 5, 1984
Letter 2.1-3
File 2.1, 2.3

Technical Representative
Argonne National Laboratories
Argonne, IL 60439

Attention: Mr. M. Monarch

FWEC Contract 11-35625
Argonne National Laboratories
Energy Audits & Audit Training in Egypt
TRANSMITTAL OF DELIVERABLES 2, 3 & 6

Gentlemen:

FWEC is pleased to transmit the documents and material necessary to meet the requirements of deliverable Number 2, Number 3 and Number 6 all of which apply to Subtask 1B of our contract.

These deliverables are:

1. Deliverable #2 Pre-Audit Course Instruction Package
   Quantity: 1
   Due Date: End of week 1
   (Dec. 15, 1984)
   • Items included are:

   a. Pre-Audit Course Instructions Package-w/ copies of Overheads & Related Material and Course Outline
   b. Text Books - Handbook of Energy Audit
      - Industrial Energy Conversion Manuals (3 Vol.)
   c. Energy Conservation Forms
   d. Software For - Energy Consumption Summary
      - Energy Consumption Per Production Unit
      - Conversion Factors

2. Deliverable #3-Pre-Audit Course Material for Trainees
   Quantity: 16 Sets for Trainees: Plus 3 file sets
   Due Date: End of week 1
   (Dec. 15, 1984)
   Items Included are:
   As Deliverable #2 above, but excluding Paragraph(d) Software.

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3. Deliverable #6-Pre-Audit Data Analysis Package
   Quantity: 1
   Due Date: December 22, 1984
   Note that this analysis software is already included above as Paragraph (d)

   Of Deliverable #2 - It is not resubmitted as per your instruction.

For your reference, we include the summary of deliverable items as an attachment herewith, marked to reflect deliverables completed.

Please advise if any further information or clarification would be of value to you.

Very truly yours,

FOSTER WHEELER ENERGY CORPORATION

C. E. Kastner, Jr.

CEK:lt

cc: H. Feintuch - (FW)
Dr. R. Cirillo (ANL) w/2 sets Deliverable #3 & Summary List
T. Wolsko (ANL)
R. Houghton (ANL)

Attachments: Deliverable #2 (1 set)
Deliverable #3 (17 sets)
Summary List (All cc's)

12/5/84

EGYPTIAN ENERGY AUDIT PROGRAM

SUMMARY OF DELIVERABLE ITEM SCHEDULE

SUB TASK	DELIVERABLE	TITLE	TIME (END OF WEEK)
1A	1	Plant Selection Report (2)	2
1B	2	~~Pre Audit Course Instruction Pkg~~ 12/5/84	1
1B	3	~~Pre Audit Course Mtl for Trainees~~ 12/5/84	1
1B	4	Pre Audit Course Test Results	5
1B	5	Pre Audit Course Evaluation Report	5
1C	6	~~Pre Audit Data Analysis Package~~ 12/5/84	2
1C	7	Pre Audit Draft Report (2) & Presentation(ANL OEP)	4/5
1C	8	Pre Audit Report (2) & Presentation (PLT Mgmt)	5
1C	9	Pre Audit Final Report	6
1D	10	Audit Course Instruction Pkg	3
1D	11	Audit Course Mtl for Trainees	4
1D	12	Audit Course Test Results	8
1D	13	Audit Course Evaluation Report	8
1E	14	Audit Data Analysis Package	5
1E	15	Audit Draft Report/Presentation (ANL OEP)	9/10
1E	16	Audit Report/Presentation (PLT Mgmt)	10/11
1E	17	Audit Final Report	12

End of Week	1	2	3	4	5	6	7	8	9
Deliverable(s)	(2,3)	(1,6)	(10)	(11,7)	(4,5,14,8)	(9)	( )	(12,13)	(15)

10	11	12
(15,16)	(16)	(17)

FOSTER WHEELER ENERGY CORPORATION

110 SOUTH ORANGE AVENUE · LIVINGSTON, NEW JERSEY 07039 · PHONE 201-533-1100

January 22, 1985
Letter #2.1-18
File 2.1, 1.2

Technical Representative
Argonne National Laboratories
Argonne, IL 60439

Attn: M. Monarch

FWEC Contract 11-35625
Argonne National Laboratories
Energy Audits & Audit Training in Egypt
Deliverable #4

Gentlemen:

This letter serves to transmit the following data for deliverable number four which is satisfied by this data.

Deliverable #4 contents:

1. Graded homework assignment No.1
2. Graded homework assignment No.2
3. Graded final examination.
4. Confidential summary of the individual and overall grade for each trainee.
5. Answers to final exam and blank final exam (held from deliverable #10 letter #2.1-9).

As a convenience to your records, we include herewith, as an attachment, the updated summary of deliverables for the project.

In the event that further discussion or clarification is required, please contact the undersigned.

Very truly yours,

FOSTER WHEELER ENERGY CORPORATION

C.E. Kastner, Jr.

CEK/ne

cc: H. Feintuch
T. Wolsko (ANL)
R. Houghton (ANL)

1/22/84

EGYPTIAN ENERGY AUDIT PROGRAM

SUMMARY OF DELIVERABLE ITEM SCHEDULE

SUB TASK	DELIVERABLE	TITLE	TIME (END OF WEEK)
1A	1	~~Plant Selection Report (2)~~ 12/20/84	2
1B	2	~~Pre Audit Course Instruction Pkg~~ 12/5/84	1
1B	3	~~Pre Audit Course Mtl for Trainees~~ 12/5/84	1
1B	4	~~Pre Audit Course Test Results~~ 1/22/85	5
1B	5	Pre Audit Course Evaluation Report	5
1C	6	~~Pre Audit Data Analysis Package~~ 12/5/84	2
1C	7	~~Pre Audit Draft Report (2) & Presentation (ANL OEP)~~ 1/21/85	4/5
1C	8	Pre Audit Report (2) & Presentation (PLT Mgmt)	5
1C	9	Pre Audit Final Report	6
1D	10	~~Audit Course Instruction Pkg~~ 1/12/85	3
1D	11	~~Audit Course Mtl for Trainees~~ 1/16/85	4
1D	12	Audit Course Test Results	8
1D	13	Audit Course Evaluation Report	8
1E	14	~~Audit Data Analysis Package~~ 1/12/85	5
1E	15	Audit Draft Report/Presentation (ANL OEP)	9/10
1E	16	Audit Report/Presentation (PLT Mgmt)	10/11
1E	17	Audit Final Report	12

End of Week	1	2	3	4	5	6	7	8	9
Deliverable(s)	(2,3)	(1,6)	(10)	(11,7)	(4 5,8)	(9)	( )	(12,13)	(15)

10	11	12
(15,16)	(16)	(17)

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FOSTER WHEELER ENERGY CORPORATION

110 SOUTH ORANGE AVENUE · LIVINGSTON, NEW JERSEY 07039 · PHONE 201-533-1100

February 24, 1985
Letter #2.1- 28
File 2.1, 10.2

Technical Representative
Argonne National Laboratories
Argonne, Il 60439

Attn: Mr. Monarch.

FWEC Contract 11-35625
Argonne National Laboratories
Energy Audits & Audit Training
in Egypt
Deliverable #5

Gentlemen:

This letter serves to document and to formally transmit the "Preaudit course evaluation report ", as completed and made available on 1/31/85, thus completing the requirements for transmittal #5.

As a convenience to yours records, we include herewith, as an attachment, the updated summary of deliverables for the project.

In the event that further discussion or clarification is required, please contact the undersigned.

Veru truly yours,

FOSTER WHEELER ENERGY CORPORATION

C.E. Kartner, Jr.

CEK/ba

cc: H. Feintuch
T. Wolsko (ANL)
R. Houghton (ANL)

1/22/85
1/24/85 #19
1/27/85 #20
1/31/85 #28
(2/24/85)

EGYPTIAN ENERGY AUDIT PROGRAM

SUMMARY OF DELIVERABLE ITEM SCHEDULE

SUB TASK	DELIVERABLE	TITLE	TIME (END OF WEEK)
1A	1	~~Plant Selection Report (2)~~ 12/20/84, 1/27/85 (w/comments)	2
1B	2	~~Pre Audit Course Instruction Pkg~~ 12/5/84	1
1B	3	~~Pre Audit Course Mtl for Trainees~~ - 12/5/84	1
1B	4	~~Pre Audit Course Test Results~~ 1/22/85	5
~~1B~~	~~5~~	~~Pre Audit Course Evaluation Report~~ 1/31/85	~~5~~
1C	6	~~Pre Audit Data Analysis Package~~ 12/5/84	2
1C	7	~~Pre Audit Draft Report (2) & Presentation (ANL OEP)~~ 1/21/85	4/5
1C	8	~~Pre Audit Report (2) & Presentation (PLT Mgmt)~~ 1/24/84	5
1C	9	Pre Audit Final Report	6
1D	10	~~Audit Course Instruction Pkg~~ 1/12/85	3
1D	11	~~Audit Course Mtl for Trainees~~ 1/16/85	4
1D	12	Audit Course Test Results	8
1D	13	Audit Course Evaluation Report	8
1E	14	~~Audit Data Analysis Package~~ 1/12/85	5
1E	15	Audit Draft Report/Presentation (ANL OEP)	9/10
1E	16	Audit Report/Presentation (PLT Mgmt)	10/11
1E	17	Audit Final Report	12

End of Week	1	2	3	4	5	6	7	8	9
Deliverable(s)	(2,3)	(1,6)	(10)	(11,7)	(4 5,8 14)	(9)	( )	(12,13)	(15)

10	11	12
(15,16)	(16)	(17)

PREAUDIT COURSE EVALUATION REPORT

BY

FOSTER WHEELER ENERGY CORPORATION

FOR

ARGONNE NATIONAL LABORATORY

CONTRACT #44006402

WORK ORDER #44016402

25Y

TABLE OF CONTENTS

1.0 INTRODUCTION

2.0 SUMMARY AND RECOMMENDATIONS

3.0 DISCUSSION

APPENDIX: SURVEY QUESTIONNAIRE

1.0 Introduction:

Foster Wheeler Energy Corporation (FWEC) as a contractor to Argonne National Laboratory (ANL) has prepared and has presented a pre-audit training course as a part of its work scope under the contract.

This report provides an evaluation of the course as presented, and porvides recommendations foı course improvement, as well as recommendations for additional course work.

2.0 Summary and Recommendations:

The preaudit training course, of nominally 3 days duration, is intended to provide the student with a systematic approach to data collection on a plant which is considered for audit.

The course, as presented, met this objective, and provided a basis, and its logic, for the preaudit.

In parallel with the training, two actual preaudits were made, thus providing "on the job" training.

Slightly over 90% of the trainees rated the course good to excellent on an overall weighted basis.

Comments received most frequently were: the course provided a systematic, or well organized approach, more case studies or in depth case studies are required (desired) and more training/discussion on the use of measuring instruments is required (desired).

Recommendations by FWEC are:

1) Attempt, when not prohibitive for other reasons, to provide classroom training in advance of implementation of audit and/or "on the job" training.

2) Provide a subordinate course, or an extension of current course, planned to display case studies, Probably this should be a "working group" course, in which the problem should be given to the group, and a solution generated by the group, to compare with the case study answer.

3.0 Discussion:

3.1 General:

The preaudit training program was presented by FWEC to teach the engineering personnel of OEP to conduct preaudits. (A subsequent course will be presented to teach the detail of the audit itself, including use of instruments.)

The objectives of the preaudit, as defined for this project, are as follow:

- o learn about the plant and its operation,
- o collect and analyze preaudit data,
- o develop initial ideas for both no cost/low cost and investment energy conservation opportunities, and
- o plan for the audit.

3.2 Execution:

The training program was conducted in three - one day classroom sessions, with homework, followed by a final examination.

Attendance and classroom participation was good, and all individuals passed the course.

3.3 Comments Received:

3.3.1 The main comment received, in response to the question which asked "what did you actually gain by attending?" was that the course provided a systematic, and well organized approach to preaudit.

Actually, this message was the primary objective of the training and appears to have hit the mark well.

3.3.2 An additional frequent comment received requested more case studies, and greater depth in case studies.

FW intended to use case studies only in brief, to emphasis a point. Quite possibly future programs should be extended to involve a

working group environment, to develop and work out the case studies, begining with the problem and finishing with a comparison of the group(s) solution to the actual experience.

3.3.3 A lesser comment received requested greater discussion/training in the use of instruments.

This training lies outside of the scope of preaudit, and is to be dealt with on the future audit training program (Subtask 1D)

3.3.4 The remaining comments could be summarized as generally commenting on the concept of preaudit as a full one step audit, or on individual thoughts relating to execution of training.

3.4 Final Results:

The homework grading, and the final examination dispalyed a typical bell shaped distribution. This indicates that the course material fell within the groups capability, and that an understanding the material could be achieved by any (all) students who put forth the effort.

Classroom participation, in large part, was good, and "on the job" training rounded out the course by utilization of the same approach in the field.

3.5 Survey Forms:

The actual forms, with comments, as used to obtain student input, are included as an Appendix to this report.

A summary of comments is included on the following page.

SUMMARY OF COMMENTS

5. What were you objectives in attending this Course, Seminar, Workshop, etc. and to what extent were they met?

   - o covered all objectives, really excellent
   - o no meaning without completing the audit
   - o collecting info on conservation
   - o how to make preaudit
   - o can not understand this question
   - o learning how audit is conducted and ECO'S
   - o understand more about preaudit and its arrangement
   - o not in depth

6. What did you actually gain by attending?

   - o how to achieve preaudit to any plant and how to behave as an energy engineer
   - o systematic method to perform preaudit to achieve proper audit
   - o systematic approach, collect and analyse data
   - o scheduling of time, good thinking and good contact with U.S.Engineers
   - o can now prepare preaudit program
   - o how to analyse data and use forms
   - o new concepts, clear info on preaudit
   - o new ideas, concentrated knowledge and info how to conduct preaudit
   - O organizing skills, deeper view of preaudit
   - o procedure and formats for preaudit

7. Referring to your answer to question No. 6, how do you anticipate being able to apply this to your job?

   - o how to plan audit program
   - o using instruction package and forms will make preaudit easier
   - o use systematic method
   - o it is now easy to apply preaudit
   - o able to apply it by nearly 85%
   - o use of forms
   - o easy to apply to job, preaudit 1st is the way to go
   - o info will be of great benefit to my job
   - o using these skills and developing them to match our needs
   - o nearly the same presented, the same applies practically in our preaudit

8. Would you recommend this program for other employees and why or why not?

   - o yes (no reason given)
   - o yes (incredible value)
   - o yes (good, systematic, scientific)
   - o yes (program a good one)
   - o no (in Egypt fear of production loss interferes with conservation)
   - o yes (but must also learn about instruments)
   - o yes (more case studies, instruments)
   - O yes (because of its importance)
   - o no (no reason given)
   - o no (no need, already covered by engineers participating in audits)
   - o blank response

* Questions 1 to 4 are scoring - no comments

Summary of Comments cont.

9. Other comments.

- need more case studies in ECO'S
- more details about case studies
- case studies must provide more info
- our comments should be carried out
- tools and material available in advance
- time available for practical training is limited

APPENDIX

SUMMARY EVALUATION

1. Your Name Samir Eskander Department OEP

2. Name of Course, Seminar, Workshop Attended.

Preaudit Course

3. Sponsored By Whom, Where, When?

Foster Wheeler Energy Corporation.

4. How would you rate this Course, Seminar, Workshop, etc. with regards to:

	Excellent	Very Good	Good	Fair	Poor	Does Not Apply
a. Practical Value	✓					
b. Achievement of Objectives	✓					
c. New Concepts	✓					
d. Comprehensiveness of Coverage	✓					
e. Adherence to Outline	✓					
f. Use of:						
Visual Aids	✓					
Case Studies	✓					
Discussions	✓					
Outside Assignments	✓					
g. Conference or Trng. Ldr.						
Poise, Confidence and Control of Group	✓					
Accepted by Group	✓					
Knowledge	✓					
h. Facilities	✓					
I. OVERALL RATING	✓					

(OVER)

5. What were your objectives in attending this Course, Seminar, Workshop, etc. and to what extent were they met?

The Course Covered all objectives, and it is realy excellent.

6. What did you actually gain by attending?

How to achive pre audit to any plan, and how to behave as Energy. Engineer.

7. Referring to your answer to question No. 6, how do you anticipate being able to apply this to your job?

How to plan pre audit program for any plant and pre parting for Audit.

8. Would you recommend this program for other employees and why or why not?

Yes, For plant energy manager.

9. Other Comments.

Need more case study in ECO's.

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SUMMARY EVALUATION

1. Your Name _____ Department _____

2. Name of Course, Seminar, Workshop Attended.

PREAUDIT COURSE

3. Sponsored By Whom, Where, When?

_____

4. How would you rate this Course, Seminar, Workshop, etc. with regards to:

	Excellent	Very Good	Good	Fair	Poor	Does Not Apply
a. Practical Value	✓					
b. Achievement of Objectives	✓					
c. New Concepts	✓					
d. Comprehensiveness of Coverage	✓					
e. Adherence to Outline	✓					
f. Use of:						
Visual Aids	✓					
Case Studies		✓				
Discussions		✓				
Outside Assignments		✓				
g. Conference or Trng. Ldr.						
Poise, Confidence and Control of Group	✓					
Accepted by Group	✓					
Knowledge	✓					
h. Facilities	✓					
I. OVERALL RATING	✓					

(OVER)

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5. What were your objectives in attending this Course, Seminar, Workshop, etc. and to what extent were they met?

6. What did you actually gain by attending:

Systematic method To perform a pre Auidit to achieve a proper. Audit.

7. Referring to your answer to question No. 6, how do you anticipate being able to apply this to your job?

Adhering to the provided instruction Package and forms by(Fw) will make it easier to achieve Our goal Preaudit.

8. Would you recommend this program for other employees and why or why not?

I strongly recommend this program for other employees for The following reasons :—

1. incredible value.
2. Simple To be applied.
3. Systematic Sequence.
4. Scientific approach.

9. Other Comments.

I Suggest

a. Using Metalic Tags & wire will Serve a wider range (higher Temp.)

b. More details about Case Studies required

Ude

SUMMARY EVALUATION

1. Your Name Ahmed Adel Abd El Hamid Department _____

2. Name of Course, Seminar, Workshop Attended.

   Preaudit Course

3. Sponsored By Whom, Where, When?

   O.E.P, in O.E.P Center from 6/1/1985 to 24/1/1985

4. How would you rate this Course, Seminar, Workshop, etc. with regards to:

	Excellent	Very Good	Good	Fair	Poor	Does Not Apply
a. Practical Value			✓			
b. Achievement of Objectives		✓				
c. New Concepts		✓				
d. Comprehensiveness of Coverage			✓			
e. Adherence to Outline	✓					
f. Use of:						
Visual Aids		✓				
Case Studies	✓					
Discussions		✓				
Outside Assignments	✓					
g. Conference or Trng. Ldr.						
Poise, Confidence and Control of Group		✓				
Accepted by Group	✓					
Knowledge			✓			
h. Facilities		✓				
I. OVERALL RATING		✓				

(OVER)

5. What were your objectives in attending this Course, Seminar, Workshop, etc. and to what extent were they met?

I think that your Talk about Energy Conservation accompanied by Economic studies.

6. What did you actually gain by attending?

I gained some informations about Energy and systematic approach to the subject of Energy. I think that now we can collect and analyse the data and define factories in which Energy Conservation must be made.

7. Referring to your answer to question No. 6, how do you anticipate being able to apply this to your job?

now I believe that we are able to apply this systematic method to many jobs

8. Would you recommend this program for other employees and why or why not?

I recommend this program for other employees because this a very good systemic and scientific method to deal with Energy Conservation

9. Other Comments.

I hope that practical studies to Energy Conservation be made using instrumentation in a very near future.

SUMMARY EVALUATION

1. Your Name ALY ELSAYED AHMED Department _____

2. Name of Course, Seminar, Workshop Attended.

PREAUDIT

3. Sponsored By Whom, Where, When?

O.E.P FROM 6/1/85 TO 24/1/85

4. How would you rate this Course, Seminar, Workshop, etc. with regards to:

	Excellent	Very Good	Good	Fair	Poor	Does Not Apply
a. Practical Value				✓		
b. Achievement of Objectives		✓				
c. New Concepts			✓			
d. Comprehensiveness of Coverage		✓				
e. Adherence to Outline	✓					
f. Use of:						
Visual Aids		✓				
Case Studies			✓			
Discussions		✓				
Outside Assignments			✓			
g. Conference or Trng. Ldr.						
Poise, Confidence and Control of Group	✓					
Accepted by Group	✓					
Knowledge			✓			
h. Facilities		✓				
I. OVERALL RATING						

(OVER)

5. What were your objectives in attending this Course, Seminar, Workshop, etc. and to what extent were they met?

MY OBJECTIVE IS TO KNOW HOW TO MAKE AN ENERG PREAUDIT

I THINK THE COURSE (ESPECIALLY VISITING THE FACTORIES) WAS VERY GOOD

6. What did you actually gain by attending?

THE ACTUAL GAIN IS HOW TO ANALYZE THE DATA AND USE OF THE ENERGY FORMS

7. Referring to your answer to question No. 6, how do you anticipate being able to apply this to your job?

I THINK THE USE OF THESE FORMS WILL FACILIATE MY WORK

8. Would you recommend this program for other employees and why or why not?

YES, I RECOMMEND IT, but I must be completed by a course in Audit and how to use the instruments

9. Other Comments.

I PREFER THE CASE STUDIES MUST BE COMPLETE i.e THE CASE STUDY MUST MENTION THE CASE OF THE FACTORY BEFORE ANY IMPROVEMEN.

SUMMARY EVALUATION

1. Your Name MOHAMED MANSOUR Department _____

2. Name of Course, Seminar, Workshop Attended.

PREAUDIT COURSE

3. Sponsored By Whom, Where, When?

SPONSORED BY OEP, IN OEP CENTER, FROM 6-1 TO 24-1-1985

4. How would you rate this Course, Seminar, Workshop, etc. with regards to:

	Excellent	Very Good	Good	Fair	Poor	Does Not Apply
a. Practical Value					☒	
b. Achievement of Objectives		☒				
c. New Concepts			☒			
d. Comprehensiveness of Coverage		☒				
e. Adherence to Outline	☒					
f. Use of:						
Visual Aids	☒					
Case Studies		☒				
Discussions		☒				
Outside Assignments				☒		
g. Conference or Trng. Ldr.						
Poise, Confidence and Control of Group		☒				
Accepted by Group			☒			
Knowledge	☒					
h. Facilities			☒			
I. OVERALL RATING		☒				

(OVER)

5. What were your objectives in attending this Course, Seminar, Workshop, etc. and to what extent were they met?

(i) They were :- 1- Collecting the suitable informations about conservation to help in our program in energy conservation

(ii) They were met at 70 %.

6. What did you actually gain by attending?

I gained "how I can prepare a preaudit program at its articles to walk through this program."

7. Referring to your answer to question No. 6, how do you anticipate being able to apply this to your job?

I'll be able to apply with nearly 85 %.

8. Would you recommend this program for other employees and why or why not?

No, because, in Egypt, most of engineers in factories know how they can conserve waste energy but may be they have not investment or have not enough time stop machines and repair these parts fearing (from their view) that repair may affect the production

9. Other Comments.

SUMMARY EVALUATION

1. Your Name _____ Department _____

2. Name of Course, Seminar, Workshop Attended.

   PREAUDIT COURSE.

3. Sponsored By Whom, Where, When?

   Sponsored by D.E.P. in DEP Center, from 6-1 to 24-1/1985.

4. How would you rate this Course, Seminar, Workshop, etc. with regards to:

	Excellent	Very Good	Good	Fair	Poor	Does Not Apply
a. Practical Value					■	
b. Achievement of Objectives			■			
c. New Concepts				■		■
d. Comprehensiveness of Coverage	■					
e. Adherence to Outline		■				
f. Use of:						
Visual Aids						■
Case Studies				■		
Discussions			■			
Outside Assignments		■				
g. Conference or Trng. Ldr.						
Poise, Confidence and Control of Group	■					
Accepted by Group	■					
Knowledge	■		■			
h. Facilities					■	
I. OVERALL RATING			■			

(OVER)

5. What were your objectives in attending this Course, Seminar, Workshop, etc. and to what extent were they met?

It's better if we complete the Audit but it has no meaning without completing the all project.

6. What did you actually gain by attending?

time schedual - good thinking & good contact with ~~American~~ American peoples and understanding the pre audit

7. Referring to your answer to question No. 6, how do you anticipate being able to apply this to your job?

It's easy to apply preaudit inside our factories for our group of engineering

8. Would you recommend this program for other employees and why or why not?

Yes I recommend this program for other employees because this program is a good one.

9. Other Comments.

SUMMARY EVALUATION

1. Your Name _____ Department _____

2. Name of Course, Seminar, Workshop Attended.

   Renault Course

3. Sponsored By Whom, Where, When?

   _____

4. How would you rate this Course, Seminar, Workshop, etc. with regards to:

	Excellent	Very Good	Good	Fair	Poor	Does Not Apply
a. Practical Value		✓				
b. Achievement of Objectives		✓				
c. New Concepts	✓	✓				
d. Comprehensiveness of Coverage						
e. Adherence to Outline		✓				
f. Use of:						
Visual Aids		✓				
Case Studies				✓		
Discussions			✓			
Outside Assignments			✓			
g. Conference or Trng. Ldr.						
Poise, Confidence and Control of Group			✓			
Accepted by Group			✓			
Knowledge			✓			
h. Facilities		✓				
I. OVERALL RATING		✓				

(OVER)

5. What were your objectives in attending this Course, Seminar, Workshop, etc. and to what extent were they met?

This question is not clear, So I have no answer

6. What did you actually gain by attending?

- New Concepts, more information
- real method for applying a Preaudit to be able to apply Audit
- The Instructions of PREaudit is So clear

7. Referring to your answer to question No. 6, how do you anticipate being able to apply this to your job?

- I anticipate that it is very easy to apply this in my Job if our budget Covers all what we need
- in my openion It is a good way to start our energy Conservat through Preaudit then an audit
- The Concept is available in a certain industries at first then Forall

8. Would you recommend this program for other employees and why or why not?

I recommend This Program Forall employes and I hope that we give more Case studies, more tools and instrument more time For achieving our energy Conservation I hope that through Preaudit we go Forward and strongly to an audit

9. Other Comments.

I Prefer to take an idea about details of Course that we will take to have our Comments and our share in this Course

I mean books and materials of Course to be available before the start of Course

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SUMMARY EVALUATION

1. Your Name _____ Department _____

2. Name of Course, Seminar, Workshop Attended.

Preaudit training course

3. Sponsored By Whom, Where, When?

Dr. H. Feintuch at N.E.P., Cairo, Egypt

4. How would you rate this Course, Seminar, Workshop, etc. with regards to:

	Excellent	Very Good	Good	Fair	Poor	Does Not Apply
a. Practical Value			✓			
b. Achievement of Objectives			✓			
c. New Concepts				✓		
d. Comprehensiveness of Coverage			✓			
e. Adherence to Outline		✓				
f. Use of:						
Visual Aids			✓			
Case Studies			✓			
Discussions			✓			
Outside Assignments			✓			
g. Conference or Trng. Ldr.						
Poise, Confidence and Control of Group		✓				
Accepted by Group		✓				
Knowledge		✓				
h. Facilities			✓			
I. OVERALL RATING			✓			

(OVER)

5. What were your objectives in attending this Course, Seminar, Workshop, etc. and to what extent were they met?

- Not in depth

6. What did you actually gain by attending?

- procedure for preaudit
- good formats for preaudit

7. Referring to your answer to question No. 6, how do you anticipate being able to apply this to your job?

Nearly the same presented, the same applied practically in our preaudit

8. Would you recommend this program for other employees and why or why not?

No need, it was already covered for all engineering participating in audits.

9. Other Comments.

- Lack of case studies with detailed energy conservation projects & recommendations.
  All the presented in the course have results only.
- Instrumentation & measure, it is better to be included in preaudit course not audit course.
- Entrance to energy conservation scientific & technical aspects, will be benefit, not only procedure as presented

SUMMARY EVALUATION

1. Your Name _____ Department _____

2. Name of Course, Seminar, Workshop Attended.

   Preaudit Course.

3. Sponsored By Whom, Where, When?

   Pu Factor Wheeler

4. How would you rate this Course, Seminar, Workshop, etc. with regards to:

	Excellent	Very Good	Good	Fair	Poor	Does Not Apply
a. Practical Value				✓		
b. Achievement of Objectives			✓			
c. New Concepts			✓			
d. Comprehensiveness of Coverage			✓			
e. Adherence to Outline			✓			
f. Use of:						
Visual Aids			✓			
Case Studies				✓		
Discussions		✓				
Outside Assignments		✓				
g. Conference or Trng. Ldr.						
Poise, Confidence and Control of Group		✓				
Accepted by Group			✓			
Knowledge		✓				
h. Facilities			✓			
I. OVERALL RATING		✓				

(OVER)

5. What were your objectives in attending this Course, Seminar, Workshop, etc. and to what extent were they met?

— Learning to a great extent how energy audit program can be conducted (in both theoretical & practical ways), knowing new ideas about Energy Conservation opportunities and enrich my knowledge in that field, and I think that these goals were achieved to a great extent.

6. What did you actually gain by attending?

— New ideas in the field of Energy Conservation
— Concentrated knowledge and informations in that field.
— How the Precaudit program can be Conducted.

7. Referring to your answer to question No. 6, how do you anticipate being able to apply this to your job?

I believe that, all informations gained during the course will be of a great benifit to my job.

8. Would you recommend this program for other employees and why or why not?

Yes, because of it's importance.

9. Other Comments.

— Time available for practical training in the course is very limited.

SUMMARY EVALUATION

1. Your Name _____ Department _____

2. Name of Course, Seminar, Workshop Attended.

   Preaudit Course

3. Sponsored By Whom, Where, When?

   O. E. P. Jan., 1985

4. How would you rate this Course, Seminar, Workshop, etc. with regards to:

	Excellent	Very Good	Good	Fair	Poor	Does Not Apply
a. Practical Value		✓				
b. Achievement of Objectives		✓				
c. New Concepts		✓				
d. Comprehensiveness of Coverage		✓				
e. Adherence to Outline		✓				
f. Use of:						
Visual Aids					✓	
Case Studies				✓		
Discussions				✓		
Outside Assignments						
g. Conference or Trng. Ldr.						
Poise, Confidence and Control of Group			✓			
Accepted by Group						
Knowledge		✓				
h. Facilities				✓		
I. OVERALL RATING			✓			

(OVER)

5. What were your objectives in attending this Course, Seminar, Workshop, etc. and to what extent were they met?

6. What did you actually gain by attending?

7. Referring to your answer to question No. 6, how do you anticipate being able to apply this to your job?

8. Would you recommend this program for other employees and why or why not?

9. Other Comments.

SUMMARY EVALUATION

1. Your Name _____ Department _____

2. Name of Course, Seminar, Workshop Attended.

Pre-Audit training Course

3. Sponsored By Whom, Where, When?

_____

4. How would you rate this Course, Seminar, Workshop, etc. with regards to:

	Excellent	Very Good	Good	Fair	Poor	Does Not Apply
a. Practical Value			✓			
b. Achievement of Objectives			✓			
c. New Concepts			✓			
d. Comprehensiveness of Coverage			✓			
e. Adherence to Outline			✓			
f. Use of:						
Visual Aids			✓			
Case Studies			✓			
Discussions			✓			
Outside Assignments		✓				
g. Conference or Trng. Ldr.						
Poise, Confidence and Control of Group			✓			
Accepted by Group			✓			
Knowledge			✓			
h. Facilities			✓			
I. OVERALL RATING			✓			

(OVER)

5. What were your objectives in attending this Course, Seminar, Workshop, etc. and to what extent were they met?

Understand more about the preaudit and its arrangements.

6. What did you actually gain by attending?

orgnizing skills, deeper view to the preaudit.

7. Referring to your answer to question No. 6, how do you anticipate being able to apply this to your job?

by using these orgnizing skills & developing them to match our needs.

8. Would you recommend this program for other employees and why or why not?

No

9. Other Comments.

FOSTER WHEELER ENERGY CORPORATION

110 SOUTH ORANGE AVENUE · LIVINGSTON, NEW JERSEY 07039 · PHONE 201-533-1100

January 10, 1985
Letter 2.1-9
File 1.2,2.1

Technical Representative
Argonne National Laboratories
Argonne, IL 60439

Attention: Mr. M. Monarch

FWEC Contract 11-35625
Argonne National Laboratories
Energy Audits & Audit Training in Egypt
TRANSMITTAL OF DELIVERABLES 10 & 14

Gentlemen:

FWEC is pleased to transmit the documents and material necessary to meet the requirements of deliverable Number 10 and Number 14 all of which apply to Subtask 1D.

These deliverables are:

1. Deliverable #: Audit Course Instruction Package
   Quantity: 1
   Due Date: End of week 3
   (January 12, 1985)
   Items included are:

   a. Audit Course Instructions Package-w/ copies of Overheads & related Material and Course Outline
   b. A copy of the final exam with answer sheet (to be provided later)
   c. Software For audit activities, as listed below:

      a) Insulation Projection
         "Heatalyzer" by NICA

      b) Cost Estimating
         "Chem Cost" by COADE

      c) Boiler Efficiency
         "Boiler efficiency and economics" by TECS

      d) Heat Exchangers
         "Detailed heat exchanger design" by Engineering Inc

      e) Condensate Drum Size
         "Separate - two phase separator sizing" by TECS

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f) HVAC.
"Commercial HVAC Load User's Guide Ver 2.3"
by Elite Software

The above software was purchased specifically for this project, and is transfered to ANL with all license requirements in effect.

2. Deliverable #14 Audit Data Analysis Package
Quantity: 1
Due Date: End of week 5 (January 26, 1985)
Note that this analysis software is already included above as Paragraph (c) of Deliverable #10 - It is not resubmitted as per your instruction.

For your reference, we include the summary of deliverable items as an attachment herewith, marked to reflect deliverables completed.

Please advise if any further information or clarification would be of value to you.

Very truly yours,

FOSTER WHEELER ENERGY CORPORATION

C. E. Kastner, Jr.

CEK:ne

cc: H. Feintuch - (FW)
T. Wolsko (ANL)
R. Houghton (ANL)

Attachments: Deliverable #10 (1 set)
Summary List (All cc's)

SUMMARY OF DELIVERABLE ITEM SCHEDULE

12/20/84
1/10/85

SUB TASK	DELIVERABLE	TITLE	TIME (END OF WEEK)
1A	1	~~Plant Selection Report (2)~~ 12/20/84	2
1B	2	~~Pre Audit Course Instruction Pkg~~ 12/5/84	1
1B	3	~~Pre-Audit Course Mtl for Trainees~~ 12/5/84	1
1B	4	Pre Audit Course Test Results	5
1B	5	Pre Audit Course Evaluation Report	5
1C	6	~~Pre Audit Data Analysis Package~~ 12/5/84	2
1C	7	Pre Audit Draft Report (2) & Presentation(ANL OEP)	4/5
1C	8	Pre Audit Report (2) & Presentation (PLT Mgmt)	5
1C	9	Pre Audit Final Report	6
1D	10	~~Audit Course Instruction Pkg~~ 1/10/85	3
1D	11	Audit Course Mtl for Trainees	4
1D	12	Audit Course Test Results	8
	13	Audit Course Evaluation Report	8
1E	14	~~Audit Data Analysis Package~~ 1/10/85	5
1E	15	Audit Draft Report/Presentation (ANL OEP)	9/10
1E	16	Audit Report/Presentation (PLT Mgmt)	10/11
1E	17	Audit Final Report	12

End of Week	1	2	3	4	5	6	7	8	9
	✓	✓	✓						
Deliverable(s)	(2,3)	(1,6)	(10)	(11,7)	(4,5,14,8)	(9)	( )	(12,13)	(15)

10	11	12
(15,16)	(16)	( )

FOSTER WHEELER ENERGY CORPORATION
110 SOUTH ORANGE AVENUE · LIVINGSTON, NEW JERSEY 07039 · PHONE 201-533-1100

January 16, 1985
Letter #2.1-16
File 1.2, 2.1

Technical Representative
Argonne National Laboratories
Argonne, IL 60439

Attn: M. Monarch

FWEC Contract 11-35625
Argonne National Laboratories
Energy Audits & Audit Training in Egypt
Transmittal of Deliverable #11

Gentlemen:

FWEC is pleased to transmit the documents and material necessary to meet the requirements of deliverable Number 11, which applies to subtask 1D.

Deliverable #11 Audit Course Instruction Package
Quantity: 16 sets for trainees plus 3 file copies
Due Date: End of week 4
(January 19, 1985)
Items included are:

Audit Course Instructions Package - w/copies of Overheads and related Material and Course Outline (two volumes/set).

For your reference, we include the summary of deliverable items as an attachment herewith, marked to reflect deliverables completed.

Please advise if any further information or clarification would be of value to you.

Very truly yours,

FOSTER WHEELER ENERGY CORPORATION

C.E. Kastner, Jr.

CEK/ne

cc: H. Feintuch
T. Wolsko (ANL)
R. Houghton (ANL)

Attachments: Deliverable #11 (19 sets). Summary List (all cc's)

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[illegible]

SUMMARY OF DELIVERABLE ITEM SCHEDULE

12/20/84
1/12/85
1/16/85

SUB TASK	DELIVERABLE	TITLE		TIME (END OF WEEK)
A	1	~~Plant Selection Report (2)~~	12/20/84	2
1B	2	~~Pre Audit Course Instruction Pkg~~	12/5/84	1
1B	3	~~Pre Audit Course Mtl for Trainees~~	12/5/84	1
1B	4	Pre Audit Course Test Results		5
1B	5	Pre Audit Course Evaluation Report		5
1C	6	~~Pre Audit Data Analysis Package~~	12/5/84	2
1C	7	Pre Audit Draft Report (2) & Presentation(ANL CEP)		4/5
1C	8	Pre Audit Report (2) & Presentation (PLT Mgmt)		5
1C	9	Pre Audit Final Report		6
1D	10	~~Audit Course Instruction Pkg~~	1/12/85	3
1D	11	~~Audit Course Mtl for Trainees~~	1/16/85	4
1D	12	Audit Course Test Results		8
	13	Audit Course Evaluation Report		8
1E	14	~~Audit Data Analysis Package~~	1/12/85	5
1E	15	Audit Draft Report/Presentation (ANL CEP)		9,10
1E	16	Audit Report/Presentation (PLT Mgmt)		10/11
E	17	Audit Final Report		12

End of Week	1	2	3	4	5	6	7	8	9
Deliverable(s)	(2,3)	(1,6)	(10)	(11,7)	(4,5,14,8)	(9)	( )	(12,13)	(15

10	11	12
(15,16)	(16)	( )

FOSTER WHEELER ENERGY CORPORATION

110 SOUTH ORANGE AVENUE · LIVINGSTON, NEW JERSEY 07039 · PHONE 201-533-1100

March 26, 1985
Letter #2.1-38
File 2.1, 1.2

Technical Representative
Argonne National Laboratories
Argonne, IL 60439

Attn: M. Monarch

FWEC Contract 11-35625
Argonne National Laboratories
Energy Audits & Audit Training in Egypt
Deliverable #12

Gentlemen:

This letter serves to transmit the following data for deliverable number twelve which is satisfied by this data.

Deliverable #12 contents:

1. Graded homework assignment No. 1
2. Graded homework assignment No. 2
3. Graded homework assignment No. 3
4. Graded homework assignment No. 4
5. Graded final examination
6. Confidential summary of the individual and overall grade for each trainee.
7. Answers to final exam and blank final exam (held from deliverable #10 letter #2.1-9).

As a convenience to your records, we include herewith, as an attachment, the updated summary of deliverables for the project.

In the event that further discussion or clarification is required, please contact the undersigned.

Very truly yours,

FOSTER WHEELER ENERGY CORPORATION

C.E. Kastner, Jr.

CEK/ba

cc: H. Feintuch
T. Wolsko (ANL)
R. Boughton (ANL)

CABLE ADDRESS: REWOP LIVINGSTONNEWJERSEY

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1/22/85
1/24/85 #19
1/27/85 #20
1/31/85 #28
(2/24/85)
3/7/85 #33
→ 3/26/85 #38

EGYPTIAN ENERGY AUDIT PROGRAM

SUMMARY OF DELIVERABLE ITEM SCHEDULE

SUB TASK	DELIVERABLE	TITLE	TIME (END OF WEEK)
1A	1	~~Plant Selection Report (2)~~ 12/20/84, 1/27/85 (w/comments)	2
1B	2	~~Pre Audit Course Instruction Pkg~~ 12/5/84	1
1B	3	~~Pre Audit Course Mtl for Trainees~~ 12/5/84	1
1B	4	~~Pre Audit Course Test Results~~ 1/22/85	5
~~1B~~	~~5~~	~~Pre Audit Course Evaluation Report~~ 1/31/85	~~5~~
1C	6	~~Pre Audit Data Analysis Package~~ 12/5/84	2
1C	7	~~Pre Audit Draft Report (2) & Presentation (ANL CEP)~~ 1/21/85	4/5
1C	8	~~Pre Audit Report (2) & Presentation (PLT Mgmt)~~ 1/24/84	5
1C	9	~~Pre Audit Final Report~~ 3/7/85 #37	6
1D	10	~~Audit Course Instruction Pkg~~ 1/12/85	3
1D	11	~~Audit Course Mtl for Trainees~~ 1/16/85	4
1D	12	~~Audit Course Test Results~~ 3/26/85 #38	~~8~~ 12
1D	13	Audit Course Evaluation Report	~~8~~ 12
1E	14	~~Audit Data Analysis Package~~ 1/12/85	5
1E	15	Audit Draft Report/Presentation (ANL CEP)	9/10
1E	16	Audit Report/Presentation (PLT Mgmt)	10/11
1E	17	Audit Final Report	12

End of Week	1	2	3	4	5	6	7	~~8~~ 12	9
Deliverable(s)	(2,3)	(1,6)	(10)	(11,7)	(4 5,8)	(9)	( )	(12,13)	(15

10	11	12
(15,16)	(16)	(17)

FOSTER WHEELER ENERGY CORPORATION

110 SOUTH ORANGE AVENUE · LIVINGSTON, NEW JERSEY 07039 · PHONE 201-533-1100

March 28, 1985
Letter #2.1-37
File 2.1, 10.2

Technical Representative
Argonne National Laboratories
Argonne, Il 60439

Attn: Mr. Monarch

FWEC Contract 11-35625
Argonne National Laboratories
Energy Audits & Audit Training
in Egypt
Deliverable #13

Gentlemen:

This letter serves to document and to formally transmit the "Audit Course Evaluation Report," which completes the requirements for deliverable #13.

As a convenience to your records, we include herewith, as an attachment, the updated summary of deliverables for the project.

In the event that further discussion or clarification is required, please contact the undersigned.

Very truly yours,

FOSTER WHEELER ENERGY CORPORATION

C. E. Kastner, Jr.

CEK:fs

cc: H. Feintuch
T. Wolsko (ANL)
R. Houghton (ANL)

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CABLE ADDRESS: REWOP LIVINGSTONNEWJERSEY

1/24/85 #19
1/27/85 #20
1/31/85 #28
(2/24/85)
3/7/85 #33
3/26/85 #38

EGYPTIAN ENERGY AUDIT PROGRAM

SUMMARY OF DELIVERABLE ITEM SCHEDULE

3/26/85 #35
→ 3/28/85 #37

SUB TASK	DELIVERABLE	TITLE	TIME (END OF WEEK)
1A	1	~~Plant Selection Report (2)~~ 12/20/84, 1/27/85 (w/comments)	2
1B	2	~~Pre Audit Course Instruction Pkg~~ 12/5/84	1
1B	3	~~Pre Audit Course Mtl for Trainees~~ 12/5/84	1
1B	4	~~Pre Audit Course Test Results~~ 1/22/85	5
~~1B~~	~~5~~	~~Pre Audit Course Evaluation Report~~ 1/31/85	~~5~~
1C	6	~~Pre Audit Data Analysis Package~~ 12/5/84	2
1C	7	~~Pre Audit Draft Report (2) & Presentation (ANL OEP)~~ 1/21/85	4/5
1C	8	~~Pre Audit Report (2) & Presentation (PLT Mgmt)~~ 1/24/84	5
1C	9	~~Pre Audit Final Report~~ 3/7/85 #33	6
1D	10	~~Audit Course Instruction Pkg~~ 1/12/85	3
1D	11	~~Audit Course Mtl for Trainees~~ 1/16/85	4
1D	12	~~Audit Course Test Results~~ 3/26/85 #38	~~8~~ 12
1D	13	~~Audit Course Evaluation Report~~ 3/28/85 #37	~~8~~ 12
1E	14	~~Audit Data Analysis Package~~ 1/12/85	5
1E	15	~~Audit Draft Report/Presentation (ANL OEP)~~ 3/26/85 #35	9/10
1E	16	Audit Report/Presentation (PLT Mgmt)	10/11
1E	17	Audit Final Report	12

End of Week	1	2	3	4	5	6	7	~~8~~ 12	9
Deliverable(s)	(2,3)	(1,6)	(10)	(11,7)	(4 14 5,8)	(9)	( )	(12,13)	(15)

10	11	12
(15,16)	(16)	(17)

AUDIT COURSE EVALUATION REPORT

BY

FOSTER WHEELER ENERGY CORPORATION

FOR

ARGONNE NATIONAL LABORATORY

CONTRACT #44006402

WORK ORDER #44016402

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APPENDIX

Survey Questionnaire 9

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1.0 Introduction

Foster Wheeler Energy Corporation (FWEC) as a contractor to Argonne National Laboratory (ANL) has prepared and has presented an audit training course, as a part of its work scope under the contract.

This report provides an evaluation of the course as presented, and provides recommendations for course improvement, as well as recommendations for additional course work.

2.0 Summary and Recommendations

The audit training course, of nominally five (5) days duration, is intended to provide the student with classroom and field training on procedures and analysis to be used during an actual plant audit. Special emphasis was to be put on the use of portable instruments and case study examples for steam systems, combustion systems, electrical systems and insulation. Also discussed in detail were methods of cost estimation and economic evaluation.

This course, as presented, met its objectives and provided a firm basis from which the procedures and analysis associated with an effective audit were clearly illustrated.

In parallel with the training, two actual audits were made, thus providing "on the job" training.

Slightly over 93% of the trainees rated the course good to excellent on an overall weighted basis.

Comments received most frequently were:

A comprehensive approach to the procedures of energy audit, good guide for future studies, OEP staff will be able to apply these procedures, course should not be given again because all the staff in OEP attended this course, require more time to cover, concentrated material, we should participate in calculation of ECO's and all office work.

Recommendations by FWEC are:

1) In the future consider the possibility of developing training courses which would be somewhat less intensive or concentrated by focusing-in on a fewer number of topics. This would be suitable for those who have already taken the present course.

2) We recommend that the present course be given periodically for new employees.

3) We strongly agree that the entire OEP staff participate fully in all aspects of ECO calculations and all office work. We believe that participation in all aspects of the work is the real key to developing a more self relient staff of workers. This, of course, must mean not only the glamour work of computer programs and sophisticated instrumentation, but more importantly the detailed work of calculations and developing sketches.

3.0 Discussion

3.1 General

The audit training program was presented by FWEC to teach the engineering personnel of OEP how to conduct audits.

The objectives of the audit, as defined for this project, are as follows:

- Portable instrument setup and use, and associated personnel briefing.
- Data collection and analysis.
- Development of recommendations for both no cost/low cost and investment energy conservation opportunities, based upon economic evaluations and listing of priorities.
- Preparation and presentation of a comprehensive energy audit report.

3.2 Execution

The training program was conducted in five - one day classroom sessions, with homework, followed by a final examination.

Attendance and classroom participation was good, and all individuals passed the course.

3.3 Comments Received

3.3.1 The main comment received, in response to the question which asked "what did you actually gain by

attending?" was that the course provided a comprehensive approach to procedures used in an energy audit and will be a good guide for future studies.

Since this message was the primary objective of the training, the course certainly appears to have been quite effective.

3.3.2 An additional frequent comment received was that the course was too concentrated and that more time is needed to cover the material.

We certainly agree with this comment, however, in a program which is meant to cover a wide range of material in a relatively short period of time there is really no alternative. The only way to deal with this problem would be to focus-in on one area only and cover it in depth over a period of several weeks. Doing this, however, would mean that other areas would be totally neglected.

3.3.3 Another comment received said that this course should not be given again since it was already taken by all of the OEP staff.

This comment does not seem to recognize that future employees will require professional training and the similar wording of this comment sounds as if it were developed by committee rather than individually.

One of the comments which spoke of a need for "more complicated instruments" and more "advanced data that is applied in the U.S.A. today" we found especially amusing

because it personified the mystique which we have noted time and time again among the trainees who seek glamorous and/or magical means to obtain a sophisticated final result rather than the true path which is simply dedicated, detailed, complete and sometimes tedious hard work.

3.3.4 The remaining comments could be summarized as generally commenting on the concept of audit or on individual thoughts relating to execution of training.

3.4 Final Results

The homework grading, and the final examination displayed a typical bell shaped distribution. This indicates that the course material fell within the groups capability, and that an understanding of the material could be achieved by any (all) students who put forth the effort.

Classroom participation, in large part, was good, and "on the job" training rounded out the course by utilization of the same approach in the field.

3.5 Survey Forms

The actual forms, with comments, as used to obtain student input are included as an Appendix to this report.

A summary of comments is included on the following page.

SUMMARY OF COMMENTS

Questions 1 to 4 are scoring - no comments

5. What were your objectives in attending this Course, Seminar, Workshop, etc. and to what extent were they met?

- To know about the different aspects of the energy auditing procedures.
- To learn procedures of audit and analysis of ECO's
- More information about energy audits and how they are conducted
- To enable OEP staff to do auditing themselves in future
- To learn how to do an audit and procedures to evaluate ECO's
- Course is well prepared and covers the majority of what we need. In future hope for advanced information for instruments and tools
- To learn procedures of audit and analysis of ECO's
- Learning the audit course and its new concepts
- My objective was to learn to make an energy audit
- To have new concepts in energy conservation
- Training for an energy audit

6. What did you actually gain by attending?

- A comprehensive approach to the procedures of energy audit
- Instrumentation - software (for different applications)
- How to analyse ECO's, procedures for estimating cost and discussing priorities of ECO's
- New ideas, concepts and information
- Methodology for auditing
- Good figures and formalities
- Acquaintance with basic information about energy auditing
- I gained good data, analysis of ECO's and how to estimate cost
- I gained information and very good data especially in manuals available
- I gained how to analyse ECO's, how to estimate investment and priorities of ECO's
- Good data and quick results about evaluation of ECO's
- I learned to do an energy audit and can do this work myself in other factories
- How to determine ECO's, do estimating and analyse information
- Simple and accurate procedures to implement an energy audit
- New methodology

7. Referring to your answer to question No. 6, how do you anticipate being able to apply this to your job?

- It is in direct relationship with the nature of the goal of OEP
- More accurate and specific instruments can be obtained
- Training for all staff should take place for software
- OEP staff will be able to apply same procedures and analysis and gain good results
- This course will be of great value to my job and will help me to contribute in energy audit projects
- Good guide for future studies
- I have the ability to do energy audits with our group in OEP
- Hope to cover all items mentioned. Depends on budget available and how it is financed

- o OEP staff will be able to apply the same procedures if they have the required instruments
- o We have the ability to apply these concepts to other factories
- o I can do it myself
- o Very helpful

8. Would you recommend this program for other employees and why or why not?

- o Yes (no reason given)
- o Yes (specified sections can be useful for certain employees)
- o No (because all of OEP staff attended this course)
- o Yes (because of its importance)
- o Yes (next time involve economists in estimating sessions)
- o Yes (owing to its great value)
- o Yes (useful for some employees. May need different program for other employees depending on their requirements)
- o No (because the staff of OEP attended this course and they will be able to implement this course)
- o Yes (new technology for other employees)
- o No (because all the staff in OEP attended this course)
- o No (we can explain the course to new employees)
- o Yes (to energy managers in plants)
- o Yes (no reason given)

9. Other comments.

- o Very tight . . . needs more time
- o A large amount of handouts which require more time to cover
- o More practical training and sharing in the preparation of energy audit report is essential
- o Concentrated material, more exercises and case studies
- o We should cooperate in the calculations of ECO's and all office work
- o More time, more detailed explanation, computer program training for all staff, more complicated instruments can be utilized by our staff, instruments we saw are too simple, hope to see more data which will give us the whole benefit of advanced data that is applied nowadays in U.S.A.
- o We should participate in calculation of ECO's and all office work done after completing factory visit. In audit book there were some charts and tables missed in the estimation course
- o Case studies must be discussed in seminar for future application later
- o Short time for course, no computer training
- o More practical training is preferable

APPENDIX

Survey Questionnaire

SUMMARY EVALUATION

1. Your Name ATALLA Department _____

2. Name of Course, Seminar, Workshop Attended.

Energy Audit

3. Sponsored By Whom, Where, When?

_____

4. How would you rate this Course, Seminar, Workshop, etc. with regards to:

	Excellent	Very Good	Good	Fair	Poor	Does Not Apply
a. Practical Value	✓					
b. Achievement of Objectives	✓					
c. New Concepts		✓				
d. Comprehensiveness of Coverage		✓				
e. Adherence to Outline	✓					
f. Use of:						
Visual Aids		✓				
Case Studies	✓					
Discussions		✓				
Outside Assignments						
g. Conference or Trng. Ldr.						
Poise, Confidence and Control of Group	✓					
Accepted by Group	✓					
Knowledge						
h. Facilities		✓				
I. OVERALL RATING		✓				

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(OVER)

5. What were your objectives in attending this Course, Seminar, Workshop, etc. and to what extent were they met?

To know about the different aspects of the energy auditing procedures

6. What did you actually gain by attending?

A comprehensive approach to the procedures of energy audit.

7. Referring to your answer to question No. 6, how do you anticipate being able to apply this to your job?

It is in direct relationship with the nature of the goal of OEP

8. Would you recommend this program for other employees and why or why not?

yes.

9. Other Comments.

The program was very light. Such a program needs more time to talk in more detail about some of its aspects.

SUMMARY EVALUATION

1. Your Name _____ Department _____

2. Name of Course, Seminar, Workshop Attended.

AUDIT

3. Sponsored By Whom, Where, When?

OEP March 85

4. How would you rate this Course, Seminar, Workshop, etc. with regards to:

	Excellent	Very Good	Good	Fair	Poor	Does Not Apply
a. Practical Value		✓				
b. Achievement of Objectives		✓				
c. New Concepts		✓				
d. Comprehensiveness of Coverage		✓				
e. Adherence to Outline	✓					
f. Use of:						
Visual Aids		✓				
Case Studies		✓				
Discussions		✓				
Outside Assignments		✓				
g. Conference or Trng. Ldr.						
Poise, Confidence and Control of Group		✓				
Accepted by Group	✓					
Knowledge		✓				
h. Facilities		✓				
I. OVERALL RATING		✓				

5. What were your objectives in attending this Course, Seminar, Workshop, etc. and to what extent were they met?

6. What did you actually gain by attending?

Instrumentation - Soft ware (for different application)

7. Referring to your answer to question No. 6, how do you anticipate being able to apply this to your job?

- More accurate and specific instruments can be obtained to cover the other expected needs of Auditing
- Training for all staff should take place for Software

8. Would you recommend this program for other employees and why or why not?

yes. This program is general, specified sections can be utilized for a certain standard of employees.

9. Other Comments.

- A large amount of handout and data which require more time to cover were distributed

SUMMARY EVALUATION

1. Your Name SAMIR ESKANDER Department OEP

2. Name of Course, Seminar, Workshop Attended.

AUDIT PROCEDURES & ANALYSIS

3. Sponsored By Whom, Where, When?

FWEC

4. How would you rate this Course, Seminar, Workshop, etc. with regards to:

	Excellent	Very Good	Good	Fair	Poor	Does Not Apply
a. Practical Value	✓					
b. Achievement of Objectives	✓					
c. New Concepts		✓				
d. Comprehensiveness of Coverage		✓				
e. Adherence to Outline						
f. Use of:						
Visual Aids	✓					
Case Studies	✓					
Discussions		✓				
Outside Assignments		✓				
g. Conference or Trng. Ldr.						
Poise, Confidence and Control of Group	✓					
Accepted by Group		✓				
Knowledge	✓					
h. Facilities		✓				
I. OVERALL RATING	✓					

OVER →

(OVER)

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5. What were your objectives in attending this Course, Seminar, Workshop, etc. and to what extent were they met?

Training to achive Energy Audit.

Very good to the material _ But not enough time for training for Measuring instruments.

6. What did you actually gain by attending?

Simple and accurate procedurs to implementation ENERY AUDIT.

7. Referring to your answer to question No. 6, how do you anticipate being able to apply this to your job?

Very helpful

Would you recommend this program for other employees and why or why not?

Yes, To Energy Manager in Plants

9. Other Comments.

_ Short time for Course.

_ No, computer training.

SUMMARY EVALUATION

1. Your Name _____ Department _____

2. Name of Course, Seminar, Workshop Attended.

   Audit Procedures and Analysis

3. Sponsored By Whom, Where, When?

   "OEP"

4. How would you rate this Course, Seminar, Workshop, etc. with regards to:

	Excellent	Very Good	Good	Fair	Poor	Does Not Apply
a. Practical Value		✓				
b. Achievement of Objectives			✓			
c. New Concepts		✓				
d. Comprehensiveness of Coverage		✓				
e. Adherence to Outline			✓			
f. Use of:						
Visual Aids		✓				
Case Studies			✓			
Discussions				✓		
Outside Assignments			✓			
g. Conference or Trng. Ldr.						
Poise, Confidence and Control of Group		✓				
Accepted by Group		✓				
Knowledge		✓				
h. Facilities		✓				
I. OVERALL RATING		✓				

5. What were your objectives in attending this Course, Seminar, Workshop, etc. and to what extent were they met?

To learn the procedures of audit and the analysis of the energy conservation opportunities.

6. What did you actually gain by attending?

I gained how to analyze the energy conservation opportunities and the procedures of estimating its cost and discussing the priority of these energy conservation opportunities

7. Referring to your answer to question No. 6, how do you anticipate being able to apply this to your job?

I think that the "O E P" staff will be able to apply the same procedures and analysis and gain good results.

8. Would you recommend this program for other employees and why or why not?

No. because all of the O E P staff attended this course.

9. Other Comments.

SUMMARY EVALUATION

1. Your Name _____ Department _____

2. Name of Course, Seminar, Workshop Attended.

   Audit Procedures and Analysis.

3. Sponsored By Whom, Where, When?

   Foster Higbee Corp. Fayetteville (O-Town), Feb. 1 thru 1985.

4. How would you rate this Course, Seminar, Workshop, etc. with regards to:

	Excellent	Very Good	Good	Fair	Poor	Does Not Apply
a. Practical Value			✓			
b. Achievement of Objectives			✓			
c. New Concepts		✓				
d. Comprehensiveness of Coverage			✓			
e. Adherence to Outline		✓				
f. Use of:						
Visual Aids		✓				
Case Studies				✓		
Discussions		✓				
Outside Assignments			✓			
g. Conference or Trng. Ldr.						
Poise, Confidence and Control of Group		✓				
Accepted by Group		✓				
Knowledge		✓				
h. Facilities			✓			
I. OVERALL RATING		✓				

5. What were your objectives in attending this Course, Seminar, Workshop, etc. and to what extent were they met?

Objectives :-
- Getting more information about the energy audit activity.
- Learning how Energy audit program can be conducted.

These objectives were met to a large extent.

6. What did you actually gain by attending?

- New ideas, concepts and information.

7. Referring to your answer to question No. 6, how do you anticipate being able to apply this to your job?

- The course will be of a great value to my job and will help me to contribute in energy audit projects.

8. Would you recommend this program for other employees and why or why not?

Yes, because of it's importance.

9. Other Comments.

More practical training and sharing in the preparation of the energy audit report is very essential.

SUMMARY EVALUATION

1. Your Name _____ Department _____

2. Name of Course, Seminar, Workshop Attended.

   Audit

3. Sponsored By Whom, Where, When?

   Foster Wheeler Corp. (O.E.P.) Feb. 85

4. How would you rate this Course, Seminar, Workshop, etc. with regards to:

	Excellent	Very Good	Good	Fair	Poor	Does Not Apply
a. Practical Value			✓			
b. Achievement of Objectives			✓			
c. New Concepts		✓				
d. Comprehensiveness of Coverage			✓			
e. Adherence to Outline		✓				
f. Use of:						
Visual Aids		✓				
Case Studies				✓		
Discussions		✓				
Outside Assignments			✓			
g. Conference or Trng. Ldr.						
Poise, Confidence and Control of Group		✓				
Accepted by Group		✓				
Knowledge		✓				
h. Facilities		✓				
I. OVERALL RATING		✓				

5. What were your objectives in attending this Course, Seminar, Workshop, etc. and to what extent were they met?

6. What did you actually gain by attending?

New methodology

7. Referring to your answer to question No. 6, how do you anticipate being able to apply this to your job?

8. Would you recommend this program for other employees and why or why not?

Yes

9. Other Comments.

More practical training is preferable

SUMMARY EVALUATION

1. Your Name _____ Department _____

2. Name of Course, Seminar, Workshop Attended.

Audit Course

3. Sponsored By Whom, Where, When?

F.W. Experts — O.E.P., Cairo, Egypt

4. How would you rate this Course, Seminar, Workshop, etc. with regards to:

	Excellent	Very Good	Good	Fair	Poor	Does Not Apply
a. Practical Value		✓	✓			
b. Achievement of Objectives			✓			
c. New Concepts			✓			
d. Comprehensiveness of Coverage		✓				
e. Adherence to Outline		✓				
f. Use of:						
Visual Aids			✓			
Case Studies			✓			
Discussions			✓			
Outside Assignments			✓			
g. Conference or Trng. Ldr.						
Poise, Confidence and Control of Group		✓				
Accepted by Group			✓			
Knowledge		✓				
h. Facilities			✓			
I. OVERALL RATING			✓			

5. What were your objectives in attending this Course, Seminar, Workshop, etc. and to what extent were they met?

To enable the O.E.P staff, for doing the auditing by themselves in the future.
The result is satisfiency (60 %)

6. What did you actually gain by attending?

- methodology for auditing
- good figures and formalities
- acquainting the basic information about energy auditing

7. Referring to your answer to question No. 6, how do you anticipate being able to apply this to your job?

A good guide for the future studies

8. Would you recommend this program for other employees and why or why not?

all engineers were involved in this program, may be economist must be involved for estimation & sessions.

9. Other Comments.

Concentrated material, more excercises and case studies.

SUMMARY EVALUATION

1. Your Name [redacted] Department Engineering

2. Name of Course, Seminar, Workshop Attended.

AUDIT PROCEDURES AND ANALYSIS

3. Sponsored By Whom, Where, When?

Foster Wheeler Energy Corporation ; In CAIRO , From 20/2/86 to 20/3/

4. How would you rate this Course, Seminar, Workshop, etc. with regards to:

	Excellent	Very Good	Good	Fair	Poor	Does Not Apply
a. Practical Value			✓			
b. Achievement of Objectives			✓			
c. New Concepts		✓				
d. Comprehensiveness of Coverage			✓			
e. Adherence to Outline			✓			
f. Use of:						
Visual Aids		✓				
Case Studies		✓				
Discussions			✓			
Outside Assignments				✓		
g. Conference or Trng. Ldr.						
Poise, Confidence and Control of Group		✓				
Accepted by Group			✓			
Knowledge			✓			
h. Facilities		✓				
I. OVERALL RATING			✓			

5. What were your objectives in attending this Course, Seminar, Workshop, etc. and to what extent were they met?

To learn how to make an energy audit, the procedures of evaluation of energy conservation opportunities

6. What did you actually gain by attending?

I gained good data, Analyse of energy conservation opportunities and how to estimate the cost of it.

7. Referring to your answer to question No. 6, how do you anticipate being able to apply this to your job?

I have the ability to do Energy audit with our group in "O. E.P"

8. Would you recommend this program for other employees and why or why not?

Yes, owing to it's great value.

9. Other Comments.

we should be co-operate in the calculations of ECO's and all office work

SUMMARY EVALUATION

1. Your Name _____ Department _____

2. Name of Course, Seminar, Workshop Attended.

AUDIT

3. Sponsored By Whom, Where, When?

O.E.P. March 1985

4. How would you rate this Course, Seminar, Workshop, etc. with regards to:

	Excellent	Very Good	Good	Fair	Poor	Does Not Apply
a. Practical Value		✓				
b. Achievement of Objectives		✓				
c. New Concepts		✓				
d. Comprehensiveness of Coverage			✓			
e. Adherence to Outline			✓			
f. Use of:						
Visual Aids				✓		
Case Studies				✓		
Discussions			✓			
Outside Assignments			✓			
g. Conference or Trng. Ldr.						
Poise, Confidence and Control of Group		✓				
Accepted by Group		✓				
Knowledge			✓			
h. Facilities			✓			
I. OVERALL RATING			✓			

5. What were your objectives in attending this Course, Seminar, Workshop, etc. and to what extent were they met?

I think that This Course is well Prepared and Cover the majority of what we need
In future I hope it gives us advanced information for instrvments and Tools.

6. What did you actually gain by attending?

* I gained Some information and very good data in many itemes especially in manuals available
* I hope that I can be able to apply this in my Practical Sector

7. Referring to your answer to question No. 6, how do you anticipate being able to apply this to your job?

I think it is very useful if I have the availability to Cover all itemes mentioned and it depends on budget available and how it must be financed

8. Would you recommend this program for other employees and why or why not?

I think This Program is useful for Some employees and may not for other
Perhaps need different Programms depending on the standard of data needed according to employees requirments

9. Other Comments.

more Time
more Details explanation
I hope that in future we have a scientific Programm fits our needs because we have local circumstances differs than applied in U.S.A

* Computer Programm should be available in Training
  For all O.E.P staff

* more Complicated instruments Can be
  utilized by our staff (instruments that
  mentioned is not available)
  and we See a very simple instruments

* I hope to See more data which give as
  whole benefit in advanced data that
  is applied nowadays in U.S.A

SUMMARY EVALUATION

1. Your Name _____ Department _____

2. Name of Course, Seminar, Workshop Attended.

   Audit procedures and analysis

3. Sponsored By Whom, Where, When?

   "OEP"

4. How would you rate this Course, Seminar, Workshop, etc. with regards to:

	Excellent	Very Good	Good	Fair	Poor	Does Not Apply
a. Practical Value			✓			
b. Achievement of Objectives			✓			
c. New Concepts		✓				
d. Comprehensiveness of Coverage		✓				
e. Adherence to Outline			✓			
f. Use of:						
Visual Aids			✓			
Case Studies			✓			
Discussions				✓		
Outside Assignments			✓			
g. Conference or Trng. Ldr.						
Poise, Confidence and Control of Group		✓				
Accepted by Group			✓			
Knowledge		✓				
h. Facilities			✓			
I. OVERALL RATING			✓			

5. What were your objectives in attending this Course, Seminar, Workshop, etc. and to what extent were they met?

To learn the procedures of audit and the analysis of the energy conservation opportunities.

6. What did you actually gain by attending?

I gained How to analyze the energy conservation opportunities. and How to estimate the investement cost for different applications Also I take a good idea for the priority of the energy conservation opportunities

7. Referring to your answer to question No. 6, how do you anticipate being able to apply this to your job?

I believe that the "OEP" staff will be able to apply the same procedures if they have the required instruments

8. Would you recommend this program for other employees and why or why not?

No, because the staff of "OEP" attended this Course and they will be able to implement this Course

9. Other Comments.

SUMMARY EVALUATION

1. Your Name _____ Department _____

2. Name of Course, Seminar, Workshop Attended.

   Audit Procedures and Analysis.

3. Sponsored By Whom, Where, When?

   A.F.P.

4. How would you rate this Course, Seminar, Workshop, etc. with regards to:

	Excellent	Very Good	Good	Fair	Poor	Does Not Apply
a. Practical Value			✓			
b. Achievement of Objectives			✓			
c. New Concepts		✓				
d. Comprehensiveness of Coverage			✓			
e. Adherence to Outline				✓		
f. Use of:						
Visual Aids			✓			
Case Studies		✓				
Discussions						
Outside Assignments			✓			
g. Conference or Trng. Ldr.						
Poise, Confidence and Control of Group		✓				
Accepted by Group			✓			
Knowledge			✓			
h. Facilities				✓		
I. OVERALL RATING			✓			

5. What were your objectives in attending this Course, Seminar, Workshop, etc. and to what extent were they met?

Learning the audit course and its new concepts.

6. What did you actually gain by attending?

Good data & quick results about evaluation of energy conservation programs.

7. Referring to your answer to question No. 6, how do you anticipate being able to apply this to your job?

We have the ability to apply these concepts for the other factories.

8. Would you recommend this program for other employees and why or why not?

Yes because of the staff of the O.E.P. attended this course and can get another information & new technology of the other employees.

9. Other Comments.

SUMMARY EVALUATION

1. Your Name _____ Department _____

2. Name of Course, Seminar, Workshop Attended.

   Energy Audit

3. Sponsored By Whom, Where, When?

   FOSTER WHEELER ENERGY CORPORATION IN OF.P PRIMITIZ → 28/3/5

4. How would you rate this Course, Seminar, Workshop, etc. with regards to:

	Excellent	Very Good	Good	Fair	Poor	Does Not Apply
a. Practical Value		✓				
b. Achievement of Objectives			✓			
c. New Concepts			✓			
d. Comprehensiveness of Coverage			✓			
e. Adherence to Outline		✓				
f. Use of:						
Visual Aids.			✓			
Case Studies			✓			
Discussions			✓			
Outside Assignments				✓		
g. Conference or Trng. Ldr.						
Poise, Confidence and Control of Group			✓			
Accepted by Group				✓		
Knowledge				✓		
h. Facilities				✓		
I. OVERALL RATING			✓			

(OVER)

5. What were your objectives in attending this Course, Seminar, Workshop, etc. and to what extent were they met?

my objective was to learn how to make an energy audit

6. What did you actually gain by attending?

I learned how to make energy audit and I can do the work myself in other factories

7. Referring to your answer to question No. 6, how do you anticipate being able to apply this to your job?

I can do it myself

8. Would you recommend this program for other employees and why or why not?

No I don't recommend it for other employees because all the engineering stuff in O.C.P attended the course

9. Other Comments.

I think you should let us participate in the calculation of ECO's saving and all office work that done after completing the factories visit and also in the audit ~~to~~ book there were some charts and tables needed in the Estimation course.

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SUMMARY EVALUATION

1. Your Name _____ Department _____

2. Name of Course, Seminar, Workshop Attended.

_____

3. Sponsored By Whom, Where, When?

_____

4. How would you rate this Course, Seminar, Workshop, etc. with regards to:

	Excellent	Very Good	Good	Fair	Poor	Does Not Apply
a. Practical Value		✓				
b. Achievement of Objectives			✓			
c. New Concepts			✓			
d. Comprehensiveness of Coverage			✓			
e. Adherence to Outline			✓			
f. Use of:						
Visual Aids			✓			
Case Studies			✓			
Discussions			✓			
Outside Assignments			✓			
g. Conference or Trng. Ldr.						
Poise, Confidence and Control of Group			✓			
Accepted by Group			✓			
Knowledge			✓			
h. Facilities			✓			
I. OVERALL RATING			✓			

5. What were your objectives in attending this Course, Seminar, Workshop, etc. and to what extent were they met?

To have a new concepts in energy conservation

6. What did you actually gain by attending?

How to determine ECO's
How to do an estimation
How to manage your information

7. Referring to your answer to question No. 6, how do you anticipate being able to apply this to your job?

I think that

8. Would you recommend this program for other employees and why or why not?

No, because, after we applied this use again
I think that we can explain the outline of this course to the new employees

9. Other Comments.

Case studies, I think that Case studies must discuss with your team in Seminar So we can imagine a future view for our application later

APPENDIX

3.8.1-10

PRE-SCREENING SURVEY I & II

EXAMPLE OF INITIAL INDUSTRIAL AUDIT PLANT PRE-SCREENING FORM SUBMITTED TO EGYPTIAN INDUSTRY BY OEP

NOTE: The purpose of this form was to collect summary data.

ORGANIZATION FOR ENERGY PLANNING

INDUSTRIAL ENERGY CONSERVATION PROJECT

Application For Participation

Company Name : _____

Address : _____

Telephone : _____

Person to be Contacted : _____

Nature of Company's Business : _____

Products : _____

Production Quantity : _____ , for year 198 ____

1. Please describe briefly the type of processes used :

2. Please specify approximately the annual quantity of energy used :

LPG _____ Mazout _____

Gasoline _____ Electricity _____

Kerosene _____ Other (specify) _____

Data are for year 198 ___

Please indicate the energy-using equipment you have (Indicate number) :

Boilers _____

Furnaces _____

Kilns _____

Ovens _____

Electricity Generators _____

Heavy electrical machinery _____

Other (specify) _____

_____

_____

Do you consider your equipment to be : New _____ Moderately aged ____ Old _____

Have you already undertaken any energy conservation studies or have you implemented any energy conservation measures ?

Please describe :

What do you consider to be your biggest energy problem now ?

Organization
for Energy Planning

جهاز تخطيط الطاقة

جهاز تخطيط الطاقة

برنامج ترشيد الطاقة فى القطاع الصناعى

طلب اشتراك

اسم الشركة :

العنوان :

رقم التليفون :

اسم المسئول عن الموضوع :

طبيعة نشاط الشركة :

انواع المنتجات :

كميات الانتاج :

١ـ برجاء شرح نوع العمليات الصناعية المستخدمة :

٢ـ برجاء تحديد كميات الطاقة المستهلكة تقريبا سنويا :

L.P.G. : مازوت :

بنزين : كهرباء :

كيروسين : اخرى (تحدد) :

بيانات عام ١٩٨

٣ـ هل تتضمن عمليات الانتاج عمليات تسخين ؟
وضح :

أ) الهدف الاساسى منها

ب) درجات حرارة المائع قبل وبعد التسخين

جـ) نوع الوقود المستعمل فى التسخين وخواصه

٤ـ برجاء تحديد المعدات المستخدمة للطاقة (حدد العدد) :

- أفران صهر
- محارق "Kilns"
- افران تسخين
- غلايات
- معدات كهربائية ثقيلة
- اخرى (تحدد)

٥ـ هل تعتبر أجهزتكم جديدة : متوسطة العمر : قديمة :

٦ـ هل سبق لكم القيام بأى دراسات لترشيد الطاقة أو قمتم بتطبيق أى اجراءات لترشيد الطاقة ؟
فى حالة الاجابة بنعم يرجى الشرح

٧ـ ما هى اكبر المشاكل التى تواجهكم حاليا فى مجال الطاقة فى رأيكم ؟

PRE-SCREENING SURVEY II

EXAMPLE OF SECOND INDUSTRIAL AUDIT PLANT PRE-SCREENING
FORM SUBMITTED TO EGYPTIAN INDUSTRY BY OEP

NOTE: The purpose of this form was to collect more detailed information after evaluation of the initial screening study.

EQUIPMENT DATA FORM

NAME OF COMPANY : PRODUCTIVE UNIT : DEPARTMENT :

				Feed Energy					Produced Energy						Equipment Performance			Date & Specifications		
					Specifications							Rate of Production / hour				Stopage Average /1000 operating hour				
Name and Type	Quantity	Manufacturer	Year of Manu.	Rate of Feed Consumption/ hour	Fuel Kind Pressure Temperature	Steam Pressure Temperature	Elec. Current Volt Amp.	Pressed Air Pressure	Steam Pressure Temperature	Elec. Current Volt Amp.	Pressed Air Pressure	Acc. to Factory guarantee	Actual	Eff-ciency %	Actual Operating Hours / day	Sudden Stopage %	Periodical Stopage %	Measuring Equipments	Control Equipments	Other Additions

Responsible Manager (Name) : Date :

Position :

Signature

Remarks :

1- Mention units used for the data

2- In (other additions) field; mention reasons of the waster in both feed energy and produced energy, if any

Also specifications of supplemental related equipments with respect to energy waste etc.

3- Complete data in other page if necessary

إسم الشركة: الوحدة الأنتاج القسم:

الأسم و الطراز.	العدد	الشركة الصانعة.	سنة الصنع.	الطاقة المغذية: معدل إستهلاك التغذية في الساعة	الطاقة المغذية: المواصفات: وقود: النوع الضغط الحرارة	الطاقة المغذية: المواصفات: بخار: الضغط الحرارة	الطاقة المغذية: المواصفات: تيار كهربائي: الفولت الأمبير	الطاقة المغذية: المواصفات: هواء مضغوط: الضغط	الطاقة المغذية: المواصفات: بخار: الضغط الحرارة	الطاقة المغذية: المواصفات: تيار كهربائي: الفولت الأمبير	الطاقة المغذية: المواصفات: هواء مضغوط: الضغط	معدل الأنتاج في الساعة: حسب ضمان المصنع	معدل الأنتاج في الساعة: الفعلي	معدل الأنتاج في الساعة: الكفاءة %	أداء المعدة: ساعات التشغيل الفعلية في اليوم	أداء المعدة: متوسط الأعطال لكل ألف ساعة تشغيل: أعطال مفاجئة %	أداء المعدة: متوسط الأعطال لكل ألف ساعة تشغيل: أعطال صيانة %	بيان ومواصفات: أجهزة القياس	بيان ومواصفات: أجهزة التحكم	إضافات أخرى

ملاحظات:

١- يرجى ذكر الوحدات المستخدمة لجميع البيانات.

٢- يرجى ذكر في بند "إضافات أخرى" أسباب الفقد في الطاقة المغذية والمنتجة إن وجد- وبيان ومواصفات أي ملحقات للمعدة خاصة بإستغلال الفقد في الطاقة وخلافه.

٣- يرجى إستكمال البيانات في ملحق لهذه الأستمارة إن لزم الأمر.

تاريخ:

المدير المسؤول و الأسم:

الوظيفة:

التوقيع:

APPENDIX

3.8.1-11

SUMMARY PLANT DATA FROM OEP
PRE-SCREENING ACTIVITY

EGYPTIAN ORGANIZATION FOR ENERGY PLANNING
INDUSTRIAL PLANT SCREENING DATA

PLANT 1 - MULTI-PROCESS PLANT FACILITY

EL NASR CO. FOR COKE & CHEMICALS

PRODUCTS:

A - Coke Plant:

- Ammonium sulphate
- Benzol, Nitration -grade
- Coke Foundry (60 mm)
- Coke Metallurgical (40 mm)
- Coke 40 mm
- Coke 2[illegible]/40 mm
- Coke 10/25 mm
- Co[illegible] Breeze 10 mm
- Co[illegible] [illegible]lu[illegible] 10 mm
- Tol[illegible]e [illegible]ation grade
- Xylene S, 95/80

B - Fertilizer Plant:

- Ammonia, liquified
- Ammonia, solution
- Calcium Ammonium - nitrate fertilizer
- Nitric Acid dil 55%

C - Heavy Chemicals Plant:

- Ammonium Nitrate (explosive grade)
- Nitric Acid, Conc. 98.5%

D - Tar Plant:

- Carbolic Liquor
- Coal Tar Fuel (C.T.F.)
- Creosote Oil
- Cresylic Acid
- Naphthalene, hot, pressed
- Phenol, crude
- Pitch
- Pitch, electrode
- Tar, steal work
- Varnish C_1

PLANT 1 - continued

E. Pilot Plant

- Anti-Acid Mortars
- Phenol - Formaldhyde Resin (NOVOLAC)
- Naphthalene, pure

ENERGY EQUIPMENT:

- Boilers	10
- Heating Furnace	6
- Kilns	1
- Heavy Duty Elec. Equipment	32
- Coke Battery	3
- art ; Preheaters	2
- Suction Turbine	5

MAIN PROBLEMS:

- Instrumentations are needed to monitor energy flow
- Steam traps are not working
- The condensate of steam goes to drain instead of reuse
- Insulation of steam pipes
- Waste heat recovery
- Low power factor for electric motors

PLANT 2 - FOOD AND COSMETIC ADDITIVES

CARIOCO, FOR CONCENTRATED FOOD & PERFUMES

PRODUCTS:

- Perfumed paste and oil ,
- Taste and smelling materials1
- Cosmetics

ENERGY EQUIPMENT:

- Boilers 10

  (but they are located at different farms)

MAIN PROBLEMS:

- Instrumentation is needed
- Insulations
- Reuse of condensate
- Steam traps
- Waste heat recovery
- Low load factor

PLANT 3 - TEXTILE DYEING CAIRO CO. FOR DYEING AND PREFFRITIONS

PRODUCT:

Bleaching and dyed yars

- Bleached and dyed sheets and clothes
- Printed sheets and clothes (cotton and blended)

ENERGY EQUIPMENT

- Boilers	8 oil-fired
- Dryers	7 oil-fired
- Electric Motors	200 (more than 10 HP)

MAIN PROBLEMS:

- Instrumentations are needed
- Reuse of condensate steam
- Waste heat recovery
- Load factor and power factor low
- Insulation

PLANT 4 - TEXTILE WEAVING AND SPINNING

THE EGYPTIAN CO. FOR SPINNING & WEAVING OF WOOL (WOOLTEX)

PRODUCTS: (in 4 factories)

- Wool cloth
- Wool/polyster blend cloth

ENERGY EQUIPMENT

- Electric machinery for looms

- Boilers

MAIN PROBLEMS:

- Electric power equipment - new equipment is more energy intensive than old equipment because it improves product quality. Cannot always run new equipment at optimum efficiency because of limitations of feed.

- Boilers - unknown at this time.

- Instrumentation - no monitoring on electrical equipment.

PLANT 5 - MANUFACTURER ELECTRIC CABLES THE EGYPTIAN CO. FOR ELECTRICAL CABLES

PRODUCTS:

All kinds of cables and electrical wires and insulated wires.

ENERGY EQUIPMENT:

- Melting Furnaces	2 electrical
- Boilers	6 residual fuel oil (Mazout)

MAIN PROBLEMS:

- Monitoring instrumentation
- Poor power factor
- Reuse of condensate steam
- Waste heat recovery

PLANT 6 - MANUFACTURE OF IRON AND STEEL PRODUCTS DELTA STEEL MILL CO.

PRODUCTS:

- Concrete-reinforcing steel bars
- Wire drawing
- Cast steel
- Cast iron

ENERGY EQUIPMENT:

- Melting furnaces	8 (6 arc and 2 induction furnaces) electrical
- Heating furnaces	3 residual fuel oil
- Boilers	4 residual fuel oil
- Heavy electric equipment	9 motors - 1500 HP 2 motors - 1000 HP 6 motors - 600 HP

MAIN PROBLEMS:

- Measuring and control instruments are needed
- Most of instruments are old and not accurate
- Poor scrap field preparation which causes unnecessary long opening time for the furnace
- Leakage of heat and flame from furnaces
- Poor power factor
- Reuse of condensate steam
- Waste heat recovery

PLANT 7 - MANUFACTURE OF STEEL PRODUCTS

NATIONAL METAL INDUSTRIES CO. (NAMETN)

PRODUCTS:

Concrete-reinforcing bars St. 37 and St. 52

ENERGY EQUIPMENT:

- Melting furnaces	2 residual fuel oil
- Heating furnaces	3 residual fuel oil
- Boilers	5 residual fuel oil
- Heavy duty elec. equipment	3 electrical

MAIN PROBLEMS:

- Measuring and control equipment is needed
- Most of measuring equipment is old and not accurate
- Ageing of furnaces and equipment
- Poor power factor
- Leakage of heat and flame from furnaces
- Reuse of condensate steam
- Waste heat recovery

PLANT 8 - MANUFACTURE GLASS PRODUCTS EL NASR GLASS AND CRYSTAL CO.

PRODUCTS:

- Transparent glass planes
- Bottles, glasses
- Fiber glass
- Glass Crystal

ENERGY EQUIPMENT;

- Melting Furnaces	15 residual fuel oil
- Kilns	32 electrical
- Boilers	3 residual fuel oil

MAIN PROBLEMS:

- Currently use butagas (butane) in furnaces used for softening the glas; and cutting instead of natural gas.
- Reuse of condensate butagas
- Waste heat recovery
- Measuring instruments are needed

PLANT 9 - MANUFACTURE OF PORTLAND CEMENT

THE PORTLAND CEMENT CO. IN HELWAN

PRODUCTS:

- Normal Portland Cement
- Sulphate- resisting cement
- Slage cement
- Karnak cement
- Low- heat cement
- White cement

ENERGY EQUIPMENT:

Wet Process:

- Rotary kilns	8 residual fuel oil
- Boilers	4 residual fuel oil

Dry Process:

- Rotary kilns	2 mazout
- Boilers	5 mazout

MAIN PROBLEMS:

- Measuring instruments are needed for the wet process factory
- Waste heat recovery may be applied in the dry process factory.
- Reuse of condensate water
- Pollution control

PLANT 10 - CAST IRON PRODUCTS MANUFACTURER

MISR CO. FOR ENGINEERING & TOOLS

PRODUCTS:

- Trailers
- Pumps
- Tanks
- Bus assembly

ENERGY EQUIPMENT:

- Melting Furnaces	5 residual fuel oil
- Heating furnaces	2 residual fuel oil
- Heat treatment furnaces	18 electric
- Heavy duty elec. equipment	5

MAIN PROBLEMS:

- Need to renew the casting workshop
- Need to renew the forging workshop
- Low power factor
- Need to rearrange the production lines
- Waste heat recovery

PLANT 11 - FORGING INDUSTRY

EL NASR CO. FOR FORGING INDUSTRY

PRODUCTS:

- Forged steel parts for railway and automotive industry

ENERGY EQUIPMENT:

- Heating furnaces	30
- Heavy electric equipment	20

MAIN PROBLEMS:

- Absence of measuring and control instrumentation
- Waste heat recovery
- Still using kerosine as main fuel instead of using the available economic coke gas as fuel on large scale

PLANT 12 - TEXTILE SPINNING AND WEAVING

EL NASR CO FOR READY MADE GARMENTS AND WOVENS

PRODUCTS:

- Tricot
- Underwear and outerwear and socks

ENERGY EQUIPMENT:

- Boilers	3
- Heavy electric equipment	2

MAIN PROBLEMS:

- To be completed after visits

PLANT 13 - TEXTILE SPINNING AND WEAVING

EL NASR CO. FOR SPINNING, WEAVING & TRICOT (ELSHOURBA

PRODUCTS:

- Yarn
- Clothes
- Underwear
- Ready-made garmets and socks

ENERGY EQUIPMENT

- Steam boilers	2
- Dryers	2

MAIN PROBLEMS:

To be completed after visits.

PLANT 14 - FERROUS AND NON-FERROUS METAL PRODUCTS

THE EGYPTIAN COPPER COMPANY

PRODUCTS:

- Steel rods, wire, castings and rollers
- Aluminum and its alloys sheets, discs and kettles
- Copper wires, rods, pipes and castings
- Liquified oxygen and nitrogen production

ENERGY EQUIPMENT:

- Melting furnaces ?
- Heating furnaces ?
- Boilers ?
- Heavy duty elec. equipment ?

MAIN PROBLEMS:

- Absence of measuring and control instrumentation
- Poor power factor
- Waste heat recovery

PLANT 15 - PHOSPHATE AND FERTILIZER PRODUCTS

MISR PHOSPHATE CO.

PRODUCTS:

Phosphate products

ENERGY EQUIPMENT:

- Boilers ?
- Heating furnaces ?
- Heavy electric equipment ?

MAIN PROBLEMS:

To be completed after visits

PLANT 16 - PAPER CARTON MANUFACTURER

MIDDLE EAST PAPER CO. (SIMO)

PRODUCTS:

- Carton paper products for packing

ENERGY EQUIPMENT:

- Heating furnaces ?
- Heavy electric equipment ?

MAIN PROBLEMS:

- Absence of measuring and control instrumentation
- Waste heat recovery

PLANT 17 - TEXTILE SPINNING AND WEAVING EL SIUDE SPINNIG & WEAVING Co.

PRODUCTS:

- Yarns and clothes

ENERGY EQUIPMENT

- Melting furnaces	3
- Boilers	5
- Heavy elec. equipment	?

MAIN PROBLEMS:

- Poor power factor
- Waste heat recovery

PLANT 18 - BRICK MANUFACTURER THE SANDY BRICKS CO.

PRODUCTS:

All types of sand-based bricks and lime powder

ENERGY EQUIPMENT:

- Kilns ?
- Boilers ?

MAIN PROBLEMS:

- Absence of measuring instruments
- Using residual fuel oil as a main fuel and not using the available natural gas in the plant area

PLANT 19 - TEXSTILE SPINNING AND WEAVING CAIRO CO. FOR RAYON WOVEN

PRODUCTS:

- Cotton, rayon, and blended cloths

ENERGY EQUIPMENT:

- Boilers 6

MAIN PROBLEMS:

To be completed after visit

PLANT 20 - TEXTILE SPINNING AND WEAVING

UNIRAB SPINNING & WEAVING COMPANY

PRODUCTS:

- Yarn and clothes

ENERGY EQUIPMENT:

- Steam boilers	3
- Dryers	2 oil-fired
- Drying electric equipment	?

MAIN PROBLEMS:

- Absence of measuring instrumentation
- Poor power factor
- Waste heat recovery

PLANT 21 - FERTILIZER MANUFACTURER ABOKIR CO FOR FERTILIZERS & CHEMICAL INDUSTRIES

PRODUCTS:

- Uric fertilizers 46.5% azot

ENERGY EQUIPMENT:

- Boilers	3
- Heating furnaces	1
- Electrical motors	6

MAIN PROBLEMS:

- More steam than needed
- Waste heat recovery
- Modification required in the urea reactor to work on 270 bar instead of 315 bar which will increase the production by about 10%

PLANT 22 - LINEN AND RELATED PRODUCT MANUFACTURER

TANTA CO, FOR LINEN & OILS

PRODUCTS:

- Ratung wood
- Linen oil
- Linen products
- Strands
- Furniture
- Wood products

ENERGY EQUIPMENT:

- Melting furnaces	1
- Boilers	4
- Electrical motors	?

MAIN PROBLEMS:

- Power factor 0.6
- Reuse of condensate steam
- Waste heat recovery

PLANT 23 - METAL PRODUCT MANUFACTURER

ALEXANDRIA CO. FOR METAL PRODUCTS

PRODUCTS:

- Heaters
- Fully automatic washers
- Ovens, cooker
- Kitchen materials

ENERGY EQUIPMENT:

- Melting furnace using coke ?
- Heating urnace, electrical ?
- Boilers 2

MAIN PROBLEMS:

- Low power factor

PLANT 24 - TEXTILE SPINNING AND WEAVING

NASR CO. FOR WOOL & SELECTED TEXTILES

PRODUCTS:

- Wool clothes
- Blankets
- Cotton clothes and underwear
- Ready-made suits

ENERGY EQUIPMENT:

- Melting furnaces ?
- Heating furnaces ?
- Boilers ?

MAIN PROBLEMS:

- Treatment of residual fuel oil
- Low-efficiency boilers
- Chemical treatment of water

PLANT 25 - RAILWAY EQUIPMENT MANUFACTURER

THE EGYPTIAN GENERAL CO. FOR RAILWAY MATERIALS

PRODUCTS:

- Railway cars for passengers, goods and trams
- Tanks for gasoline, coal and water

ENERGY EQUIPMENT:

- Hot water heaters 8
- Heavy duty elec. equipment ?
  (generators and welding machines)

MAIN PROBLEMS:

To be completed after visits.

PLANT 26 - SUGAR AND RELATED PRODUCTS MANUFACTURER

EGYPTIAN CO. FOR SUGAR AND REFINERY

PRODUCTS:

- Sugar
- Alcohol (white)
- Yeast
- Carbon Dioxide
- Vinegar
- Tanner, adhesive materials and solvents
- Paper pulp
- Artificial wood
- Oxygen
- Perfumes

ENERGY EQUIPMENT:

Boilers

MAIN PROBLEMS:

- Insulation of pipes
- Low power factor
- Measuring equipment
- Natural gas use

PLANT 27 - SPINNING AND WEAVING MANUFACTURE

THE EGYPTIAN SPINNING & WEAVING CO.

PRODUCTS:

- Clothes
- Wool socks
- Underwear
- Tricot
- Wool blankets

ENERGY EQUIPMENT:

- Boilers 2 residual fuel oil

MAIN PROBLEMS:

- Poor power factor

-Reuse of condensate steam

PLANT 28 - BICYCLE MANUFACTURE EGYPTIAN CO. FOR LIGHT TRANSPORT MEANS

PRODUCTS:

- Bicycles
- Auto-bicycles
- Welded Tubes

ENERGY EQUIPMENT:

- Melting furnaces	5
- Heating furnaces	3
- Boilers	2
- Heavy Electric equipment	3
- Welding station	5 LPG

MAIN PROBLEMS:

To be completed after visits

PLANT 29 - MANUFACTURER OF MATCHES NILE CO. FOR MATCHES

PRODUCTS:

- Box matches
- Plywood
- Fabricated houses

ENERGY EQUIPMENT:

- Boilers 2 residual fuel oil

MAIN PROBLEMS:

To be completed after visit

PLANT 30 - METAL PRODUCTS MANUFACTURER

THE GENERAL CO. FOR METALS

PRODUCTS:

- Casting, rolled and cold drawing products of Al, Zn, Ag, Cu, Pb, Tn and its alloys

ENERGY EQUIPMENT:

- Melting furnaces	50
- Heating furnaces	10
- Electric refinery (CU)	1
- Boilers	1
- Heavy duty elec. equipment	3

MAIN PROBLEMS:

- Most of equipment and furnaces are old
- Measuring and control instrumentation is needed
- Poor power factor
- Waste heat recovery

PLANT 31 - DYERS OF CLOTH MIQR BEIDA DYERS

PRODUCTS:

- Cotton sheets
- Cotton yarns
- Wool tops

ENERGY EQUIPMENT:

- Boilers 6

MAIN PROBLEMS:

To be completed after visits

PLANT 32 - TEXTILE SPINNING AND WEAVING MANUFACTURER

MISR SPINNING & WEAVING CO. IN MAHALLA EL KOUBRA

PRODUCTS:

- Yarns, cloth from cotton
- Wool and blended sheets
- Sheets
- Towels and ready-made garments

ENERGY EQUIPMENT

- Melting furnaces 2
- Heating furnaces 8
- Boilers ?
- Heavy electric equipment for air conditioning power stations

MAIN PROBLEMS:

- Residual fuel oil treatment to get rid of sulphur and vanidium

PLANT 33 - SPINNING AND WEAVING MANUFACTURER

DELTA SPINNING & WEAVING CO.

PRODUCTS:

- Yarns
- Clothes
- Ready-made garments

ENERGY EQUIPMENT:

- Melting furnaces	1
- Boilers	4
- Heavy electric equip.(transformers)	14
- Motors	4
- Internal combustion engines (buses, cars, etc.)	61

MAIN PROBLEMS

- Stabilization of voltage

PLANT 34 - RAYON AND COTTON MANUFACTURER

INDUSTRIAL SHOPS CO FOR RAYON & COTTON (ICO)

PRODUCTS:

- Yarns, clothes and ready-made garments from cotton, wool, rayon and blended

ENERGY EQUIPMENT:

- Boilers 12
- Dryers 3

MAIN PROBLEMS:

- Absence of measuring instrumentation
- Poor maintenance due to lack of experience

PLANT NO. 35 - REFRACTORY MANUFACTURER EGYPTIAN CO. FOR REFRACTORIES

PRODUCTS:

- Insulating refractories resisting heat and acids

ENERGY EQUIPMENT:

- Kilns ?
- Heating furnaces ?
- Boilers ?
- Heavy electric equipment ?

MAIN PROBLEMS:

To be completed after visits

PLANT 36 - CARPET AND SHEET MANUFACTURER

THE ARALIAN CO. FOR CARPETS & SHEETS

PRODUCTS:

- Carpets
- Blankets from wool, polyester and blended

ENERGY EQUIPMENT:

- Boilers

MAIN PROBLEMS:

To be completed after visits

PLANT 37 - MANUFACTURER OF RUBBER AND PLASTIC PRODUCTS

EL NASR CO. FOR RUBBER PRODUCTS

PRODUCTS:

- Hoses for water, residual fuel oil, steam, oxygen, LPG
- Conveyor belts, V belts
- Foam products, shoes and robes
- Rubber parts
- Rubber floor covers

ENERGY EQUIPMENT:

- Melting furnace	1
- Boiler	3
- Heavy duty elec. equip.	?

MAIN PROBLEMS:

- Stabilization of voltage

PLANT 38 -MANUFACTURER OF METALLIC STRUCTURES

THE EGYPTIAN CO. FOR METALIC STRUCTURES

PRODUCTS:

- Metallic frames
- Cranes
- Oil tank towers
- Fence wire and river boats

ENERGY EQUIPMENT:

- Heavy duty elec. equipment	
- Welding machines	255
- Metal-forming machines	106

MAIN PROBLEMS:

- Low power factor

PLANT 39 - MANUFACTURER OF OIL AND SOAP

MISR CO. FOR OIL AND SOAP

PRODUCTS:

Cooking oil, artificial fat and soap

- Glycerin
- Animal foods

ENERGY EQUIPMENT:

Boilers

MAIN PROBLEMS

Absence of measuring instruments

- Waste heat recovery
- Stabilization of voltage

PLANT 40 - CANNED FOOD PRODUCTION

EDFINA CO FOR CANNED FOOD

PRODUCTS:

- Juice
- Frozen vegetables
- Jam
- Canned vegetables and fish

ENERGY EQUIPMENT:

Melting furnaces	2
- Boilers	2
- Heating furnaces	?
- Heavy duty elec. equip.	?

MAIN PROBLEMS:

- Poor power factor
- Waste heat recovery
- Steam pipes insulation

PLANT 41 - PORCELAIN AND CERAMIC PRODUCT MANUFACTURE

GENERAL CO FOR PORCELAIN & CERAMIC PRODUCTS

PRODUCTS:

- Household porcelain sets
- Bathroom ceramic sets

ENERGY EQUIPMENT:

- Kilns ?
- Heating furnaces ?
- Boilers ?
- Heavy electric equip. ?

MAIN PROBLEMS:

To be completed after visits

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APPENDIX

3.8.1

INDUSTRIAL ENERGY CONSERVATION

ENERGY POLICY AND RENEWABLE ENERGY
FIELD TESTING PROJECT

Part 2 of 2

Project No. 263-0123.1

Argonne National Laboratory

PASA No. IEG-0123-P-ER-3089-00

March 1986

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APPENDIX

3.8.1-12

RFP PROPOSAL NO. 84-44-010

INDUSTRIAL ENERGY AUDITS AND
AUDIT TRAINING IN EGYPT

ARGONNE NATIONAL LABORATORY
9700 South Cass Avenue, Argonne, Illinois 60439
Telephone 312/972- 7081

March 12, 1984

Gentlemen:

Subject: Request for Proposal No. 84-44-010 - Industrial Energy Audits and Audit Training in Egypt

Argonne National Laboratory (ANL) is assisting the Agency for International Development (AID) in an energy policy planning activity with the Government of the Arab Republic of Egypt (AID Project No. 263-0123). In this activity ANL will be working with the Organization for Energy Planning (OEP) established by Egyptian Presidential Decree #112 of 1983. OEP's mission is to provide technical support for national energy planning and analysis. The Director of OEP reports to the Egyptian Supreme Council on Energy (SCE) through a Board of Directors representing five organizations in Egypt that impact and are impacted by energy planning and policy. The makeup of the council is such that the work of OEP will be presented to the highest level of Egyptian government officials.

Your attention is directed to the enclosed documents which constitute requirements for this Request for Proposal and should be fully complied with as indicated.

Proposal package includes:

Enclosure No. 1 - Description of Work, dated February 9, 1984.
Enclosure No. 2 - Information Required in Technical Proposals.
Enclosure No. 3 - Evaluation Criteria.
Enclosure No. 4 - Sample Contract with Appendices A, C and D-4.
Enclosure No. 5 - Pre-Award Information dated 9/1/82.
Enclosure No. 6 - Contract Pricing Proposal - Optional Form 60.

It is requested that proposals be prepared in accordance with the instructions contained in the enclosures listed above. Proposals will be submitted in original and three copies to the following address:

Argonne National Laboratory
9700 South Cass Avenue
Argonne, IL 60439
Attention: Mr. Frank Foster - PRO 201
Subcontracts Department

Proposals will identify the individual(s) - name, title, and telephone number - who will represent the community in any ensuing negotiations. Your proposal should be properly identified and should be mailed or hand carried sufficiently in advance to assure arrival at the address specified above no later than 4:30 p.m. CST, April 13, 1984. Proposals received after that date will be considered only to the extent that it is in the Laboratory's best interest to do so. Your proposal should be valid for a minimum period of 120 days and should include all the information requested as well as any additional information which you feel would be helpful in the Laboratory's evaluation. It is anticipated that contract awards will be made no later than May 31, 1984.

This Request for Proposal does not commit the Laboratory to pay any cost for the preparation and submission of a proposal. It is also brought to your attention that the authorized Laboratory Procurement Official is the only individual who can legally commit the Laboratory to the expenditure of funds in connection with this proposed procurement.

All questions, comments and correspondence should be directed to the undersigned at the address specified on page one or telephone (312)972-7081.

Sincerely,

Robert P. Hazlett
for Frank Foster
Buyer Specialist
Administrative Services Division

FWF/jw
Enclosures

DESCRIPTION OF WORK
February 9, 1984

ENCLOSURE 1

1.0 BACKGROUND

Argonne National Laboratory (ANL) is assisting the Agency for International Development (AID) in an energy policy planning activity with the Government of the Arab Republic of Egypt (AID Energy Planning Sub-Project No. 263-0123.1). In this activity ANL will be working with the Organization for Energy Planning (OEP) established by Egyptian Presidential Decree #112 of 1983. OEP's mission is to provide technical support for national energy planning and analysis. The Director of OEP reports to the Egyptian Supreme Council on Energy (SCE) through a Board of Directors representing five organizations in Egypt that affect and are affected by energy planning and policy. The makeup of the council is such that the work of OEP will be presented to the highest level of Egyptian government officials.

A list of priority projects has been established under the energy policy planning activity. Of highest priority is the development of an industrial energy conservation program. The list was developed with the caveat that work performed exclusively or primarily by foreign consultants was to be discouraged. Therefore each effort will include as part of its planning and resource requirements the training of Egyptian personnel.

The first task of the industrial energy conservation program calls for the establishment of a training program for the conduct of industrial energy audits. The second task requires the performance of a number of industrial energy audits that result in specific recommendations for cost-effective steps to reduce energy consumption. Recommendations for energy conservation will include low-cost measures such as insulation and maintenance and operation changes, medium-cost measures such as combustion control and heat exchangers, and may include capital intensive technology change. The training program may be structured so that industrial energy audits are accomplished while the final phases of field training takes place.

To accomplish the two major tasks of industrial energy audit training and performance in Egypt, Argonne National Laboratory is issuing this request for Proposal (RFP) for a basic ordering agreement (BOA). Under the auspice of the BOA, Argonne National Laboratory may choose to contract with more than one firm in both the conduct of industrial energy audits and energy audit training.

For both Tasks 1 and 2 the contractor is expected to make all necessary arrangements for lodging and meals; passports and visas; international travel; reproduction of reports; office supplies; and other materials, tools and aids specified elsewhere in the scope of work.

2. SCOPE OF WORK

The scope of work is comprised of two major tasks: the training program and the actual industrial audits.

Task 1. Industrial Energy Audit Training Program

The contractor will develop and conduct an industrial energy audit training program in Egypt for Egyptian nationals. In addition to items previously specified, the contractor is responsible for teaching aids, textbooks, instructional equipment and all other materials required to perform the task. Training will be in English, giving appropriate consideration that English is a second language for the trainees. OEP/ANL will have the responsibility for selecting the trainees and arranging for classroom accommodations. Each class size is expected to be from 10-20 trainees. It is anticipated that the training program will commence with a one- to two-week classroom session followed by a one- to two-week session of field work where each trainee will participate in an actual or practice audit at a plant facility. OEP/ANL, in consultation with the contractor, will select an appropriate plant site for the field training. It is expected that as many as three classroom/field sessions will be conducted in the course of a twelve month period.

The objective of the training program is to prepare the trainees for conducting in-plant industrial energy audits for a wide range of industrial processes (e.g. cement manufacture, textiles, food processing) and equipment (e.g. boilers, dryers, motors) that is pervasive in many different types of industries. Therefore the training program must emphasize the practical and applied aspects of energy audit performance rather than only the theoretical aspects. Both classroom and field training must emphasize the use of survey instrumentation to collect data.

At the conclusion of the training session it is expected that the trainee will have the capability, using appropriate instrumentation, to perform in-plant measurements that will result in an accounting of energy flows for, at a minimum, the following systems:

- Boiler, furnace and oven combustion systems;
- Process steam systems including boiler, steam lines, steam traps, etc.;
- Electric motors and motor-coupled mechanical systems; and
- Waste heat discharge systems (i.e. hot water, steam and hot exhaust gas).

It is anticipated that graduates of the training program will participate in the actual audits of Task 2.

Task 2. Industrial Energy Audits

The contractor will be responsible for conducting a number of industrial energy audits in Egypt. The contractor will be responsible for all instrumentation, analytical hardware/software systems, and similar support necessary to perform all phases of the audit process. It should be noted that all information and data obtained or processed in the audit or audit-related procedures must be kept proprietary. No information will be released without the express written approval of OEP/ANL. The contractor will be responsible for taking appropriate steps to insure that audit-related information and data (processed in Egypt or outside Egypt) is kept proprietary. The industrial energy audit will include the following sequential steps:

- Plant selection from a list of candidate plants,
- Scheduling of pre-audit evaluation,
- Pre-audit data collection and consultation with plant management,
- Preparation and presentation of pre-audit evaluation to OEP/ANL,
- Scheduling of plant audits,
- Plant audits,
- Analysis and evaluation of audit data,
- Development of recommendations,
- Preparation of written reports,
- Presentation of results, and
- Post-audit support and consultation.

Each of the above tasks is described below in greater detail.

Plant Selection. OEP/ANL will be responsible for developing a list of candidate plants for energy audit. The contractor will be responsible for assisting OEP/ANL in this task. The list will contain all energy-related information that is currently available. The contractor will assist OEP/ANL in screening the information and selecting the most favorable candidates for energy audit.

Plants expected to be chosen for industrial audit during the first twelve-month period will be primarily medium-sized industries (e.g. textiles and food processing). This may change, however, to include some larger industries as the plant selection data are reviewed. Therefore the audit program should be geared to analysis of, at a minimum, the following process systems and equipment:

- Boiler, furnace and oven combustion systems,
- Process steam systems including boiler, steam lines, steam traps, etc.,

- Electric motors and motor-coupled mechanical systems, and
- Waste heat discharge systems (i.e. hot water, steam and hot exhaust gas).

Schedule Pre-Audit Plant Interview. OEP/ANL will be responsible for arranging for a pre-audit visit to the plant and conference with plant management based on the contractor's requirements for pre-audit evaluation. The contractor will provide OEP/ANL with a full set of criteria for the pre-audit evaluation.

Pre-Audit Information Gathering and Consultation with Plant Management. The contractor will be accompanied by one or more member(s) of the OEP/ANL observer team and possibly one or two energy audit trainees (see Task 1). The contractor will be responsible for utilizing a pre-audit procedure to gather information that will allow a subsequent determination of the suitability of conducting a full-scale plant audit. The contractor will be responsible for pre-audit information gathering and pre-audit consultation with plant management. OEP/ANL will be responsible for obtaining the cooperation of plant management.

Presentation of Pre-Audit Evaluation to OEP/ANL. As a result of the pre-audit plant visit and analysis of pre-audit information, the contractor will report to OEP/ANL as to the advisability of performing an industrial energy audit. The report will include the proposed scope of the overall audit, target areas where energy savings might be found, estimated time to complete the audit, disposition of management/operators and any other information supportive of a recommendation. Based on the contractors' recommendations, it will be an OEP/ANL responsibility to decide whether an energy audit should be performed at a particular plant. In the determination of the disposition of a plant for industrial audit, OEP/ANL may require that the contractor return to the plant to secure additional information.

Schedule Plant Audit. It will be an OEP/ANL responsibility (with contractor assistance) to schedule an industrial energy audit with plant management It will be the contractor's responsibility to brief plant management on the audit strategy, make arrangements to connect instrumentation and obtain signature approval for any modifications or hookups to plant facilities as well as any instructions to plant operating personnel regarding plant operation during the audit.

Plant Audit. It will be the contractor's responsibility to perform the complete plant audit and advise plant management and OEP/ANL of audit progress on a regular basis. The contractor will also be responsible for not only general insurance of their audit personnel but any special coverage required for working in a variety of plant environments. The contractor may be responsible for field training of Egyptian personnel that have completed the classroom portion of the training course in energy audits (see Task 1) by including them in the audit activity. The contractor will be responsible for advanced training of Egyptian personnel that have successfully completed both the classroom and field portions of the training program.

It is the responsibility of the contractor to perform the audit in such a manner as to cause minimum disruption to the plant process. Where variable load conditions are significant in a plant operation the contractor is responsible for collecting audit data that suitably reflects these conditions. The contractor is responsible for documenting the calibration and proper working order of all instrumentation used in the audit process. The contractor is expected to have an adequate supply of spare survey instrument parts to assure non-interrupted collection of data.

Analysis and Evaluation of Audit Data. The contractor will have full responsibility for processing and analyzing the audit data. The contractor is responsible for maintaining all audit-related information and data proprietary. The contractor is also responsible for any supportive analytical tools such as computer hardware/software systems. The contractor will be responsible for instructing the Egyptian trainees in the data processing and analysis activity. If computer-based software systems are used, the contractor will provide instruction on the use of the systems and advise trainees on the basic algorithms used to perform the analysis and the significance of results. All proprietary software used must be available for licensing with full documentation under reasonable terms. It may be required that the analysis and evaluation of audit data be performed entirely in Egypt.

Development of Recommendations. The contractor will be responsible for developing specific recommendations for energy conservation or management based on the processing and analysis of audit data. The recommendations would include both operational and hardware modifications. Each energy conservation recommendation should be specific and include quantitative estimates of energy savings and an economic analysis based on capital and operating costs. If computer-based software systems are used, the contractor will advise trainees on the basic algorithms used to perform the analysis and the significance of results. All proprietary software used by the contractor must be available for licensing with full documentation under reasonable terms. It may be required that the analysis of energy conservation measures be performed entirely in Egypt.

Audit Report. The contractor will be responsible for the preparation of a written audit report in English that provides specific energy conservation recommendations that can be readily implemented. An economic analysis must be performed for each recommendation. The audit report will include all raw data in an appendix, documentation as to calibration of instrumentation, indicate all assumptions made, algorithms used in the analyses, and all other pertinent data necessary to support the energy conservation recommendations. The contractor will be responsible for submitting a draft report to OEP/ANL in a timely manner prior to submission to plant management. OEP/ANL reserves the right of review and edit prior to submission of the report to plant management. The contractor is responsible to keep the reports confidential and not make available any information concerning the report to any third parties without the written permission of OEP/ANL. Upon approval of the audit report by OEP/ANL, the contractor will be responsible for submission of an adequate number of copies of the report to plant management.

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Oral Presentation. The contractor will be responsible for an oral presentation/discussion of the audit report before OEP officials, government officials, and plant management. During the presentation the contractor is expected to be in a position to adequately defend the analyses and recommendations contained in the audit report. OEP/ANL, in consultation with the contractor, will schedule the meeting with plant management. The contractor will be responsible for any audio-visual mater als necessary for the oral presentation.

Post-Audit Support and Consultation. The audit process calls for specific recommendations for energy conservation measures that can actually be implemented. The audit contractor will be responsible for followup work with plant management regarding operation and maintenance and general housekeeping energy conservation measures. The audit contractor may also be called upon to assist OEP/ANL in the preparation of competitive bid packages for each capital cost energy conservation measure recommended in the audit report. The audit contractor may also be asked to interact with the engineering firm or vendor designated to perform the work in order that a smooth and orderly transfer of information takes place that would assure a successful, cost-effective completion of the project. OEP/ANL will have the responsibility of coordinating discussion between the audit contractor and firms contracted to carry out the audit recommendation.

ENCLOSURE 2

INFORMATION REQUIRED IN TECHNICAL PROPOSALS

The Technical Proposal should contain information in four sections as follows:

1. Program Approach
2. Capabilities
3. Experience
4. Personnel and Corporate Qualifications

Under each of the four sections above, the discussion should address both Task 1, Industrial Energy Audit Training, and Task 2, Industrial Energy Audits. For each section and each task, more detailed information can be included in a set of Appendices to the Technical Proposal as follows:

Appendix A Training Program General Information

Appendix B Industrial Energy Audit General Information

Appendix C Pre-Audit Data Collection Forms

Appendix D Audit Data Collection Forms and Survey Instrument Data Specifications

Appendix E Analytical Procedure Documentation

Appendix F Experience Citations

Appendix G Resumes and Organizational Structure

A more detailed description of these sections follows.

3.1 PROGRAM APPROACH

In this section, present a capsule discussion of the approach that would be used to accomplish each major program task. The proposer is cautioned to resist a reiteration of the stated scope of work but rather discuss how the scope of work would be accomplished. A discussion of items that would allow a better understanding of a proposed approach is presented below. The approach for Task 1 and Task 2 should include a discussion of why the proposed procedures are suitable for Egypt.

Approach to Task 1. Industrial Energy Audit Training

Present a discussion of the approach that would be used in the conduct of an energy audit training program in Egypt for Egyptian nationals with a varied technical background (e.g. from Associate Engineer to Ph.D level). Information that would be beneficial in judging the approach would be, but not necessarily limited to, the following:

1. One or more proposed course outlines with time tables. For example, a flexible course outline that could accommodate associate engineers with no experience, with experience, advanced degree personnel, etc., would be helpful.
2. Proposed use of textbooks, workbooks, references, etc.
3. Proposed use of visual aids, films, video tapes, etc.

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4. Proposed use of instrumentation especially designed for training purposes such as boiler training simulator, measurement equipment rigs, etc.

5. Any special approaches to instruction.

6. Test procedures to grade students and follow-up procedures to upgrade individual student performance.

7. Course evaluation procedures that would allow an evaluation of the performance of the course and indicate areas for future improvement.

Place any additional information in Appendix A.

Approach to Task 2. Industrial Energy Audit Program

Present a discussion of the approach that would be used in the conduct of an industrial energy audit in Egypt. The discussion should cover, in a comprehensive manner, all the audit steps itemized in the Scope section and be presented in a sequential step-by-step fashion. In discussing the approach, the proposer is invited to present a generic case as well as an example case using a hypothetical plant (e.g. food processing, textile). The following is a list of approach suggestions covering some of the audit steps:

1. Plant Selection. Indicate the approach(es) that would be used to screen plants for a pre-audit interview. The proposer might suggest several approaches ranging from situations where only a plant name and address is given to a case where energy consumption, SIC, etc., data are available. Among the plant screening strategies could be a plant tour noting the type and condition of equipment and making appropriate inquires of plant operators and management.

2. Pre-Audit Data Collection Procedures. Describe the nature of the pre-audit procedures that would be used. Indicate the approach that would be used to collect pre-audit technical data. The approach must logically start with an explanation of the technical audit to plant management. The next step could be to check records, inspect the plant with plant personnel and obtain the necessary data. Place any additional documentation (e.g. interview form, data collection forms) in Appendix C.

3. Pre-Audit Evaluation. Indicate how the information collected would be used to evaluate the plant as a candidate foran energy audit. As a reminder, among other possible functions, the pre-audit process should provide adequate information to allow selection of good candidates for energy conservation measures as well as provide information on the effort level necessary to perform the audit. Outline computation or grading sheets that might allow an orderly appraisal of plant candidacy.

4. Plant Audit. Discuss the approach that would be used in the actual plant audit starting with interaction with plant management to secure certain operating agreements, etc. The discussion of approach should include the following:

a) The structure of a typical audit team (e.g. number of people, division of labor, background);

b) Include in the discussion a description of the instrumentation used (perhaps correlated to types of process systems or equipment measured in a concise table). For instance, indicate the type of measurement (e.g. temperature, CO) taken, measuring device used (e.g. thermocouple, CO monitor with ±% accuracy), process applications (e.g. boiler exhaust gas stack); and

c) Include in the discussion information that would give assurance that the approach used would be adequate to cover analysis of all systems and equipment specified in the scope of work.

Place any general supplementary information in Appendix B. Place any additional documentation (e.g. audit data collection forms, survey instrument specifications) in Appendix D.

5. Audit Data Analysis and Evaluation. Discuss the approach used to process and analyze the data collected during the audit. The discussion should be a logical follow-up of the discussion on data collection. Indicate if computer-based analytical systems are to be used and provide information adequately describing the system (e.g. specify hardware system requirements) Specify what steps would be taken to ensure that all information processed and/or collected in the plant screening, pre-audit and audit process is kept proprietary. Indicate if the audit analysis can be per formed entirely in Egypt. Specify any special conditions (e.g. computer hardware system requirements) that would be required for the analysis to be performed in Egypt. If all or part of the analysis must be performed outside Egypt, specify what steps would be taken to assure OEP/ANL that audit information transmitted outside Egypt would be kept proprietary. Provide an outline of the written audit report. The data processing approach would be adequately described by specifying data input/output (e.g. hot exhaust gas with input data specifications of temperature and gas volume flow and output or processed data of #Btu/hr @ °F). Of special interest would be a discussion of the approach used to analyze data where process equipment operates under variable load conditions. Place any additional analytical procedure documentation in Appendix E.

6. Energy Conservation Recommendations. Discuss the approach used to translate processed audit data into specific recommendations for energy conservation. Provide an outline of the written audit report. Include a discussion on the economic evaluation of the recommendations. Again, indicate if computer-based analytical systems are to be used, with full particulars. All proprietary software used must be available for licensing with full documentation under reasonable terms. The approach used to develop a set of recommendations would be adequately described by

specifying input/output data. It is expected that the process of developing recommendations would typically involve four types of analysis: a technical analysis of the current situation; application of an energy conservation measure whether it be house keeping, equipment operation modification or hardware addition; the resultant energy savings; economic evaluation of the measure. Indicate if the audit analysis can be performed entirely in Egypt. Specify any special conditions (e.g. computer hardware system requirements) that would be required for the analysis to be performed in Egypt. If all or part of the analysis must be performed outside Egypt, specify what steps would be taken to assure OEP/ANL that audit information transmitted outside Egypt would be kept proprietary. Place any additional documentation in Appendix E.

3.2 CAPABILITIES

In this section information is requested pertaining to the proposer's current capabilities to perform the work specified in the approach section. The information presented in this section should follow exactly the format and items of information presented in the approach section with an appropriate indication for each element of approach whether the capability exists or has to be developed. Capability is meant to include hardware (e.g. instrumentation, classroom aids) as well as procedures. It is expected that the proposer may have to develop or modify certain procedures to accommodate the Egyptian situation. The proposer should provide under both tasks a clear indication of whether procedures and hardware are currently available or must be purchased or developed. Current procedures that require modification should be considered and presented as existing capability with a short discussion of the modification required.

All proprietary software that is used to process audit data and analyze procedures for energy management or energy conservation must be available for licensing under reasonable terms. The proposer must therefore stipulate whether licensing is available and make clear the general conditions and estimated cost of a licensing arrangement with OEP/ANL. In the event that the proposer is using software licensed from a third party, it will be incumbent upon the proposer to obtain the required licensing information from third parties. For third party licensing agreements, the proposer should place the information received from the firm or firms with the authority to issue licenses in Appendix E.

3.3 EXPERIENCE

In this section the proposer should describe all previous experience relevant to the scope of work for each major task. Experience should be cited as U.S., foreign, developing country or Egypt-specific.

Task 1. Industrial Energy Audit Training

Summarize experience in conducting training courses for industrial energy audits or other types of energy audit. Indicate the nature of the course, average length of session, estimate of the education and experience background of trainees. Include in Appendix F a list of training courses held simply indicating place, location, and any other concise descriptors. Also include in Appendix F any references, letters of commendation, praise, etc. regarding the conduct of the training courses.

Task 2. Industrial Energy Audits

Provide a synopsis of industrial energy audit experience including areas of specialization (e.g. types of industry and/or unit operations). Also indicate any foreign experience and the nature of the experience. Indicate total number of industrial audits performed, distribution by type of industry (e.g. food, chemical). Also indicate the type of energy conservation recommendations developed as a result of different audits. Include in Appendix F any references or supplemental lists reflecting the industrial audit experience.

3.4 QUALIFICATIONS AND ORGANIZATION

Indicate the qualifications of personnel and organizations that would perform the work. If portions of the work are to be subcontracted, the qualifications and the work of the subcontractor organization and personnel should be fully delineated and described.

3.4.1 Personnel Qualification. In this section briefly describe the qualifications of personnel that would be involved for each task. The information placed in this section should be limited to one-half page per person and only pertain to qualifications pertinent to the program tasks. The complete resumes of personnel should be included in Appendix G.

3.4.2 Organization Qualifications. Provide a project organization chart showing staffs and subcontractor(s) where appropriate. The organizational chart should show names and functions of key personnel and how the various contractor groups and subcontract organizational units (if any) will support the project. Management responsibility within the organization and for the project should be clearly indicated. Place any supplemental information in Appendix G.

4.0 COST ESTIMATION

The AID project (AID Energy Planning Sub-Project No. 263-0123.1) that involves Tasks 1 and 2 will begin place for a four-year period. Argonne National Laboratory (ANL) is submitting this RFP for the contracting of work under a Basic Ordering Agreement (BOA) so that the work may be initiated on an as-needed basis for the first year. Under the BOA, it is currently anticipated that contracts will be initially let for a minimum of three industrial energy audit training sessions under Task 1 and a minimum of 15 industrial audits (based on approximately 13 days effort per audit) under Task 2. It is

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requested that proposers submit an estimate of cost individually for both Task 1 and Task 2 based on these initial criteria and on the prescribed set of assumptions indicated below. The guidelines established for an expected effort level for each training session and each audit are considered by ANL as an approximation to be used for comparing costs among proposers.

It should also be noted that the actual effort level for performance of Tasks 1 and 2 (e.g. actual number of training sessions, actual number of audits performed, time required per audit) may vary. These uncertainties are what necessitate a BOA-type contract arrangement and will be dealt with as the program progresses.

Task 1. Industrial Energy Audit Training

For the purpose of cost comparison among proposers, assume the following for each training session:

- o 15 students,
- o Two weeks (10) days of classroom instruction, and
- o One week (5 days) of field instruction.

Provide individual cost estimates as follows:

- o A total of three consecutive training sessions, and
- o Incremental cost per training session after three sessions.

Task 2. Industrial Energy Audits

For the purpose of cost comparison among proposers, assume the following for each industrial audit:

- o Three days of effort for plant screening and pre-audit procedures,
- o Five days of effort for in-plant audit, and
- o Five days of effort to finalize and present audit report.

Provide the cost estimate as follows:

- o Fifteen consecutive audits, and
- o Incremental cost per audit after fifteen audits.

EVALUATION CRITERIA

A contractor proposal evaluation panel will be established to evaluate proposals and recommend the selection of contractor(s). Contractors are invited to submit proposals for Task 1 and/or Task 2 or both Task 1 and Task 2. Tasks 1 and 2 will be evaluated independently of each other. Credit is available for proposals that include a response to both Task 1 and Task 2.

For each task, proposals will be evaluated for approach, capability, experience, and organizational qualifications using the following criteria with their respective weights (i.e. points):

Task 1 - Industrial Energy Audit Training

Approach.....

Capability, Experience and Organizational Qualifications.....

Available Credit for Task 2 Response.....

Task 2 - Industrial Energy Audits

Approach.....

Capability, Experience and Organizational Qualifications.....

Available Credit for Task 1 Response.....

ARGONNE NATIONAL LABORATORY
Argonne, Illinois 60439

CONTRACT NO. 31-109-38-

AGREEMENT BETWEEN

THE UNIVERSITY OF CHICAGO
(Operator of Argonne National Laboratory)

and

_____

_____

The University of Chicago, an Illinois not-for-profit corporation, operator of Argonne National Laboratory and herein called the "Laboratory", acting under Prime Contract No. 31-109-Eng-38 with the United States Government (called the "Government") represented by the U.S. Department of Energy (called the "Department") desires _____ (called the "Contractor") a _____ organized under the laws of the State of _____ to perform the services set forth under Article 1 of this contract and the Contractor is willing to perform such services. The effective date of this contract is _____.

THEREFORE, the parties mutually agree as follows:

ARTICLE I - DESCRIPTION OF WORK

The Contractor shall furnish the personnel, facilities, equipment, materials and supplies necessary to perform the work described in _____ attached hereto and hereby made a part of this contract.

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Specific activities to be considered may include consortia for design, construction, and operation of nuclear plants; methods to incorporate improved technical criteria and evaluation procedures, as they become available, into the regulatory process; and integrated nuclear reactor export marketing approaches and other international policy options such as cooperative agreements and joint ventures in nuclear energy research and development.

Each task will be performed in accordance with an agreed time schedule, work product and cost schedule. The senior staff will direct and participate in the execution of all tasks. The services to be performed shall be described and set forth from time to time in separate work orders issued pursuant to the terms of this agreement in the form attached hereto as Exhibit "A". No work shall proceed until a work order has been signed by both parties.

The Contractor will consult with the Laboratory, by telephone or otherwise, at monthly intervals and at such other times as may be deemed desirable by the Laboratory or the Contractor, with respect to progress on outstanding work orders. The Contractor is to notify promptly and discuss with the Laboratory any anticipated need to deviate from an agreed upon time schedule, work product, cost schedule or assignment of personnel.

2. The services herein provided for shall be furnished from time to time, as required by the Laboratory, commencing on March 1, 1983 and continuing through February 28, 1984 or through the period of any extension of this agreement, provided however, that this agreement is not sooner terminated as hereinafter provided.

3. It is agreed that the Laboratory is not required to request any minimum dollar amount of service or, for that matter, any service whatsoever and that the Contractor is not required to fill an order if he has no personnel able to meet the particular requirement.

ARTICLE II - COMPENSATION FOR SERVICES

1. The Contractor shall receive as full compensation for all services performed hereunder, including necessary travel, and as full reimbursement for travel and living expenses incurred in connection with the performance of such services:

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A. Amounts computed by multiplying the appropriate hourly rate, or rates, set forth below by the number of direct labor hours performed, which rates shall include wages, overhead, general and administrative expense and profit. Vouchers may be submitted once each month to the Assistant Controller of the Laboratory. The Contractor will substantiate vouchers by evidence of actual payment and by individual daily job timecards or such other substantiation approved by the Laboratory. Promptly after receipt of each substantiated voucher, the Laboratory shall, except as otherwise provided in this agreement, and subject to the provisions of 3, below, make payment thereom.

Category	Hourly Rate
Senior Partners	$200.00
Junior Partners	$150.00
Senior Associates	$100.00
Junior Associates	$ 75.00
Paralegals	$ 50.00

B. The Laboratory's normal working hours are 8:30 AM to 5:00 PM, Monday through Friday. The Contractor shall not receive payment for any hours worked outside these specified hours unless specifically authorized by the Laboratory.

C. The following holidays are observed by the Laboratory:

New Year's Day	Thanksgiving (2 days)
Memorial Day	Christmas Eve
Independence Day	Christmas Day
Labor Day	New Year's Eve

D. Cost of necessary telephone, telegraph and postal services, and computer charges, when authorized by work order.

E. Travel expenses for Laboratory-directed travel reimbursable in accordance with Appendix C, "Travel Policy for Contractor Personnel", dated 7/6/82, which is attached hereto. Such travel will be detailed in the applicable work order and approved by the Laboratory's cognizant technical representative for each work order where travel is indicated.

2. Work releases will be issued for each task required in accordance with Exhibit A, "Work Order" form, dated 10/1/80, signed by the authorized Laboratory Procurement official on behalf of the Laboratory and the appropriate corporate official on behalf of the Contractor.

3. At any time or times prior to final payment under this agreement the Laboratory may cause to be made such audit of the invoices or vouchers and substantiating material as shall be deemed necessary. Each payment theretofore made shall be subject to reduction to the extent of amounts which are found by the Laboratory not to have been properly payable and shall also be subject to reduction for overpayments, or to increase for underpayments on preceeding invoices or vouchers.

ARTICLE III - MANNER OF PAYMENT

1. The Contractor shall be paid monthly upon submission of properly certified and current invoices bearing the work order number and code description of the Agreement No. 31-109-38-7067 to the Assistant Controller of the Laboratory. Such invoices must be sufficiently detailed to permit the identification of the various compensable items under this agreement.

2. Attached to each billing and copy thereof, there must be furnished the following certification which must be manually signed by an authorized representative of the Contractor:

   "I certify that the above bill is correct and just; that the amounts claimed represent fair charges against Argonne National Laboratory and that reimbursement has not and will not be received therefor under any other Government contract or other source of Government funds."

3. The Contractor agrees to furnish the Laboratory by the twenty-fifth (25th) day of each month, an approximation of accrued expenditures for that month.

4. Terms: Net 10 days.

ARTICLE IV - DISCONTINUANCE

Discontinuance of future application of this Basic Ordering Agreement can be accomplished upon thirty (30) days written notice by either party. Discontinuance of the Basic Ordering Agreement will not affect any individual work order(s) referencing the Basic Ordering Agreement entered into prior to the effective date of the discontinuance, and all provisions of the Basic Ordering Agreement shall pertain thereto until completed or otherwise terminated.

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ARTICLE V - CONTRACTOR EMPLOYEES

It is understood and agreed that Contractor and Contractor's employees are not employees of the Laboratory and are entitled to no employee benefits or privileges nor any payment from the Laboratory, except such payments as set forth in Article II - COMPENSATION FOR SERVICES of the Schedule of this Agreement. All such payments shall be made to the Contractor and no payment shall be made to any of the Contractor's employees.

ARTICLE VI - COMPLETION OF WORK ORDER

Any work order issued during the effective period of this agreement and not completed within the period shall be completed by the Contractor within the time specified in the order and the rights and obligations of the Contractor and the Laboratory respecting that work order shall be governed by the terms of the agreement as fully and to the same extent as if completed during the effective period of this agreement, provided that the Contractor shall not be required to perform any work under this agreement after March 31, 1984.

ARTICLE VII - KEY PERSONNEL

The personnel specified in each work order under this agreement are considered to be essential to the work being performed. Prior to diverting any of the specified individuals to other programs, the Contractor shall notify the cognizant Procurement Official of Argonne National Laboratory reasonably in advance and shall submit justification (including proposed substitutions) in sufficient detail to permit evaluation of the impact on the program. No diversion shall be made by the Contractor without the written consent of the cognizant Procurement Official of Argonne National Laboratory: Provided, that the cognizant Procurement Official of Argonne National Laboratory may ratify in writing such diversion and such ratification shall constitute the consent of the cognizant Procurement Official of Argonne National Laboratory required by this clause. The work order may be amended from time to time during the course of the agreement either to add or delete personnel, as appropriate.

ARTICLE VIII - RIGHTS TO PROPOSAL DATA

It is agreed that, as a condition of the award of this agreement, and notwithstanding the provisions of any notice appearing on the proposal, the Government shall have the right to use, duplicate, disclose and have others do so for any purpose whatsoever, the technical data contained in the proposal upon which this agreement is based.

ARTICLE IX - APPLICABLE DOCUMENTATION

The following documents are attached hereto and are hereby made a part of this agreement:

1. Appendix "A", "Standard Terms and Conditions for Fixed-Price Contracts", dated June 1, 1980.

2. Appendix "C", Travel Policy for Contractor Personnel, dated 7/6/82.

3. Appendix "D-3", Intellectual Property Provisions for Consultant Contracts, dated November 1, 1982.

4. Appendix "E" Indemnification, Insurance and Safety, Form ANL-366 (Rev. 10/82).
5. Appendix "F" Organizational Conflicts of Interest - Special, dated 5/79.

6. Exhibit A, Work Order, dated 10/1/80.

ARTICLE X - CONFLICTS IN DOCUMENTATION

Any discrepancy, inconsistency, or conflict in one or more of the documents identified in Article X which can reasonably be ascertained by the Contractor shall be immediately submitted to the Laboratory for its written decision. Any work undertaken by the Contractor without such decision shall be at the Contractor's own risk.

ARTICLE XI - LABORATORY REPRESENTATIVES

1. The Authorized Laboratory Procurement Official is the only person at the Laboratory who is authorized to change the scope of work or any other part of this agreement.

2. All letters and notices from the Contractor shall be submitted to the attention of the Laboratory's Buyer Specialist.

3. Unless the Contractor is otherwise notified in writing, technical questions relating to the work may be discussed with J. H. Talboy (312) 972-6390 who is the Laboratory's Technical Representative on this Contract.

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IN WITNESS WHEREOF, the parties hereto have executed this Supplemental Agreement No. ___ this ____ day of _____, 1983.

THE UNIVERSITY OF CHICAGO
(Operator of Argonne National Laboratory)

By _____
F. W. Foster

Title Senior Buyer
Administrative Services Division

_____

By _____

Title _____

I, _____, certify that I am the _____ _____ of the corporation named as "Contractor" herein; that _____ who signed this Supplemental Agreement No. ___ on behalf of the Contractor was then _____ of said corporation; that I know his signature and his signature thereto is genuine; and that said Supplemental Agreement No. ___ was duly signed, sealed and attested for and in behalf of said corporation by authority of its governing body.

By _____

Title _____

CORPORATE SEAL

ARGONNE NATIONAL LABORATORY EXHIBIT "A"

WORK ORDER Contract No. 31-109-38-7067

Date_____

Work Order No. _____ Cost Code_____

(Note: Work Order and Cost Code information must appear on all invoices.)

To:

Pursuant to Contract # 31-109-38-_____, the Contractor will perform the following services:

1.

2. Period of Performance:

3. Dollar Ceiling: The total amount to be paid by the Laboratory under this Work Order shall not exceed _____.

4. Budget: The budget for the effort described in paragraph 1 above is as follows:

5. Technical Representatives:

ANL_____ Contractor_____

6. Terms and Conditions:

This Work Order, the performance of the services described herein and the rights and obligations of the parties with respect thereto are governed by Contract No. 31-109-38-_____ between the parties dated _____, including all supplements thereto, and such terms and conditions as are set forth in this Work Order pursuant to such contract. The terms and conditions set forth in such Contract are hereby incorporated herein by reference.

Accepted and Agreed to:

ARGONNE NATIONAL LABORATORY CONTRACTOR:

By_____ _____

Title_____ _____

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APPENDIX A

STANDARD TERMS AND CONDITIONS

FOR FIXED-PRICE SUPPLY CONTRACTS

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JUNE 1, 1980

APPENDIX A

STANDARD TERMS AND CONDITIONS

FOR FIXED-PRICE SUPPLY CONTRACTS

1. Changes

The authorized Laboratory Procurement Official may at any time, by a written order, and without notice to the sureties, if any, make changes, within the general scope of this contract, in any one or more of the following: (a) drawings, designs, or specifications, where the supplies to be furnished are to be specially manufactured for the Laboratory in accordance therewith; (b) method of shipment or packing; and (c) place of delivery. If any such change causes an increase or decrease in the cost of, or the time required for, the performance of any part of the work under this contract, whether changed or not changed by any such order, an equitable adjustment shall be made in the contract price or delivery schedule, or both, and the contract shall be modified in writing accordingly. Any claim by the Contractor for adjustment under this section must be asserted within 30 days from the date of receipt by the Contractor of the notification of change; provided, however, that the authorized Laboratory Procurement Official, if he decides that the facts justify such action, may receive and act upon such claim asserted at any time prior to final payment under this contract. Where the costs of property made obsolete or excess as a result of a change is included in the Contractor's claim for adjustment, the authorized Laboratory Procurement Official shall have the right to prescribe the manner of disposition of such property. Nothing in this section shall excuse the Contractor from proceeding with the contract as changed. Except as otherwise provided herein, no payment for extra work shall be made unless such extras and the price therefor have been authorized in writing by the authorized Laboratory Procurement Official.

2. Reports and Records

The Contractor shall furnish intermediate reports to the Laboratory from time to time when requested, in such form and number as may be required by the Laboratory, summarizing activities of the Contractor under this contract and shall make such final report or reports as may be required by the Laboratory. All reports delivered to the Laboratory under this contract shall contain a signature page which will identify the person(s) preparing the report and the person(s) approving the report.

3. Examination of Records

A. The Contractor agrees that the Laboratory, the Department, the Comptroller General of the United States, or any of their duly authorized representatives, shall until the expiration of three (3) years after final payment under this contract unless the Department authorizes their prior disposition, have access to and the right to examine any directly pertinent books, documents, papers, and records of the Contractor involving transactions related to this contract.

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B. The periods of access and examination described in paragraph A above, for records which relate to litigation or the settlement of claims arising out of the performance of this contract, or costs and expenses of this contract as to which exception has been taken by the Comptroller General or any of his duly authorized representatives, shall continue until such litigation, claims or exceptions have been disposed of.

C. Nothing in this contract shall be deemed to preclude an audit by the General Accounting Office of any transaction under this contract.

4. Cost or Pricing Data

A. The Contractor agrees to submit, under the situations described in paragraph A.1., below, unless exempted under the exceptions set forth in paragraph A.2., below, and shall require each subcontractor under this contract to submit, cost or pricing data, and to certify that, to the best of his knowledge and belief, such cost or pricing data are accurate, complete and current.

1. The cost or pricing data called for under paragraph A, above, shall be submitted prior to (i) award of each subcontract the price of which is expected to exceed $100,000; and (ii) the pricing of each change or modification to this contract or to a subcontract under this contract for which the price adjustment is expected to exceed $100,000.

2. Cost or pricing data need not be furnished pursuant to this paragraph A where (i) the price or price adjustment is based on adequate price competition, established catalog or market prices of commercial items sold in substantial quantities to the general public or prices set by law or regulation; or (ii) the Contractor has not been required to furnish cost or pricing data and to certify that they are accurate, complete and current.

3. In submitting the cost or pricing data, the Contractor shall use the form of certificate set forth in paragraph B, below, and certify that the data are accurate, complete, and current as of the date when the price negotiations were concluded and the contract price was agreed upon or as of the date of agreement on the price adjustment of any change or modification. Such cost or pricing data and certificate of current cost or pricing data shall be submitted by subcontractors to the Contractor (or to their immediate next higher tier subcontractor, for delivery to the Contractor). Such data and certificates shall become a part of the prime contract records.

B. The certificates required by this clause shall be in the form set forth below. The Contractor shall be required to submit the certificate as soon as practicable after agreement is reached on the contract price.

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"CONTRACTOR'S CERTIFICATE OF CURRENT COST OR PRICING DATA"

"This is to certify that, to the best of my knowledge and belief, cost or pricing data 1/ submitted in writing, or specifically identified in writing if actual submission of the data is impracticable (see FPR 1-3.807-3(h) (2)), to _____ in support of _____ 2/ are accurate, complete and current as of _____ 3/."

Firm_____

Name_____

Title_____

(Date of Execution) 4/

1/ For definition of "cost or pricing data," see FPR 1-3.807-3.

2/ Describe the proposal, quotation, request for price adjustment, or other submission involved, giving appropriate identifying number (e.g., RFP No. _____).

3/ This date shall be the date when the price negotiations were concluded and the contract price was agreed to. The responsibility of the Contractor is not limited by the personal knowledge of the Contractor's negotiator if the Contractor had information reasonably available (see FPR 1-3.807-5(a)) at the time of agreement, showing that the negotiated price is not based on accurate, complete, and current data.

4/ This date should be close as practicable to the date when the price negotiations were concluded and the contract price was agreed upon.

C. For purposes of verifying that cost or pricing data submitted and certified to are accurate, complete and current, the Department or any of its authorized representatives shall until three (3) years after final payment under this contract have the right to examine those books, records, documents and other supporting data which will permit adequate evaluation of the cost or pricing data submitted, along with computations and projections used therein which were available to the Contractor as of the date of execution of his certificate of current cost or pricing data, and such other data, including books, records, and other documents generated during the contract period which the Department or any of its authorized representatives consider necessary to verify that the data submitted were accurate, complete, and current.

D. Whenever the price of any change or modification to this contract is expected to exceed $100,000, except where the price is based on adequate price competition, established catalog or market prices of commercial items sold in substantial quantities to the general public, or prices set by law or regulation, the Contractor agrees to furnish the Laboratory cost or

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pricing data and shall certify, using the certificate set forth in paragraph B, above, that to the best of his knowledge and belief such cost or pricing data are accurate, complete and current as of a date prior to and as close as practicable to the date of agreement on the price adjustment.

E. Whenever the Contractor was required to furnish a certificate of current cost or pricing data, either during negotiation of this contract or pursuant to the provisions of this clause, or whenever a subcontractor hereunder was required to furnish such a certificate pursuant to the provisions of this clause or of a clause in the subcontract, and the Laboratory determines that the price of this contract, including any profit or fee, or that any price adjustment negotiated for any change or modification to this contract, has been increased by any significant sums because such cost or pricing data were inaccurate or incomplete or were not current as of the date set forth in the certificate applicable to such data, such price or price adjustment shall be reduced accordingly and the contract shall be modified in writing to reflect such reduction. However, any reduction in the contract price due to defective subcontract data of a prospective subcontractor when the subcontract was not subsequently awarded to such subcontractor, will be limited to the amount (plus applicable overhead and profit markup) by which the actual subcontract, or actual cost to the Contractor if there was no subcontract, was less than the prospective subcontract cost estimate submitted by the Contractor; Provided, the actual subcontract price was not affected by the defective cost or pricing data.

(Note: Since the contract is subject to reduction under this clause by reason of defective cost or pricing data submitted in connection with certain lower tier contracts, it is expected that the Contractor may wish to include a clause in each such contract requiring the subcontractor to appropriately indemnify the Contractor. It is also expected that any subcontractor subject to such indemnification will generally require substantially similar indemnification for defective cost or pricing data required to be submitted by his lower tier contractors).

F. The Contractor agrees to insert paragraph C without change and the substance of paragraph A, B, D, and F of this clause in each subcontract hereunder in excess of $100,000 and in each subcontract of $100,000 or less at the time of making a change or modification thereto in excess of $100,000.

5. Federal, State and Local Taxes

A. Except as may be otherwise provided in this contract, the contract price includes all applicable Federal, State and local taxes and duties.

B. Nevertheless, with respect to any Federal excise tax or duty on the transactions or property covered by this contract, if a statute, court decision, written ruling or regulation takes effect after the contract date, and -

1. Results in the Contractor being required to pay or bear the burden of any such Federal excise tax or duty or increase in the rate thereof which would not otherwise have been payable on such transactions or property, the contract price shall be increased by the amount of such tax or duty or rate increase: Provided, that the Contractor if requested by the Laboratory, warrants in writing that no amount for such newly imposed Federal excise tax or duty or rate increase was included in the contract price as a contingency reserve or otherwise; or

2. Results in the Contractor not being required to pay or bear the burden of, or in his obtaining a refund or drawback of, any such Federal excise tax or duty which would otherwise have been payable on such transactions or property or which was the basis of an increase in the contract price, the contract price shall be decreased by the amount of the relief, refund, or drawback, or that amount shall be paid to Government, as directed by the Laboratory. The contract price shall be similarly decreased if the Contractor, through his fault or negligence or his failure to follow instructions of the Laboratory, is required to pay or bear the burden of, or does not obtain a refund or drawback of, any such Federal excise tax or duty.

C. No adjustment pursuant to paragraph B above will be made under this contract unless the aggregate amount thereof is or may reasonably be expected to be over $100.

D. As used in paragraph B, above, the term "Contract date" means the date set for the bid opening, or if this is a negotiated contract, the date of this contract. As to additional supplies or services procured by modification to this contract, the term "contract date" means the date of such modification.

E. Unless there does not exist any reasonable basis to sustain an exemption, the Laboratory, upon request of the Contractor, without further liability, agrees, except as otherwise provided in this contract, to furnish evidence appropriate to establish exemption from any tax which the Contractor warrants in writing was excluded from the contract price. In addition, the Laboratory may furnish evidence to establish exemption from any tax that may, pursuant to this clause, give rise to either an increase or decrease in the contract price. Except as otherwise provided in this contract, evidence appropriate to establish exemption from duties will be furnished only at the discretion of the Laboratory.

F. The Contractor shall promptly notify the Laboratory of matters which will result in either an increase or decrease in the contract price, and shall take action with respect thereto as directed by the Laboratory.

6. Notification of Claims.

The Laboratory shall notify the Contractor immediately, by registered mail addressed to the Contractor, at the plant where the contract work is being performed or at any other place the Contractor may designate, of all claims brought against the Laboratory for which the Contractor may be liable, and the Contractor shall notify the Laboratory immediately, by registered mail addressed to Argonne National Laboratory, 9700 South Cass Avenue, Argonne, Illinois 60439, to the attention of the Director of Procurement, of all claims brought against the Contractor for which the Laboratory may be liable.

7. Termination for Convenience

A. The performance of work under this contract may be terminated, in whole or from time to time in part, by the Laboratory in accordance with this clause. Termination of work hereunder shall be effected by delivery to the Contractor of a notice of termination specifying the extent to which performance of work under the contract is terminated, and the date upon which such termination becomes effective.

B. After receipt of a Notice of Termination and except as otherwise directed by the Laboratory, the Contractor shall:

1. Stop work under the contract on the date and to the extent specified in the Notice of Termination;

2. Place no further orders or subcontracts for materials, services, or facilities except as may be necessary for completion of such portion of the work under the contract as may not be terminated;

3. Terminate all orders and subcontracts to the extent that they relate to the performance of any work terminated by the Notice of Termination;

4. Assign to the Laboratory, in the manner and to the extent directed by the Laboratory, all of the right, title, and interest of the Contractor under the orders or subcontracts so terminated;

5. Settle all outstanding liabilities and all claims arising out of such termination of orders and subcontracts subject to the approval or ratification of the Laboratory to the extent it may require, which approval or ratification shall be final for all the purposes of this clause;

6. Transfer title and deliver to the Laboratory in the manner, to the extent, and at the times directed by the Laboratory (i) the fabricated or unfabricated parts, work in process, completed work, supplies, and other material produced as a part of, or acquired in connection with the performance of the work terminated by the Notice of Termination, and (ii) the completed or partially completed plans, drawings, information, and other property which, if the contract had been completed, would be required to be furnished to the Laboratory;

7. Use its best efforts to sell, in the manner, to the extent, at the time, and at the price or prices directed or authorized by the Laboratory, any property of the types referred to in paragraph 6, above; provided, however, that the Contractor (i) shall not be required to extend credit to any purchaser, and (ii) may acquire any such property under the conditions prescribed by and at a price or prices approved by the Laboratory; and provided further, that the proceeds of any such transfer or disposition shall be applied in the reduction of any payments to be made by the Laboratory to the Contractor under this contract or shall otherwise be credited to the price or cost of the work covered by this contract or paid in such other manner as the Laboratory may direct;

8. Complete performance of such part of the work as shall not have been terminated by the Notice of Termination; and

9. Take such action as may be necessary or as the Laboratory may direct for protection and preservation of the property related to this contract which is in possession of the Contractor and in which the Laboratory or the Government has or may acquire an interest.

C. After receipt of a Notice of Termination, the Contractor shall submit to the Laboratory its termination claim, in the form and with the certification prescribed by the Laboratory. Such claim shall be submitted promptly, but not later than six months from the effective date of termination. Upon failure of the Contractor to submit its termination claim within the time allowed, the Laboratory may determine, on the basis of information available to it, the amount, if any, due to the Contractor with respect to the termination and such determination shall be final. After the Laboratory has made a determination under this paragraph it shall pay the Contractor the amount so determined.

D. Subject to the provisions of paragraph C, the Contractor and the Laboratory may agree upon the whole or any part of the amount or amounts to be paid to the Contractor by reason of the total or partial termination of work pursuant to this clause, which amount or amounts may include a reasonable allowance for profit on work done and the Laboratory shall pay the agreed amount or amounts; provided, that such agreed amount or amounts, exclusive of settlement costs, shall not exceed the total contract price as reduced by the amount of payments otherwise made and as further reduced by the contract price of work not terminated. Nothing in paragraph E, below prescribing the amount to be paid to the Contractor in the event of the failure of the Contractor and the Laboratory to agree upon the whole amount to be paid to the Contractor by reason of the termination of work pursuant to this clause, shall be deemed to limit, restrict, or otherwise determine or affect the amount or amounts which may be agreed upon to be paid to the Contractor pursuant to this paragraph D.

E. In the event of the failure of the Contractor and the Laboratory to agree as provided in paragraph D upon the whole amount to be paid to the Contractor by reason of the termination of work pursuant to this clause, the Laboratory, but without duplication of any amounts agreed upon in accordance with Paragraph D, shall pay to the Contractor the following amounts.

1. For completed supplies accepted by the Laboratory (or sold or acquired as provided in paragraph B.7., above) and not theretofore paid for, a sum equivalent to the aggregate price for such supplies computed in accordance with the price or prices specified in the contract, appropriately adjusted for any saving of freight or other charges;

2. In respect of the work terminated as permitted by this clause, the total (without duplication of any items) of:

(i) the cost of such work, including initial costs and preparatory expenses allocable thereto, exclusive of any costs attributable to supplies paid or to be paid for under paragraph E.1., above; and

(ii) the cost of settling and paying claims arising out of the termination of work under subcontracts or orders as provided in paragraph B.5., above, exclusive of the amounts paid or payable on account of supplies or materials delivered or services furnished by the subcontractor prior to

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the effective date of the Notice of Termination of work under this contract, which amount shall be included in the cost on account of which payment is made under 2.(i), above; and

(iii) a sum, as profit on 2.(i) above determined by the Laboratory pursuant to paragraph 1-8.303 of the Federal Procurement Regulations (41 CFR 1-8.303), in effect as of the date of execution of this contract, to be fair and reasonable; Provided, however, that if it appears that the Contractor would have sustained a loss on the entire contract had it been completed, no profit shall be included or allowed under this paragraph E.2.(iii) and an appropriate adjustment shall be made reducing the amount of the settlement to reflect the indicated rate of loss; and

3. The reasonable costs of settlement, including accounting, legal, clerical, and other expenses reasonably necessary for the preparation of settlement claims and supporting data with respect to the terminated portion of the contract and for the termination and settlement of subcontracts thereunder, together with reasonable storage, transportation, and other costs incurred in connection with the protection or disposition of the property allocable to this contract.

The total sum to be paid to the Contractor under paragraphs E.1 and 2, above, shall not exceed the total contract price as reduced by the amount of payments otherwise made and as further reduced by the contract price of work not terminated. Except for normal spoilage and except to the extent that the Laboratory or the Government shall have otherwise expressly assumed the risk of loss, there shall be excluded from the amounts payable to the Contractor under 1 and 2.(i), above, the fair value as determined by the Laboratory of property which is destroyed, lost, stolen, or damaged so as to become undeliverable to the Laboratory or to a purchaser pursuant to paragraph B.7.

F. The obligation of the Laboratory to make any payments under this paragraph shall be subject to deductions with respect to (1) all unliquidated advance or other payments on account theretofore made to the Contractor applicable to the terminated portion of this contract, (2) any claim which the Laboratory may have against the Contractor in connection with this contract, and (3) the agreed price for, or the proceeds of sale of any materials, supplies, or other things retained by the Contractor or sold, and not otherwise recovered by or credited to the Laboratory.

G. If the termination hereunder be partial, prior to the settlement of the terminated portion of this contract, the Contractor may file with the Laboratory a request in writing that an equitable adjustment be made in the price or prices specified in the contract for the work in connection with the continued portion not terminated by the Notice of Termination, and the appropriate equitable adjustment shall be made in such price or prices.

H. The Laboratory may from time to time, under such terms and conditions as it may prescribe, make partial payments and payments on account against costs incurred by the Contractor with respect to the terminated portion of the contract, whenever in the opinion of the Laboratory the aggregate of such payments shall be within the amount to which the Contractor will be

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entitled hereunder. If the total of such payments is in excess of the amount finally agreed upon or determined to be due under this clause, such excess shall be payable by the Contractor to the Laboratory upon demand, together with interest computed at the rate established by the Secretary of the Treasury pursuant to Public Law 92-41 (50 U.S.C. App. 1215 (b)(2)) for the period from the date such excess payment is received by the Contractor to the date on which such excess is repaid; Provided, however, that no interest shall be charged with respect to any such excess payment attributable to a reduction in the Contractor's claim by reason of retention or other disposition of termination inventory until ten days after the date of such retention or disposition, or such later date as determined by the Laboratory by reason of the circumstances.

I. For the purpose of Paragraphs C and D above, the amounts of the payments to be made by the Laboratory to the Contractor shall be determined in conformity with the policies and principles set forth in Part 1-8 of the Federal Procurement Regulations (41 CFR 1-8), in effect at the date of this contract. Unless otherwise provided for in this contract, or by applicable statute, the Contractor, for a period of three years after final settlement under the contract, shall preserve and make available to the Laboratory and the Government at all reasonable times at the office of the Contractor but without direct charge to the Laboratory or the Government, all his books, records, documents, and other evidence bearing on the costs and expenses of the Contractor under the contract and relating to the work terminated hereunder or, to the extent approved by the Government, photographs, microphotographs, or other authentic reproductions thereof.

8. Default

A. The Laboratory, may subject to the provisions of paragraph B, below, by written Notice of Default to the Contractor terminate the whole or any part of this contract in any one of the following circumstances:

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1. If the Contractor fails to make delivery of the supplies or to perform the services within the time specified herein or any extension thereof, or

2. If the Contractor fails to perform any of the other provisions of this contract, or so fails to make progress as to endanger performance of this contract in accordance with its terms, and in either of these two circumstances does not cure such failure within a period of ten days (or such longer period as the Laboratory may authorize in writing) after receipt of notice from the Laboratory specifying such failure.

B. The Contractor shall not be liable for any excess costs if any failure to perform the contract arises out of causes beyond the control and without the fault or negligence of the Contractor. Such causes may include, but are not restricted to, acts of God or of the public enemy, acts of the Laboratory, or of the Government, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, unusually severe weather, and defaults of suppliers or specifically approved subcontractors due to any of such causes unless the Laboratory shall determine that the supplies or services to be furnished by the subcontractor were obtainable from other sources in sufficient time to permit the Contractor to meet the required delivery schedule. In the event of a delay in the performance of work without fault or negligence of the Contractor, the Laboratory will, by written notice to the Contractor, extend the time for performance by such period of time as the Laboratory determines to be commensurate with the period of such delay.

C. In the event the Laboratory terminates this contract in whole or in part as provided in paragraph A, the Laboratory may procure, upon such terms and in such manner as the Laboratory may deem appropriate, supplies or services similar to those so terminated, and the Contractor shall be liable to the Laboratory for any excess costs for such similar supplies or services; Provided, that the Contractor shall continue the performance of this contract to the extent not terminated under the provisions of this clause.

D. If this contract is terminated as provided in paragraph A., the Laboratory, in addition to any other rights provided in this clause, may require the Contractor to transfer title and deliver to the Laboratory or its designee, in the manner and to the extent directed by it (1) any completed supplies and (2) such partially completed supplies and materials, parts, tools, dies, jigs, fixtures, plans, drawings, information and contract rights (hereinafter called "manufacturing materials") as the Contractor has specifically produced or specifically acquired for the performance of such part of this contract as has been terminated; and the Contractor shall, upon direction of the Laboratory, protect and preserve property in possesion of the Contractor in which the Laboratory has an interest. The Laboratory shall pay to the Contractor the contract price for completed supplies delivered to and accepted by the Laboratory, and the amount agreed upon by the Laboratory and the Contractor for manufacturing materials delivered to and accepted by the Laboratory and for the protection and preservation of property.

The Laboratory may withhold from amounts otherwise due the Contractor for such completed supplies or manufacturing materials such sum as the Labora-

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tory determines to be necessary to protect the Laboratory against loss because of outstanding liens or claims of former lien holders.

E. If, after Notice of Termination of this contract in whole or in part under the provisions of this clause, it is determined for any reason that the Contractor was not in Default under the provisions of this clause, or that the default was excusable under the provisions of this clause, the rights and obligations of the parties shall be the same as if the Notice of Termination had been issued under the clause entitled "Termination for Convenience."

F. The rights and remedies of the Laboratory provided in this clause shall not be exclusive and are in addition to any other rights and remedies provided by law or under this contract.

9. Inspection

A. All supplies (which term throughout this clause includes without limitation raw materials, components, intermediate assemblies, and end products) shall be subject to inspection and test by the Laboratory, to the extent practicable at all times and places including the period of manufacture, and in any event prior to final acceptance.

B. In case any supplies or lots of supplies are defective in material or workmanship or otherwise not in conformity with the requirements of this contract, the Laboratory shall have the right either to reject them (with or without instructions as to their disposition) or to require their correction. Supplies or lots of supplies which have been rejected or required to be corrected shall be removed or corrected in place, as requested by the Laboratory, by and at the sole expense of the Contractor (including any expense of transportation and installation) promptly after notice. If the Contractor fails promptly to remove such supplies or lots of supplies when requested by the Laboratory, or to proceed promptly with the replacement or correction thereof, the Laboratory either (1) may by contract or otherwise replace or correct such supplies and charge to the Contractor the cost occasioned thereby, or (2) may terminate this contract for default as provided in the clause of the contract entitled "Default," or (3) may accept such supplies at a reduction in price which is equitable under the circumstances.

C. If any inspection or test is made by the Laboratory on the premises of the Contractor or a subcontractor, the Contractor without additional charge shall provide all reasonable facilities and assistance for the safety and convenience of the Laboratory's inspectors in the performance of their duties. If the Laboratory's inspection or test is made at a point other than the premises of the Contractor or a subcontractor, it shall be at the expense of the Laboratory; provided, that in case of rejection the Laboratory shall not be liable for any reduction in value of samples used in connection with such inspection or test. All inspections and tests by the Laboratory shall be performed in such a manner as not to delay the work unduly. Final acceptance or rejection of the supplies shall be made as promptly as practicable after delivery, except as otherwise provided in this contract, but failure to inspect and accept or reject supplies shall neither relieve the Contractor from responsibility for such supplies as are not in accordance with the contract requirements nor impose liability on the Laboratory therefor.

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D. Failure of the Laboratory, during the progress of the work, to discover or reject supplies or work not in accordance with this contract (including specifications, bills of materials, drawings and plans) shall not be deemed an acceptance thereof or a waiver of the defects therein. Except as otherwise provided in this contract, acceptance shall be conclusive except as regards latent defects, fraud, or such gross mistakes as amount to fraud.

E. The Contractor shall provide and maintain an inspection system acceptable to the Laboratory to perform the inspections and provide the controls prescribed by the specifications covering the supplies hereunder. Records of all inspection work by the Contractor shall be kept complete and available to the Laboratory during the performance of this contract and for such longer period as may be specified elsewhere in this contract.

F. The Laboratory reserves the right to charge to the Contractor any additional cost of Laboratory inspections and test when supplies are not ready at the time such inspection and test is requested by the Contractor or when reinspection or retest is necessitated by prior rejection.

10. Warranty of Supplies

A. Notwithstanding inspection and acceptance by the Laboratory of supplies furnished under this contract or any provision of this contract concerning the conclusiveness thereof, the contractor warrants that at the time of delivery:

1. all supplies furnished under this contract will be new, free from defects in material or workmanship and will conform with the specifications and all other requirements of this contract; and

2. the preservation, packaging, packing, and marking, and the preparation for, and method of, shipment of such supplies will conform with the requirements of this contract.

B. The Laboratory shall give written notice to the Contractor of any breach of the warranties in paragraph A of this clause within eighteen months after delivery of the nonconforming supplies or twelve months after initial use, whichever is earlier.

C. Within a reasonable time after such notice, the Laboratory may either:

1. by written notice require the prompt correction or replacement of any supplies or parts thereof (including preservation, packaging, packing, and marking) that do not conform with the requirements of this contract within the meaning of paragraph A of this clause; or

2. retain such supplies, whereupon the contract price thereof shall be reduced by an amount equitable under the circumstances.

D. When return, correction, or replacement is required, transportation charges and responsibility for such supplies while in transit shall be borne by the Contractor. However, the Contractor's liability for such transportation charges shall not exceed an amount equal to the cost of transportation by the usual commercial method of shipment between the place of delivery specified in this contract and the Contractor's plant, and return.

E. The Laboratory may, by contract or otherwise, correct or replace the nonconforming supplies with similar supplies and charge to the Contractor the cost occasioned to the Laboratory thereby if the Contractor (1) fails to make redelivery of the corrected or replaced supplies within the time established for their return, or (2) fails either to accept return of the nonconforming supplies or fails to make progress after their return to correct or replace them so as to endanger performance of the delivery schedule, and in either of these two circumstances does not cure such failure within a period of ten (10) days (or such longer period as the Laboratory may authorize in writing) after receipt of notice from specifying such failure. In lieu of such correction or replacement, the Laboratory may require an equitable adjustment of the contract price. In addition, if the Contractor fails to furnish timely disposition instructions, the Laboratory may dispose of the nonconforming supplies for the Contractor's account in a reasonable manner. The Laboratory is entitled to reimbursement from the Contractor or from the proceeds of such disposal for the reasonable expenses of the care and disposition of the nonconforming supplies, as well as for excess costs incurred or to be incurred.

F. Any supplies or parts thereof corrected or furnished in replacement pursuant to this clause shall also be subject to all the provisions of this clause to the same extent as supplies initially delivered. The warranty with respect to such supplies or parts thereof shall be equal in duration to that set forth in A above and shall run from the date of delivery of such corrected or replaced supplies.

G. The word "supplies" as used herein means the end item furnished by the Contractor and related services required under the contract. The word does not include technical data.

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H. The rights and remedies of the Laboratory provided in this clause are in addition to and do not limit any rights afforded to the Laboratory by any other clause of the contract or by law.

11. Responsibility for Supplies

A. Title to all supplies furnished under this contract is for the benefit of the Government and shall pass directly from the Contractor to the Government.

B. The Contractor shall be responsible for the supplies covered by this contract until they are delivered at the designated delivery point regardless of the point of inspection. After delivery to the Laboratory at the designated point and prior to acceptance or notice of rejection by the Laboratory, the Laboratory shall be responsible for the loss or destruction of or damage to the supplies only if such loss, destruction, or damage results from the negligence of officers, agents, or employees of the Laboratory acting within the scope of their employment. The Contractor shall bear all risks as to rejected supplies after notice of rejection.

12. Buy American Act

A. In acquiring end products, the Buy American Act (41 U.S. Code 10 a-d) provides that the Government give preference to domestic source end products. For the purpose of this clause:

1. "Components" means those articles, materials, and supplies which are directly incorporated in the end products;

2. "End Products" means those articles, materials, and supplies, which are to be acquired under this contract for public use; and

3. A "domestic source end product" means (i) an unmanufactured end product which has been mined or produced in the United States, and (ii) an end product manufactured in the United States if the cost of the components thereof which are mined, produced, or manufactured in the United States exceeds fifty percent (50%) of the costs of all its components. For the purpose of this paragraph A.3. (ii) components of foreign origin of the same type or kind as products referred to in paragraph B.2 or B.3 of this clause shall be treated as components mined, produced, or manufactured in the United States.

B. The Contractor agrees that there will be delivered under this contract only domestic source end products, except end products:

1. Which are for use outside the United States;

2. Which the Government determines are not mined, produced or manufactured in the United States in sufficient and reasonably available commercial quantities and of a satisfactory quality;

3. As to which the Department determines the domestic preference to be inconsistent with the public interest; or

4. As to which the Department determines the cost to the Government to be unreasonable.

J.3. Laboratory-Furnished or Contractor Acquired Property

A. Should this contract provide for the Contractor's use of Laboratory-furnished property in the performance of the contract, delivery of such property items shall be made at the time or times specified in the contract. In the event that such Laboratory-furnished property is not delivered to the Contractor by such time or times, the Laboratory shall, if requested by the Contractor, determine if any delay has been occasioned the Contractor thereby and, if so, shall grant a reasonable extension of the time for completion of performance. The Laboratory shall not be liable to the Contractor for damages or loss of profit by reason of any delay in delivery of said Laboratory-furnished property, except that in the case of such delay, upon written request of the Contractor, an equitable adjustment shall be made in the delivery schedule of this contract, or price, or both and, in other contractual provisions affected thereby, in accordance with the procedures provided for in the clause entitled "Changes."

B. Should this contract require the Contractor to acquire or manufacture for the Laboratory's account certain property (called Contractor-acquired property) in connection with its work under this contract, such property shall be installed by the Contractor in its facility as directed by the Laboratory, or if approved by the Laboratory in writing, in the plants of subcontractors. The Contractor shall insert provisions in all subcontracts under which such property is furnished to the subcontractors whereby there will be made applicable to the Laboratory or the Government and the subcontractors substantially the same rights and obligations in respect to such property as are made applicable to the Laboratory or the Government and the Contractor under this clause.

C. Title to all Laboratory-furnished or Contractor acquired property shall remain in the Government. Title thereto shall not be affected by the incorporation or attachment thereof to any property not owned by the Government, nor shall any such property, or any part thereof, be or become a fixture or lose its identity as personalty by reason of affixation to any realty. The Contractor shall maintain adequate property control records of such property consistent with good business practice and as may be prescribed by the Laboratory and shall cause all such property to be clearly marked (if not so marked) to show that it is property of the Government.

D. Laboratory-furnished or Contractor acquired property shall be used only for the performance of this contract.

E. The Contractor shall, in accordance with sound industrial practice, and applicable provisions of DOE Property Management Regulations (DOE-PMR) 41 CFR 109-60, without additional cost to the Laboratory, maintain in operating condition,

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repair, protect and preserve such Laboratory-furnished or Contractor-acquired property until disposed of by the Contractor in accordance with this clause. Should any replacement of any such property become necessary during the term of this contract because of reasonable wear and tear, the same shall be made by the Contractor at the direction of and for the account of the Laboratory and the title thereto shall vest in the Government and any delay occasioned thereby shall be considered an excusable delay under this contract.

F. Unless otherwise provided in this contract, the Contractor assumes the risk of and shall be responsible for any loss or destruction of or damage to Laboratory-furnished or Contractor-acquired property in its possession, except for reasonable wear and tear and except to the extent that such property is consumed in the performance of this contract.

G. The Laboratory shall at all times have access to the premises wherein any Laboratory-furnished or Contractor acquired property is located.

H. Upon completion of this contract, the Contractor shall submit in a form acceptable to the Laboratory, inventory schedules covering all items of Laboratory-furnished property or Contractor acquired property not consumed in the performance of this contract (including any resulting scrap), or not theretofore delivered to the Laboratory, and shall hold the same at no charge to the Laboratory for a period of sixty days, unless the period of time is extended by mutual agreement. At the expiration of such period or upon the Laboratory's earlier order the Contractor shall dismantle, prepare for shipment, and shall store or deliver said property to the Laboratory on cars or trucks at the Contractor's plant at the expense of the Laboratory, or make such other disposal of said property as may be directed by the Laboratory. The net proceeds of any such disposal shall be credited to the contract price or shall be paid over as the Laboratory may direct.

14. Permits

Except as otherwise directed by the Laboratory, the Contractor shall procure all necessary permits or licenses and abide by all applicable laws, regulations, and ordinances of the United States and of the state, territory, and political subdivision in which the work under this contract is performed. Neither the Laboratory nor the Government warrants under this contract any necessary permits or licenses will be granted and neither the Laboratory nor the Government shall be liable to the Contractor for any damages or losses because of the Contractor's failure to obtain any necessary permit or license.

15. Equal Opportunity

(The following clause is applicable unless this contract is exempt under the rules, regulations and relevant orders of the Secretary of Labor (41 CFR, ch. 60.)

During the performance of this contract the Contractor agrees as follows:

A. The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex or national origin. The Contractor will take affirmative action to ensure that applicants are

employed, and that employees are treated during employment, without regard to their race, color, religion, sex or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the Laboratory setting forth the provisions of this Equal Opportunity Clause.

B. The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex or national origin.

C. The Contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the Laboratory, advising the said labor union or workers' representative of the Contractor's commitments under this Equal Opportunity clause, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

D. The Contractor will comply with all provisions of Executive Order 11246 of September 24, 1965 as amended by Executive Order No. 11375 of October 13, 1967, and of the rules, regulations, and relevant orders of the Secretary of Labor.

E. The Contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, as amended by Executive Order No. 11375 of October 13, 1967, and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto and will permit access to his books, records, and accounts by the U. S. Department of Energy and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

F. In the event of the Contractor's noncompliance with the Equal Opportunity clause of this contract or with any of the said rules, regulations, or orders, this contract may be cancelled, terminated, or suspended, in whole or in part, and the Contractor may be declared ineligible for further Government contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions as may be imposed and remedies invoked as provided in Executive Order 11246 as amended by Executive Order No. 11375 of October 13, 1967 or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

G. The Contractor will include the provisions of paragraphs A through G in every subcontract or purchase order unless exempted by rules, regulations or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order 11246 of September 24, 1965, as amended by Executive Order No. 11375 of October 13, 1967, so that such provisions will be binding upon each subcontractor or vendor. The Contractor will take such action with respect to any subcontract or purchase order as the Department may direct as a means of enforcing such provisions, including sanctions for noncompliance; provided, however, that in the event the Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of

such direction by the Department, the Contractor may request the United States to enter into such litigation to protect the interests of the United States.

16. Contract Work Hours and Safety Standards Act - Overtime Compensation

This contract to the extent that it is of a character specified in the Contract Work Hours and Safety Standards Act (40 U.S.C. 327-333), is subject to the following provisions and to all other applicable provisions and exceptions of such Act and the regulations of the Secretary of Labor thereunder.

A. Overtime Requirements. No Contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers, mechanics, apprentices, trainees, watchmen, and guards shall require or permit any laborer, mechanic, apprentice, trainee, watchman or guard in any workweek in which he is employed on such work to work in excess of 8 hours in any calendar day or in excess of 40 hours in such work week on work subject to the provisions of the Contract Work Hours and Safety Standards Act unless such laborer, mechanic, apprentice, trainee, watchman, or guard receives compensation at a rate not less than one and one-half times his basic rate of pay for all such hours worked in excess of 8 hours in any calendar day or in excess of 40 hours in such work week, whichever is the greater number of overtime hours.

B. Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the provisions of paragraph A., the Contractor and any subcontractor responsible therefor shall be liable to any affected employee for his unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer, mechanic, apprentice, trainee, watchman, or guard employed in violation of the provisions of paragraph A. in the sum of $10 for each calendar day on which such employee was required or permitted to be employed on such work in excess of 8 hours or in excess of his standard work week of 40 hours without payment of the overtime wages required by paragraph A.

C. Withholding for unpaid wages and liquidated damages. The Laboratory may withhold from the Contractor, from any monies payable on account of work performed by the Contractor or subcontractor, such sums as may administratively be determined to be necessary to satisfy any liabilities of such Contractor or subcontractor for unpaid wages and liquidated damages as provided in the provisions of paragraph B.

D. Subcontracts. The Contractor shall insert paragraphs A through D of this clause in all subcontracts, and shall require their inclusion in all subcontracts of any tier.

17. Security and Classification.

In the event and to the extent that classified information or access to security areas may become involved in the performance of this contract the following provisions shall apply:

A. Contractor's duty to safeguard restricted data, formerly restricted data and other classified information. In the performance of the work under

this contract, the Contractor shall, in accordance with the Department's security regulations and requirements, be responsible for safeguarding Restricted Data, Formerly Restricted Data, and other classified matter and protecting against sabotage, espionage, loss and theft, the classified documents, materials, equipment, processes, etc., as well as such other material of high intrinsic or strategic value as may be in the Contractor's possession in connection with performance of work under this contract. Except as otherwise expressly provided in this contract, the Contractor shall upon completion or termination of this contract, transmit to the Laboratory any classified matter in its possession or that is under the Contractor's control in connection with the performance of this contract. If retention by the Contractor of any classified matter is required after the completion or termination of the contract and such retention is approved by the Department, the Contractor will complete a certificate of possession to be furnished to the Laboratory specifying the classified matter to be retained. (The certification shall identify the items and types or categories of matter retained, the conditions governing the retention of the matter and the period of retention if known.) If retention is approved by the Department, the security provisions of the contract will continue to be applicable to the matter retained.

B. Regulations. The Contractor agrees to conform to all security regulations and requirements of the Department.

C. Definition of Restricted Data and Formerly Restricted Data.

1. The term "Restricted Data", as used in this section, means all data concerning (i) design, manufacture, or utilization of atomic weapons; (ii) the production of special nuclear material; or (iii) the use of special nuclear material in the production of energy, but shall not include data declassified or removed from the Restricted Data category pursuant to Section 142 of the Atomic Energy Act of 1954.

2. The term "Formerly Restricted Data," as used in this clause, means all data removed from the Restricted Data category under Subsection 142d of the Atomic Energy Act of 1954, as amended.

D. Security Clearance of Personnel. The Contractor shall not permit any individual to have access to Restricted Data, Formerly Restricted Data, or other classified information, except in accordance with the Atomic Energy Act of 1954, as amended, and the Department's regulations or requirements applicable to the particular type or category of classified information to which access is required.

E. Criminal Liability. It is understood that disclosure of Restricted Data, Formerly Restricted Data, or other classified information relating to the work or services ordered hereunder to any person not entitled to receive it, or failure to safeguard any Restricted Data, Formerly Restricted Data, or any other classified matter that may come to the Contractor or any person under the Contractor's control in connection with work under this contract, may subject the Contractor, his agents, employees, or subcontractors to criminal liability under the laws of the United States. (See the Atomic Energy Act of 1954, as amended 42 U.S.C. 2011; 18 U.S.C. Sections 793 and 794; and Executive Order 11652, as amended.)

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F. Subcontracts and Purchase Orders. Except as otherwise authorized in writing by the Laboratory, the Contractor shall insert provisions similar to the foregoing in all subcontracts and purchase orders under this contract.

G. Classification. In the performance of the work under this contract the Contractor shall assign classifications to all documents, material and equipment originated or generated by the Contractor in accordance with classification guidance furnished to the Contractor by the Laboratory. Every subcontract and purchase order issued hereunder involving the origination or generation of classified documents, material or equipment, shall include a provision to the effect that in the performance of such subcontract or purchase order the subcontractor or supplier shall assign classifications to all such documents, material and equipment in accordance with classification guidance furnished to such subcontractor or supplier by the Contractor.

18. Convict Labor.

In connection with the performance of work under this contract, the Contractor agrees not to employ any person undergoing sentence of imprisonment except as provided by Public Law 89-176, September 10, 1965 (18 U.S.C. 4082 (c) (2)) and Executive Order 11755, December 29, 1973.

19. Key Personnel.

The Contractor shall furnish a list of project personnel to the Laboratory for approval and the Contractor agrees to assign such employees or persons to the performance of the work under this contract and shall not reassign or remove any of them without the consent of the Laboratory. Whenever, for any reason, one or more of the aforementioned employees is unavailable for assignment for work under the contract, the Contractor shall use its best efforts to replace such employee with an employee of substantially equal abilities and qualifications and the Laboratory shall have the right to approve such substitute employee(s).

20. Disabled Veterans and Veterans of the Vietnam Era

A. The Contractor will not discriminate against any employee or applicant for employment because he or she is a disabled veteran or veteran of the Vietnam era in regard to any position for which the employee or applicant for employment is qualified. The Contractor agrees to take affirmative action to employ, advance in employment and otherwise treat qualified disabled veterans and veterans of the Vietnam era without discrimination based upon their disability or veterans status in all employment practices such as the following: employment upgrading, demotion or transfer, recruitment, advertising, layoff or termination rates of pay or other forms of compensation, and selection for training, including apprenticeship.

B. The Contractor agrees that all suitable employment openings of the Contractor which exist at the time of the execution of this contract and those which occur during the performance of this contract, including those not generated by this contract and including those occurring at an establishment of the Contractor other than the one wherein the contract is being performed but excluding those of independently operated corporate affiliates, shall be listed at an appropriate local office of the State employment service system wherein the opening occurs. The Contractor further agrees to

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provide such reports to such local office regarding employment openings and hires as may be required. State and local government agencies holding Federal contracts of $10,000 or more shall also list all their suitable openings with the appropriate office of the State employment service, but are not required to provide those reports set forth in paragraphs D and E.

C. Listing of employment openings with the employment service system pursuant to this clause shall be made at least concurrently with the use of any other recruitment source or effort and shall involve the normal obligations which attach to the placing of a bona fide job order, including the acceptance of referrals of veterans and nonveterans. The listing of employment openings does not require the hiring of any particular job applicant or from any particular group of job applicants and nothing herein is intended to relieve the Contractor from any requirements in Executive Orders and regulations regarding nondiscrimination in employment.

D. The reports required by Paragraph B. of this clause shall include, but not be limited to, periodic reports which shall be filed at least quarterly with the appropriate local office, or where the Contractor has more than one hiring location in a State, with the central office of that State employment service. Such reports shall indicate for each hiring location (1) the number of individuals hired during the reporting period, (2) the number of nondisabled veterans of the Vietnam era hired, (3) the number of disabled veterans of the Vietnam era hired, and (4) the total number of disabled veterans hired. The reports should include covered veterans hired for on-the-job training under 38 U.S.C. 1787. The Contractor shall submit a report within 30 days after the end of each reporting period wherein any performance is made on the contract identifying data for each hiring location. The Contractor shall maintain at each hiring location copies of the reports submitted until the expiration of one year after final payment under the contract, during which time these reports and related documentation shall be made available, upon request, for examination by any authorized representatives of the Laboratory or of the Secretary of Labor. Documentation would include personnel records respecting job openings, recruitment, and placement.

E. Whenever the Contractor becomes contractually bound to the listing provisions of this clause, it shall advise the employment service system in each State where it has establishments of the name and location of each hiring location in the State. As long as the Contractor is contractually bound to these provisions and has so advised the State system, there is no need to advise the State system of subsequent contracts. The Contractor may advise the State system when it is no longer bound by this contract clause.

F. This clause does not apply to the listing of employment openings which occur and are filled outside the 50 States, the District of Columbia, Puerto Rico, Guam and the Virgin Islands.

G. The provisions of Paragraphs B, C, D and E of this clause do not apply to openings which the Contractor proposes to fill from within his own organization or to fill pursuant to a customary and traditional employer-union hiring arrangement. This exclusion does not apply to a particular opening once an employer decides to consider applicants outside of his own organization or employer-union arrangement for that opening.

H. As used in this clause:

1. "All suitable employment openings" includes, but is not limited to, openings which occur in the following job categories: production and non-production; plant and office; laborers and mechanics; supervisory and non-supervisory; technical; and executive, administrative and professional openings that are compensated on a salary basis of less than $25,000 per year. This term includes full-time employment, temporary employment of more than 3 days duration, and part-time employment. It does not include openings which the Contractor proposes to fill from within his own organization or to fill pursuant to a customary and traditional employer-union hiring arrangement nor openings in an educational institution which are restricted to students of that institution. Under the most compelling circumstances an employment opening may not be suitable for listing, including such situations where the needs of the Government cannot reasonably be otherwise supplied, where listing would be contrary to national security, or where the requirement of listing would otherwise not be for the best interest of the Government.

2. "Appropriate office of the State employment service system" means the local office of the Federal/State national system of public employment offices with assigned responsibility for serving the area where the employment opening is to be filled, including the District of Columbia, Guam, Puerto Rico and the Virgin Islands.

3. "Openings which the Contractor proposes to fill from within his own organization" means employment openings for which no consideration will be given to persons outside the Contractor's organization (including any affiliates, subsidiaries, and the parent companies) and includes any openings which the Contractor proposes to fill from regularly established "recall" lists.

4. "Openings which the Contractor proposes to fill pursuant to a customary and traditional employer-union hiring arrangement" means employment openings which the Contractor proposes to fill from union halls, which is part of the customary and traditional hiring relationship which exists between the Contractor and representatives of his employees.

I. The Contractor agrees to comply with the rules, regulations, and relevant orders of the Secretary of Labor issued pursuant to the Act.

J. In the event of the Contractor's noncompliance with the requirements of this clause, actions for noncompliance may be taken in accordance with rules, regulations, and relevant orders of the Secretary of Labor issued pursuant to the Act.

K. The Contractor agrees to post in conspicuous places available to employees and applicants for employment, notices in a form to be prescribed by the Director, Office of Federal Contract Compliance Programs, Department of Labor, provided by or through the Laboratory. Such notice shall state the Contractor's obligation under the law to take affirmative action to employ and advance in employment qualified disabled veterans and veterans of the Vietnam era for employment, and the rights of applicants and employees.

L. The Contractor will notify each labor union or representative of workers with which it has a collective bargaining agreement or other contract understanding that the Contractor is bound by terms of the Vietnam

Era Veteran's Readjustment Assistance Act and is committed to take affirmative action to employ and advance in employment qualified disabled veterans and veterans of the Vietnam era.

M. The Contractor will include the provisions of this clause in every subcontract or purchase order of $10,000 or more unless exempted by rules, regulations, or orders of the Secretary issued pursuant to the Act, so that such provisions will be binding upon each subcontractor or vendor. The Contractor will take such action with respect to any subcontract or purchase order as the Director of the Office of Federal Contract Compliance Programs may direct to enforce such provisions, including action for noncompliance.

21. Employment of the Handicapped

A. The Contractor will not discriminate against any employee or applicant for employment because of physical or mental handicap in regard to any position for which the employee or applicant for employment is qualified. The Contractor agrees to take affirmative action to employ, advance in employment and otherwise treat qualified handicapped individuals without discrimination based upon their physical or mental handicap in all employment practices such as the following: employment, upgrading, demotion or transfer, recruitment, advertising, layoff, or termination, rates of pay or other forms of compensation, and selection for training, including apprenticeship.

B. The Contractor agrees to comply with the rules, regulations, and relevant orders of the Secretary of Labor issued pursuant to the Rehabilitation Act of 1973, Public Law 93-112, as amended (hereafter referred to as the "Act").

C. In the event of the Contractor's noncompliance with the requirements of this clause, actions for noncompliance may be taken in accordance with the rules, regulations and relevant orders of the Secretary of Labor issued pursuant to the Act.

D. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices in a form to be prescribed by the Director, Office of Federal Contract Compliance Programs, Department of Labor, provided by or through the Laboratory. Such notices shall state the Contractor's obligation under the law to take affirmative action to employee and advance in employment qualified handicapped employees and applicants for employment, and the rights of applicants and employees.

E. The Contractor will notify each labor union or representative of workers with which it has a collective bargaining agreement, or other contract understanding, that the contractor is bound by the terms of section 503 of the Rehabilitation Act of 1973, and is committed to take affirmative action to employ and advance in employment physically and mentally handicapped individuals.

F. The Contractor will include the provisions of this clause in every subcontract or purchase order of $2,500 or more unless exempted by rules, regulations or orders of the Secretary issued pursuant to section 503 of the Act, so that such provisions will be binding upon each subcontractor or vendor. The Contractor will take such action with respect to any subcontract or purchase order as the Director, Office of Federal Contract Compliance

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Programs, may direct to enforce such provisions, including action for non-compliance.

22. Walsh-Healy Public Contracts Act.

To the extent that this contract requires the Contractor to furnish necessary materials, supplies, articles, or equipment in an amount which exceeds or may exceed $10,000 and is otherwise subject to the Walsh-Healy Public Contracts Act, as amended (41 U.S. Code 35-45), there are hereby incorporated by reference all representations and stipulations required by said Act and regulations issued thereunder by the Secretary of Labor, such representations and stipulations being subject to all applicable rulings and interpretations of the Secretary of Labor which are now or may hereafter be in effect.

23. Notice of Labor Disputes.

Whenever an actual or potential labor dispute is delaying or threatens to delay the performance of the work, the Contractor shall immediately notify the Laboratory in writing. Such notice shall include all relevant information concerning the dispute and its background.

24. Officials Not to Benefit

No member of or delegate to Congress or resident commissioner shall be admitted to any share or part of this contract or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this contract if made with a corporation for its general benefit.

25. Covenant Against Contingent Fees.

A. Warranty - Termination or Deduction for Breach

The Contractor warrants that no person or selling agency has been employed or retained to solicit or secure this contract upon an agreement or understanding, for a commission, percentage, brokerage, or contingent fee, excepting bona fide employees or bona fide established commercial or selling agencies maintained by the Contractor for the purpose of securing business. For breach or violation of this warranty, the Laboratory or the United States Government shall have the right to annul this contract without liability or in its discretion to deduct from the contract price or consideration, or otherwise recover, the full amount of such commission, percentage, brokerage, or contingent fee.

B. Subcontracts and Purchase Orders.

Unless otherwise authorized by the Laboratory in writing, the Contractor shall cause provisions similar to the foregoing to be inserted in all subcontracts and purchase orders entered into under this contract.

26. Assignment and Subcontracting.

A. Neither this contract nor any interest therein, nor claim thereunder, shall be assigned or transferred by the Contractor except as expressly authorized in writing by the Laboratory. The Laboratory may assign the whole or any part of this contract to the Government or its designee.

B. The Contractor shall not subcontract any portion of the work hereunder without prior written approval of the Laboratory. When requesting such approval, the Contractor shall furnish the Laboratory with the name of the proposed subcontractor(s), a description of the work proposed to be subcontracted, and such other information as the Laboratory shall require. The decision of the Laboratory on all work requests shall be final. These restrictions on subcontracting shall not apply to the procurement of material, tooling, equipment, or facilities.

27. Utilization of Small Business Concerns and Small Business Concerns Owned and Controlled by Socially and Economically Disadvantaged Individuals

A. It is the policy of the United States and the Laboratory that small business concerns and small business concerns owned and controlled by socially and economically disadvantaged individuals shall have the maximum practicable opportunity to participate in the performance of contracts let by any Federal agency or Contractor.

B. The Contractor hereby agrees to carry out this policy in the awarding of subcontracts to the fullest extent consistent with the efficient performance of this contract. The Contractor further agrees to cooperator in any studies or surveys that may be conducted by the Small Business Administration or the contracting agency which may be necessary to determine the extent of the Contractor's compliance with this clause.

C. (1) The term "small business concern" shall mean a small business as defined pursuant to Section 3 of the Small Business Act and in relevant regulations promulgated pursuant thereto.

(2) The term "small business concern owned and controlled by socially and economically disadvantaged individuals" shall mean a small business concern- (i) which is at least 51 per centum owned by one or more socially and economically disadvantaged individuals; or in the case of any publicly owned business at least 51 per centum of the stock of which is owned by one or more socially and economically disadvantaged individuals; and (ii) whose management and daily business operations and controlled by one or more of such individuals.

The Contractor shall presume that socially and economically disadvantaged individuals include Black Americans, Hispanic Americans, Native Americans, Asian - Pacific Americans, and other minorities, or any other individual found to be disadvantaged by the Small Business Administration pursuant to section 8(a) of the Small Business Act.

D. Contractors acting in good faith may rely on written representations by their subcontractors as either a small business concern or a small business concern owned and controlled by socially and economically disadvantaged individuals.

28. Labor Surplus Area Subcontracting Program.

The following clause applies if this contract exceeds $500,000.00.

A. The Contractor agrees to establish and conduct a program which will encourage labor surplus area concerns to compete for subcontracts within their capabilities. In this connection, the Contractor shall -

1. Designate a liaison officer who will (i) maintain liaison with duly authorized representatives of the Government on labor surplus area matters, (ii) supervise compliance with the Utilization of Concerns in Labor Surplus Areas Clause, and (iii) administer the Contractor's Labor Surplus Area Subcontracting Program;

2. Provide adequate and timely consideration of the potentialities of labor surplus area concerns in all "make - or buy" decisions.

3. Assure that labor surplus area concerns will have an equitable opportunity to compete for subcontracts, particularly by arranging solicitations, time for the preparation of bids, quantities, specifications, and delivery schedules to as to facilitate the participation of labor surplus area concerns.

4. Maintain records showing the procedures which have been adopted to comply with the policies set forth in this clause and report subcontract awards (see 41 CFR 1-16.804-5 regarding use of Optional Form 61). Records maintained pursuant to this clause will be kept available for review by the Government until the expiration of 1 year after the award of this contract, or for such longer period as may be required by any other clause of this contract or by applicable law or regulations; and

5. Include the Utilization of Labor Surplus Area Concerns clause in subcontracts which offer substantial labor surplus area subcontracting opportunities.

B. (1) The term "labor surplus area" means a geographical area identified by the Department of Labor as an area of concentrated unemployment or underemployment or an area of labor surplus.

(2) The term "concern located in a labor surplus area" means a labor surplus area concern.

(3) The term "labor surplus area concern" means a concern that, together with its first-tier subcontractors, will perform substantially in labor surplus areas.

(4) The term "perform substantially in labor surplus areas" means that the costs incurred on account of manufacturing, production, or appropriate services in labor surplus areas exceed 50 percent of the contract price.

C. The Contractor further agrees to insert, in any subcontract hereunder which may exceed $500,000 and which contains the Utilization of Labor Surplus Area Concerns clause, provisions which shall conform substantially to the language of this clause, including this paragraph C, and to notify the Laboratory of the names of such subcontractors.

29. Utilization of Labor Surplus Area Concerns.

A. It is the policy of the Government and the Laboratory to award contracts to labor surplus area concerns that agree to perform substantially in labor surplus areas, where this can be done consistent with the efficient performance of the contract and at prices no higher than are obtainable elsewhere. The Contractor agrees to use his best efforts to place his subcontracts in accordance with this policy.

B. In complying with paragraph A of this clause and with paragraph B of the clause entitled "Utilization of Small Business Concerns and Small Business Concerns owned and controlled by Socially and Economically Disadvantaged Individuals", the Contractor in placing his subcontracts shall observe the following order of preference: (1) Small business concerns that are labor surplus area concerns,

(2) other small business concerns and (3) other labor surplus area concerns.

C. (1) The term "labor surplus area" means a geographical area identified by the Department of Labor as an area of concentrated unemployment or underemployment or an area of labor surplus.

(2) The term "labor surplus area concern" means a concern that together with its first-tier subcontractors will perform substantially in labor surplus areas.

(3) The term "perform substantially in a labor surplus area" means that the costs incurred on account of manufacturing, production, or appropriate services in labor surplus areas exceed fifty percent (50%) of the contract price.

30. Subcontracting Plan for Small Business Concerns and Small Business Concerns Owned and Controlled by Socially and Economically Disadvantaged Individuals

The following clause applies if this contract exceeds $500,000.00.

A. The Contractor agrees to comply in good faith with the Small and Small Disadvantaged Business Concerns Subcontracting Plan which is hereby incorporated in and made a part of this contract. In this connection, the Contractor shall:

1. Use his best efforts to attain such percentage goals as may be set forth in the plan.

2. Designate an individual who will:

a. Maintain liaison with the Laboratory and the Government on matters relating to small business concerns and small business concerns owned and controlled by socially and economically disadvantaged individuals;

b. Monitor compliance with the clause entitled "Utilization of Small Business Concerns and Small Business Concerns Owned and Controlled by Socially and Economically Disadvantaged Individuals"; and

c. Administer the Contractor's plan.

3. Provide adequate and timely consideration of the potentialities of small business concerns and small business concerns owned and controlled by socially and economically disadvantaged individuals in all "make-or-buy" decisions.

4. Assure that small business concerns and small business concerns owned and controlled by socially and economically disadvantaged individuals will, consistent with efficient performance of the contract, have the maximum practicable opportunity to compete for subcontracts, particularly by arranging solicitations, time for the preparation of bids, quantities, specifications, and delivery schedules so as to facilitate the participation of such concerns. Where the Contractor's lists of potential subcontractors which are small business concerns and small business concerns owned and controlled by socially and economically disadvantaged individuals are excessively long, reasonable effort shall be made to give all such concerns an opportunity to compete over a period of time.

5. Maintain records showing:

a. Whether each subcontractor is a small business concern or a small business concern owned and controlled by socially and economically disadvantaged individuals; and

b. Procedures which have been adopted to comply with the plan and the policies set forth in this clause.

6. Notify the Laboratory before soliciting bids, quotations, or proposals on any subcontract (including purchase orders) in excess of $10,000 if:

a. No small business concern or small business concern owned and controlled by socially and economically disadvantaged individuals is to be solicited, and

b. The Laboratory's consent to the subcontract is required by a "Subcontracts" clause in this contract. Such notification will state the Contractor's reasons for nonsolicitation of small business and small business concerns owned and controlled by socially and economically disadvantaged individuals and will be given as early in the procurement cycle as possible so that the Laboratory may suggest potentially qualified small business concerns or small business concerns owned and controlled by socially and economically disadvantaged individuals. In no case will the procurement action be held up when to do so would in the Contractor's judgment, delay performance under the contract and the Contractor's notification shall specify that he is proceeding with the solicitation.

7. Include the "Utilization of Small Business Concerns and Small Business Concerns Owned and Controlled by Socially and Economically Disadvantaged Individuals" in all subcontracts over $10,000 which offer further subcontracting opportunities.

8. Cooperate in any studies or surveys of the Contractor's subcontracting procedures and practices as may be required by the DOE or the Small Business Administration.

9. Submit quarterly reports of subcontracting to small business concerns and small business concerns owned and controlled by socially and economically disadvantaged individuals on such forms as may be specified elsewhere in this contract.

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B. The Contractor agrees that failure to comply in good faith with the clause entitled "Utilization of Small Business Concerns and Small Business Concerns Owned and Controlled by Socially and Economically Disadvantaged Individuals," or the terms of the subcontracting plan incorporated into the contract will be a material breach of the contract and the contract may be terminated in whole or, in part, for default.

C. The Contractor further agrees to insert in all subcontracts hereunder (except those with small business concerns) which contain the clause entitled "Utilization of Small Business Concerns and Small Business Concerns Owned and Controlled by Socially and Economically Disadvantaged Individuals," which offer further subcontracting opportunities, and which may exceed $1,000,000 in the case of a subcontract for the construction of any public facility or in excess of $500,000 in the case of all other subcontracts, provisions which shall conform substantially to the language of this clause, including this paragraph C and to notify the Laboratory of the names of such subcontractors.

D. The provisions of this clause shall not apply to small business concerns.

31. Clean Air and Water.

(Applicable only if the contract exceeds $100,000, or the Laboratory has determined that the orders under an indefinite quantity contract in any one year will exceed $100,000, or a facility to be used has been the subject of a conviction under the Clean Air Act (42 U.S.C. 1857C-8 (c)(1)) or the Federal Water Pollution Control Act (33 U.S.C. 1319 (c)) and is listed by EPA, or the contract is not otherwise exempt.)

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A. The Contractor agrees as follows:

1. To comply with all the requirements of Section 114 of the Clean Air Act, as amended (42 U.S.C. 1857, et seq., as amended by Public Law 91-604) and Section 308 of the Federal Water Pollution Control Act (33 U.S.C. 1251, et seq., as amended by Public Law 92-500), respectively, relating to inspection, monitoring, entry, reports, and information, as well as other requirements specified in Section 114 and Section 308 of the Air Act and the Water Act, respectively, and all regulations and guidelines issued thereunder before the award of this contract.

2. That no portion of the work required by this contract will be performed in a facility listed on the Environmental Protection Agency list of violating facilities on the date when this contract was awarded unless and until the EPA eliminates the name of such facility or facilities from such listing.

3. To use his best efforts to comply with clean air standards and clean water standards at the facilities in which the contract is being performed.

4. To insert the substance of the provisions of this clause in any nonexempt subcontract, including this Paragraph A.4.

B. The terms used in this clause have the following meanings:

1. The term "Air Act" means the Clean Air Act, as amended (42 U.S.C. 1857 et seq., as amended by Public Law 91-604).

2. The term "Water Act" means Federal Water Pollution Control Act, as amended (33 U.S.C. 1251 et seq., as amended by Public Law 92-500).

3. The term "Clean Air Standards" means any enforceable rules, regulations, guidelines, standards, limitations, orders, controls, prohibitions, or other requirements which are contained in, issued under, or otherwise adopted pursuant to the Air Act or Executive Order 11738, an applicable implementation plan as described in Section 110 (d) of the Clean Air Act (42 U.S.C. 1857 c-5(d)), an approved implementation procedure or plan under Section 111(c) or Section 111(d), respectively, of the Air Act (42 U.S.C. 1857c-6(c) or (d)), or an approved implementation procedure under Section 112(d) of the Air Act (42 U.S.C. 1857c-7 (d)).

4. The term "Clean Water Standards" means any enforceable limitation, control, condition, prohibition, standard or other requirement which is promulgated pursuant to the Water Act or contained in a permit issued to a discharger by the Environmental Protection Agency or by a state under an approved program, as authorized by Section 402 of the Water Act (33 U.S.C. 1342), or by local government to ensure compliance with pretreatment regulations as required by Section 307 of the Water Act (33 U.S.C. 1317).

5. The term "compliance" means compliance with clean air or water standards. Compliance shall also mean compliance with a schedule or plan ordered or approved by a court of competent jurisdiction, the Environmental Protection Agency or an air or water pollution control agency in accordance with

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the requirement of the Air Act or Water Act and regulations issued pursuant thereto.

6. The term "facility" means any building, plant, installation, structure, mine, vessel, or other floating craft, location or site of operations, owned, leased or supervised by a contractor or subcontractor, to be utilized in the performance of a contract or subcontract. Where a location or site of operations contains or includes more than one building, plant, installation, or structure, the entire location or site shall be deemed to be a facility except where the Director, Office of Federal Activities, Environmental Protection Agency, determines that independent facilities are colocated in one geographical area.

32. Preference for U. S. Flag Air Carriers.

A. Public Law 93-623 requires that all Federal Agencies and Government Contractors and subcontractors will use U. S. flag air carriers for international air transportation of personnel (and their personal effects) or property to the extent service by such carriers is available. It further provides that the Comptroller General of the United States shall disallow any expenditure from appropriated funds for international air transportation on other than a U. S. flag air carrier in the absence of satisfactory proof of the necessity therefor.

B. The Contractor agrees to utilize U. S. flag air carriers for international air transportation of personnel (and their personal effects) or property to the extent service by such carriers is available.

C. In the event that the Contractor selects a carrier other than a U. S. flag air carrier for international air transportation, he will include a certification on vouchers involving such transportation which is essentially as follows:

CERTIFICATION OF UNAVAILABILITY OF U. S. FLAG AIR CARRIERS

I hereby certify that transportation service for personnel (and their personal effects) or property by certificated air carrier was unavailable for the following reasons (see Federal Procurement Regulations (41 CFR 1-1.323-3)): (state reasons).

D. The terms used in this clause have the following meanings:

1. "International air transportation" means transportation of persons (and their personal effects) or property by air thereof between a place in the United States and a place outside thereof or between two places both of which are outside the United States.

2. "U. S. flag air carriers" means one of a class of air carriers holding a certificate of public convenience and necessity issued by the Civil Aeronautics Board, approved by the President, authorizing operations between the United States and/or its territories and one or more foreign countries.

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3. The term "United States" includes the fifty states, Commonwealth of Puerto Rico, possessions of the United States and the District of Columbia.

E. The Contractor shall include the substance of this clause, including this Paragraph E, in each subcontract or purchase hereunder which may involve international air transportation.

33. Utilization of Women-Owned Business Concerns

A. It is the policy of the United States Government and the Laboratory that women-owned businesses shall have the maximum practicable opportunity to participate in the performance of contracts awarded by any Federal agency or Contractor.

B. The Contractor agrees to use his best efforts to carry out this policy in the award of subcontracts to the fullest extent consistent with the efficient performance of this contract. As used in this contract, a "woman-owned business" concern means a business that is at least 51% owned by a woman or women who also control and operate it. "Control" in this context means exercising the power to make policy decisions. "Operate" in this context means being actively involved in the day-to-day management. "Women" mean all women business owners.

34. Women-Owned Business Concerns Subcontracting Program

The following clause applies if this contract exceeds $500,000.

A. The Contractor agrees to establish and conduct a program which will enable women-owned business concerns to be considered fairly as subcontractors and suppliers under this contract. In this connection, the contractor shall:

1. Designate a liaison officer who will administer the Contractor's "Women-Owned Business Concerns Program."

2. Provide adequate and timely consideration of the potentialities of known women-owned business concerns in all "make-or-buy" decisions.

3. Develop a list of qualified bidders that are women-owned businesses and assure that known women-owned business concerns have an equitable opportunity to compete for subcontracts, particularly by making information on forthcoming opportunities available, by arranging solicitations, time for the preparation of bids, quantities, specifications, and delivery schedules so as to facilitate the participation of women-owned business concerns.

4. Maintain records showing (i) procedures which have been adopted to comply with the policies set forth in this clause, including the establishment of a source list of women-owned business concerns; (ii) awards to women-owned businesses on the source list by minority and non-minority women-owned business concerns; and (iii) specific efforts to identify and award contracts to women-owned business concerns.

5. Include the "Utilization of Women-Owned Business Concerns" clause in subcontracts which offer substantial subcontracting opportunities.

6. Cooperate in any studies and surveys of the Contractor's women-owned business concerns procedures and practices that the Laboratory may from time-to-time conduct.

7. Submit periodic reports of subcontracting to women-owned business concerns with respect to the records referred to in subparagraph 4 above, in such form and manner and at such time (not more often than quarterly) as the Laboratory may prescribe.

B. The Contractor further agrees to insert, in any subcontract hereunder which may exceed $500,000 or $1,000,000 in the case of contracts for the construction of any public facility and which offers substantial subcontracting possibilities, provisions which shall conform substantially to the language of this clause, including this paragraph, and to notify the Laboratory of the names of such subcontractors.

C. The Contractor further agrees to require written certification by its subcontractors that they are bona fide women-owned and controlled business concerns in accordance with the definition of a women-owned business concern as set forth in the Utilization of Women-Owned Business Concerns Clause at the time of submission of bids or proposals.

35. Applicable Law.

To the extent that Federal law does not exist and State law could become applicable to this contract, the laws of the State of Illinois shall apply.

APPENDIX C

TRAVEL POLICY FOR CONTRACTOR PERSONNEL

In connection with furnishing services under this contract it may be necessary for Contractor personnel to make authorized trips from time to time on official business. Travel by Contractor personnel will be controlled by the following rules:

I. The Laboratory Division Director or members of his staff responsible for authorizing the performance of services by Contractor personnel will notify the Contractor that the performances of such services are required at a place away from the Contractor's base and that travel is approved. In no case should such travel be accomplished unless it has been requested in advance by the Laboratory Division Director or his staff. In addition, any travel outside the continental limits of the United States (including Mexico) requires the prior written approval of the Laboratory and the Department of Energy (DOE, Form 445) except travel to Canada which does not involve classified discussions with official Canadian Atomic Energy personnel. Transportation of personnel or property by air outside the continental limits of the United States, e.g., Canada or Mexico, must be on an American carrier otherwise reimbursement cannot be made.

II. As full reimbursement for travel and living expenses incurred by the Contractor personnel in connection with the performance of services away from the Contractor's base and travel authorized in accordance with paragraph I, above, the Contractor shall be paid the following amounts:

A. Cost of single-class jet, tourist jet, tourist propeller and other similar airline accommodations which are less than first class or first-class rail fare and the lowest-priced single occupancy enclosed space available, not to exceed a roomette. Only where such accommodations are not reasonably available to meet necessary mission requirements will the Contractor be reimbursed for the increment of cost due to better accommodations. Less than first-class airline accommodations would not be considered reasonably available to meet necessary mission requirements if accommodations are not reasonably adequate for the medical needs of the traveler. In the event medical reasons dictate travel by first class, it will be necessary that the travel invoice seeking reimbursement state these reasons.

Travel via extra trains or extra fare planes is limited to those occasions where space on regular trains or planes is not available. However, a Contractor personnel required to travel between the West Coast and Chicago may be authorized to travel on extra fare trains where circumstances so warrant. Travel by private automobile or private plane is permitted in lieu of travel by commercial air or rail if desired; provided, however, that where the one-way trip exceeds 350 miles, reimbursement for expenses of such travel will be made on the basis of whichever costs are the lesser. Such costs of travel will be determined as follows:

1. $0.22 per mile for total miles, in accordance with the most direct route, not in excess of 110% of the distance shown on Rand-McNally Standard Distance charts in lieu of actual cost of operation.

2. Actual expenses for parking, garaging, toll roads, toll bridges, toll tunnels, ferries, and other similar charge.

3. Based on the time required for travel by air, cost of reasonable hotel accommodations and per diem allowances as set forth in subparagraph D, below.

B. Necessary local transportation costs (cab, bus, streetcar, rented automobile, etc.) at standard rates. Whenever possible the type of rented automobile used should be commensurate with the number of persons traveling, e.g., subcompact for up to two (2) persons.

In the event that the Contractor's base (home or office) or point of origin lies within a fifty (50) mile radius of the work site, Contractor shall not be entitled to recover the cost of commuting between his base or point of origin and the work site where the services are to be performed.

C. Cost of reasonable hotel accommodations.

D. A per diem subsistence allowance of Twenty-Four Dollars ($24.00) per day for each day spent in the performance of services hereunder away from the Contractor's base (home or office) providing that a duration of more than ten (10) hours is involved. (In case of travel by train, additional allowance of One Dollar ($1.00) will be allowed for each evening meal on the train). The per diem allowance will not be prorated with respect to the first twenty-four (24) hours of any travel period. Each six (6) hour period, or fraction thereof, in excess of the first twenty-four (24) hour period will be reimbursed at one-fourth (1/4) of the regulation per diem rate.

<u>EXCEPTION</u>: The foregoing per diem subsistence allowance will not be paid for persons based within a radius of fifty (50) miles of the work site where the services are to be performed.

E. Cost of laundry and valet services not to exceed One Dollar and Fifty cents ($1.50) for each twenty-four (24) hour period or Five Dollars ($5.00) for any seven (7) day period while in travel status.

III. A Contractor requesting reimbursement for the cost of first-class air fare should, along with his billing, provide satisfactory documentation of the need for the use of first-class accommodations to meet mission requirements as permitted under the circumstances described in subparagraph II.A above. Where such satisfactory documentation is not provided, reimbursement must be limited to the cost of less than first-class accommodations.

IV. Expenses will be paid subject to conditions of paragraph II above, (1) for travel from any point at which the Contractor personnel may be located at the time they are called upon to perform services to the place where the services are to be performed, and (2) for travel to the point of origin of travel or the employee's base, whichever the Contractor elects. However, in the event the Contractor does not desire the return of its personnel to their point of origin or their base, but desires that they proceed to a third point, the Laboratory may reimburse for expenses of travel to the latter point; but in any such case, reimbursement will be limited to an amount equal to the cost of transportation to the employee's point of origin or base, whichever is less.

V. It is not possible under existing regulations to make a travel advance to Contractor or Subcontractor personnel. Reimbursement will be made of allowable travel expenses upon submission of properly certified and correct invoices in the form prescribed in the payment article of this contract. Receipts shall be submitted to cover Pullman fare, air fare, rail fare, hotel bill, and where the charge exceeds $2.00 each, telephone calls, telegrams, postage, taxi fares, rented automobiles fees, and laundry and valet services.

VI. Preference for U.S. Flag Air Carriers

A. Public Law 93-623 requires that all Federal Agencies and government Contractors and subcontractors will use U.S. flag air carriers for international air transportation of personnel (and their personal effects) or property to the extent service by such carriers is available. It further provides that the Comptroller General of the United States shall disallow any expenditure from appropriated funds for international air transportation on other than a U.S. flag air carrier in the absense of satisfactory proof of the necessity, therefore.

B. The Contractor agrees to utilize U.S. flag air carriers for international air transportation of personnel (and their personal effects) or property to the extent service by such carriers is available.

C. In the event that the Contractor selects a carrier other than a U.S. flag air carrier for international air transportation, he will include a certification on vouchers involving such transportation which is essentially as follows:

CERTIFICATION OF UNAVAILABILITY OF U.S. FLAG AIR CARRIERS

I hereby certify that transportation service personnel (and their personal effects) or property by certificated air carrier was unavailable for the following reasons. Federal Procurement Regulations, 41 CFR 1-1.323-3 defines availability and unavailability as follows:

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a. Passenger or freight service by a certificated air carrier is considered "available" even though:

1. Comparable or a different kind of service by a noncertificated air carrier costs less, or

2. Service by a noncertificated air carrier can be paid for in excess foreign currency, or

3. Service by a noncertificated air carrier is preferred by the agency or traveler needing air transportation, or

4. Service by a noncertificated air carrier is more convenient for the agency or traveler needing air transportation.

b. Passenger service by a certificated air carrier will be considered to be "unavailable":

1. When the traveler, while en route, has to wait six (6) hours or more to transfer to a certificated air carrier to proceed to the intended destination, or

2. when any flight by a certificated air carrier is interrupted by a stop anticipated to be six (6) hours or more for refueling, reloading, repairs, etc., and no other flight by a certificated air carrier is available during the six (6) hour period, or

3. when by itself or in combination with other certificated or noncertificated air carriers (if certificated air carriers are "unavailable") it takes twelve (12) or more hours longer from the original airport to the destination airport to accomplish the agency's mission than would service by a noncertificated air carrier or carriers.

4. When the elapsed traveltime on a scheduled flight from origin to destination airports by noncertificated air carrier(s) is three (3) hours or less, and service by certificated air carrier(s) would involve twice such scheduled traveltime.

D. The terms used in this article have the following meanings:

1. "International air transportation" means transportation of persons (and their personal effects) or property by air thereof between a place in the United States and a place outside thereof between two places both of which are outside the United States.

2. "U.S. flag carriers" means one of a class of air carriers holding a certificate or public convenience and necessity issued by the Civil Aeronautics Board, approved by the President authorizing operations between the United States and/or its territories and one or more foreign countries.

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3. The term "United States" includes the fifty states, Commonwealth of Puerto Rico, possessions of the United States, and the District of Columbia.

E. The Contractor shall include the substance of this article, including this Paragragh E, in each subcontract or purchase hereunder which may involve international air transportation.

APPENDIX D-4
INTELLECTUAL PROPERTY PROVISIONS
SUPPLIES AND SERVICES CONTRACT

Article

I. Authorization and Consent - Supplies and Services

II. Notice and Assistance Regarding Patent and Copyright Infringement

III. Patent Indemnity - Supplies and Services

IV. Reporting of Royalties

December, 1977

I. AUTHORIZATION AND CONSENT

The Government has given its authorization and consent (without prejudice to any rights of indemnification) for all use and manufacture, in the performance of this contract or any part hereof or any amendment hereto or any subcontract hereunder (including any lower-tier subcontract), of any invention described in and covered by a patent of the United States (i) embodied in the structure or composition of any article the delivery of which is accepted by the Government or the Laboratory under this contract or (ii) utilized in the machinery, tools or methods the use of which necessarily results from compliance by the Contractor or the using subcontractor with (a) specifications or written provisions now or hereafter forming a part of this contract, or (b) specific written instructions given by the Laboratory or the Government directing the manner of performance. The entire liability to the Government for infringement of a patent of the United States shall be determined solely by the provisions of the indemnity clauses, if any, included in this contract or any subcontract hereunder (including any lower-tier subcontract), and the Government assumes liability for all other infringement to the extent of the authorization and consent hereinabove granted.

II. NOTICE AND ASSISTANCE REGARDING PATENT AND COPYRIGHT INFRINGEMENT

The provisions of this clause shall be applicable only if the amount of this contract exceeds $10,000.

(a) The Contractor shall report to the Government through the Laboratory, promptly and in reasonable written detail, each notice or claim of patent or copyright infringement based on the performance of this contract of which the Contractor has knowledge.

(b) In the event of any claim or suit against the Government on account of any alleged patent or copyright infringement arising out of the the performance of this contract or out of the use of any supplies furnished or work or services performed hereunder, the Contractor shall furnish to the Government when requested by the Government or the Laboratory all evidence and information in possession of the Contractor pertaining to such suit or claim. Such evidence and information shall be furnished at the expense of the Government except where the Contractor has agreed to indemnify the Government or the Laboratory.

(c) This clause shall be included in all subcontracts.

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III. PATENT INDEMNITY

If the amount of this contract is in excess of $10,000, the Contractor shall indemnify the Laboratory, the Government, and their officers, agents, and employees against liability, including costs, for infringement of any United States letter patent (except letters patent issued upon an application which is now or may hereafter be kept secret or otherwise withheld from issue by order of the Government) arising out of the manufacture or delivery of supplies or out of construction, alteration, modification, or repair of real property (hereinafter referred to as "construction work") under this contract, or out of the use or disposal by or for the account of the Government of such supplies or construction work. The foregoing indemnity shall not apply unless the Contractor shall have been informed as soon as practicable by the Government of the suit or action alleging such infringement, and shall have been given such opportunity as is afforded by applicable laws, rules, or regulations to participate in the defense thereof; and further, such indemnity shall not apply to:

(I) an infringement resulting from compliance with specific written instructions of the Laboratory or the Government directing a change in the supplies to be delivered or in the materials or equipment to be used, or directing a manner of performance of the contract not normally used by the Contractor;

(II) an infringement resulting from addition to, or change in, such supplies or components furnished or construction work performed which addition or change was made subsequent to delivery or performance by the Contractor; or

(III) a claimed infringement which is settled without the consent of the Contractor, unless required by final decree of a court of competent jurisdiction.

IV. REPORTING OF ROYALTIES.

If this contract is in an amount which exceeds $10,000 and if any royalty payments are directly involved in the contract or are reflected in the contract price to the Laboratory, the Contractor agrees to report in writing to the Government through the Laboratory during the performance of this contract and prior to its completion or final settlement the amount of any royalties or other payments paid or to be paid by it directly to others in connection with the performance of this contract together with the names and addresses of licensors to whom such payments are made and either the patent numbers involved or such other information as will permit identification of the patents or other basis on which the royalties are to be paid. The approval of DOE or the Laboratory of any individual payments or royalties shall not stop the Government at any time from contesting the enforceability, validity or scope of, or title to, any patent under which a royalty or payments are made.

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PRE-AWARD INFORMATION

Attached is a booklet of Representations and Certifications. Please have it executed by an official authorized to sign on behalf of your organization and return it as soon as possible.

In addition, please provide the information sought below and return a copy of this page along with the executed booklet.

1. Contractor_____ 2. Contract No. _____

3. (For purposes of this question, "radiation" includes particles with energies in the range of KeV or higher. It does not include laser, IR, UV or microwave radiation.)

   a. Is there any planned or potential use of radioactive material under the proposed contract? Yes ( ) No ( ).

   b. Is there any planned or potential use of a radiation-producing device (e.g. accelerator, reactor, x-ray machine, fusion device)? Yes ( ) No ( ).

   If a. or b. above is answered "yes", please provide the following information:

   Principal Investigator _____ Phone _____

   Health Physicist/
   Radiation Safety Officer _____ Phone _____

4. Will Contractor personnel perform any part of the work at a Government-owned Contractor-operated (GOCO) facility or at a Government-owned Government-operated (GOGO) facility? No ( )
   Yes ( ) — GOCO ( ) GOGO ( )

The following is provided for your information:

NOTICE OF RIGHT TO REQUEST PATENT WAIVER

Offerors and prospective contractors in accordance with applicable statutes and DOE Procurement Regulations have the right to request, in advance of or within 30 days after execution of the contract, a waiver of all or any part of the rights of the United States in subject inventions in accordance with applicable statutes, and the policies and procedures set forth in DOE PR 9-9.109-6. (See Paragraph 5, Page 9 - Booklet of Representations and Certifications

Attachment:

Booklet of Representations and Certifications

DEFINITIONS

Business Owners who certify that they are members of named groups (Black Americans, Hispanic Americans, Native Americans, Asian-Pacific Americans) are to be considered socially and economically disadvantaged.

The term "Native Americans" means American Indians, Eskimos, Aleuts and native Hawaiians. The term "Asian-Pacific Americans" means U.S. Citizens whose origins are from Japan, China, the Phillipines, Vietnam, Korea, Samoa, Guam, the U.S. Trust Territories of the Pacific, Northern Marianas, Laos, Cambodia, and Taiwan.

Other individuals may qualify as socially and economically disadvantaged under procedures to be separately established by the Small Business Administration at 13 CFR 124.1 - 1(3)(iii).

The Office of Minority Small Business and Capital Ownership Development in the Small Business Administration has the final authority to determine the eligibility of a concern to be designated as a small disadvantaged business and shall answer inquiries from prime contractors and others relative to the class of eligibles.

The term "subcontract" means any agreement (other than one involving an employer-employee relationship) entered into by a Federal Government prime contractor or subcontractor calling for supplies or services required for the performance of the original contract or subcontract.

A proposal may include technical data and other data, including trade secrets and/or privileged or confidential commercial or financial information, which the offeror does not want disclosed to the public or used by the Laboratory or the Government for any purpose other than proposal evaluation. To protect such data, the offeror should specifically identify each page, including each line or paragraph thereof, containing the data to be protected, and mark the cover sheet of the proposal with the notice set forth immediately below.

NOTICE

The data contained in pages _____ of this proposal have been submitted in confidence and contain trade secrets or proprietary information, and such data shall be used or disclosed only for evaluation purposes; provided that if a contract is awarded to the offeror as a result of or in connection with the submission of this proposal, the Government and the Laboratory shall have the right to use or disclose the data herein to the extent provided in the contract. This restriction does not limit the Government's or the Laboratory's right to use or disclose data obtained without restriction from any source, including the offeror.

Reference to this notice on the cover sheet should be placed on each page to which the notice applies. Data, or abstracts of data, marked with this notice will be retained on confidence and used by the Laboratory, DOE or its designated representative(s), including Laboratory or Government contractors and consultants, solely for the purpose of evaluating the proposal. The data so marked will not otherwise be disclosed or used without the offeror's prior written permission except to the extent provided in any resulting contract, or to the extent required by law. The restriction contained in the notice does not limit the Laboratory's nor the Government's right to use or disclose any data contained in the proposal if it is obtainable from any source, including the offeror, without restriction. Although it is policy to treat all proposals as confidential, neither the Laboratory nor the Government assumes any liability for disclosure or use of unmarked data and both may use or disclose such data for any purpose.

BOOKLET OF

REPRESENTATIONS AND CERTIFICATIONS FOR

CONTRACT/SOLICITATION NO. _____ MODIFICATION NO. _____

REPRESENTATIONS (Check or complete all applicable boxes or blocks.)

The Offeror represents as part of his offer that:

1. TYPE OF BUSINESS ORGANIZATION DUNS CONTRACTOR ESTABLISHMENT NO. _____

   He operates as ( ) an individual, ( ) a partnership, ( ) a nonprofit organization, ( ) a corporation, incorporated under the laws of the State of _____, with principal place of business located at _____.

2. PLACE OF CONTRACT PERFORMANCE

   Principal place of contract performance will be at:

   Street Address _____

   City _____ County _____ State _____ Zip Code _____

   Congressional District _____

3. WOMAN-OWNED BUSINESS

   Concern ( ) is, ( ) is not, exempt as set forth below.

   Concern ( ) is, ( ) is not, a woman-owned business.

   A woman-owned business is a business which is, at least, 51 percent owned, controlled, and operated by a woman or women. "Controlled" is defined as exercising the power to make policy decisions. "Operated" is defined as actively involved in the day-to-day management. "Women" means all women business owners. For the purposes of this definition, businesses which are publicly owned, joint stock associations, and business trusts are exempted. Exempted businesses may voluntarily represent that they are, or are not, woman-owned if this information is available.

4. LABOR SURPLUS AREA CONCERN

He ( ) is, ( ) is not, a labor surplus area concern.

He ( ) is, ( ) is not, located in a labor surplus area.

(For definition of "labor surplus area concern" see Code of Federal Regulations, Title 41, Para 1-1.801. For definition of labor surplus area, see U. S. Department of Labor Listing of Eligible Labor Surplus Areas under Defense Manpower Policy No. 4A.)

5. EQUAL OPPORTUNITY

He ( ) has, ( ) has not, participated in a previous contract or subcontract subject to the Equal Opportunity Clause herein, or the clause originally contained in Section 301 of Executive Order No. 10925, or the clause contained in Section 201 of Executive Order No. 11114; that he ( ) has, ( ) has not, filed all required compliance reports; and that representations indicating submission of required compliance reports, signed by proposed subcontractors, will be obtained prior to subcontract awards. (The above representation need not be submitted in connection with contracts or subcontracts which are exempt from the clause.)

6. AFFIRMATIVE ACTION PROGRAM

(1) He ( ) has developed and has on file, ( ) has not developed and does not have on file, at each establishment affirmative action programs as required by the rules and regulations of the Secretary of Labor (41 CFR 60-1 and 60-2), or (2) he ( ) has not previously had contracts subject to the written affirmative action program requirement of the rules and regulations of the Secretary of Labor.

7. COVENANT AGAINST CONTINGENT FEE

(a) He ( ) has, ( ) has not, employed or retained any company or persons (other than a full-time bona fide employee working solely for the offeror) to solicit or secure this contract, and (b) that he ( ) has, ( ) has not, paid or agreed to pay any company or person (other than a full-time bona fide employee working solely for the offeror) any fee, commission, percentage, or brokerage fee contingent upon or resulting from the award of this contract; and agrees to furnish information relating to (a) and (b) above as requested by the Authorized Laboratory Procurement Official. (Note: For interpretation of the representation, including the term "bona fide employee," see Code of Federal Regulations, Title 41, Subpart 1-1.5.)

8. IDENTIFICATION OF PROPRIETARY TECHNICAL DATA

The section of this solicitation or contract which describes the work to be performed also sets forth the Laboratory's known requirements for technical data. The Additional Technical Data Requirements clause, if included in this solicitation or contract, provides the Laboratory or the Government with the option to order additional technical data, the requirements for which are not known at the time of contracting. There is, however, a built-in limitation on the kind of technical data which may be required in paragraph (e) of the Rights in Technical Data clause (if included), which provides that the contractor may withhold delivery of proprietary data.

Accordingly, it is necessary that you indicate below that the work to be performed and the known requirements for technical data as set forth in the solicitation or contract have been reviewed, and either state that to the best of your knowledge, no data will be withheld, or submit a list identifying the proprietary data which to the best of your knowledge will likely be used in the contract performance and will be withheld.

Please indicate that you have reviewed the requirements in the technical scope of work and to the best of your knowledge:

( ) The technical scope of work has been reviewed and

( ) None of the data will be withheld; or

( ) Data will be withheld as follows:

DATA

_____

_____

_____

_____

_____

9. RIGHTS IN PROPOSAL DATA

It is Laboratory policy for a contract award based on a proposal that, in consideration of the award, the Government shall obtain unlimited rights in the technical data contained in the proposal unless the contractor marks those portions of the technical information which he asserts as "proprietary data" or specifies those portions of such technical data which are not directly related to or will not be utilized in the work to be funded under the contract. Accordingly, please indicate:

( ) No restriction on Government rights in the proposal technical data: or

( ) The following identified technical data is proprietary or is not directly related to or will not be utilized in the work to be funded under the contract:

DATA

_____ _____

_____ _____

_____ _____

_____ _____

10. PERCENT OF FOREIGN CONTENT

The offeror/contractor will represent (as an estimate), immediately after the award of a contract, the percent of the foreign content of the item or service being procured expressed as a percent of the contract award price (accuracy within plus or minus 5 percent is acceptable).

CERTIFICATIONS (Check or complete all applicable boxes or blocks)

1. SMALL AND SMALL DISADVANTAGED BUSINESS CERTIFICATION
(Applicable to offers and contracts exceeding $10,000.)

(A) The offeror ( ) certifies that he is ( ), is not ( ), a small business concern as defined in accordance with Section 3 of the Small Business Act (15 U.S.C. 632).

(B) The offeror ( ) certifies that he is a small business (as set forth in (A) above) and is ( ), is not ( ), owned and controlled by socially and economically disadvantaged individuals. Such a firm is defined as one:

(i) which is at least 51 per centum owned by one or more such individuals or, in the case of a publicly owned business, at least 51 per centum of the stock is owned by such individuals;

(ii) whose management and daily business operations are controlled by one or more such individuals; and

(iii) which certifies concerning said ownership and control in accordance with section (C) below.

(C) The offeror ( ) certifies that he is ( ), is not ( ), a minority individual(s) in accordance with (C)(i) below or that he is ( ), is not ( ), socially and economically disadvantaged in accordance with section (C)(ii) or (C)(iii). Socially and economically disadvantaged individuals are defined as:

(i) United States citizens who are Black Americans, Hispanic Americans, Native Americans, Asian Pacific Americans, or other specified minorities;

(ii) any other individual found to be disadvantaged pursuant to section 8(a) of the Small Business Act (15 U.S.C. 873); or

(iii) any other individual defined by the Small Business Administration as socially and economically disadvantaged, for purposes relating to other sections of the Small Business Act.

Failure to execute all parts of the certification will be deemed a minor informality and the offeror shall be permitted to satisfy the requirement prior to award.

2. CLEAN AIR AND WATER CERTIFICATION

(Applicable if the offer exceeds $100,000, or the Authorized Laboratory Procurement Official has determined that orders under an indefinite quantity contract in any year will exceed $100,000, or a facility to be used has been the subject of a conviction under the Clean Air Act (42 U.S.C. 1857c-8(c)(1)) or the Federal Water Pollution Control Act (33 U.S.C. 1319(c)) and is listed by EPA, or is not otherwise exempt.)

The offeror certifies as follows:

(a) Any facility to be utilized in the performance of this proposed contract has ( ), has not ( ), been listed on the Environmental Protection Agency List of Violating Facilities.

(b) He will promptly notify the Authorized Laboratory Procurement Official, prior to award, of the receipt of any communication from the Director, Office of Federal Activities, Environmental Protection Agency, indicating that any facility which he proposes to use for the performance of the contract is under consideration to be listed on the EPA List of Violating Facilities.

(c) He will include substantially this certification, including this paragraph (c), in every nonexempt subcontract.

3. CERTIFICATION OF NONSEGREGATED FACILITIES

(Applicable to (1) contracts, (2) subcontracts, and (3) agreements with applicants who are themselves performing federally assisted construction contracts, exceeding $10,000 which are not exempt from the provisions of the Equal Opportunity clause.)

By the submission of this offer, the offeror, applicant, or subcontractor certifies that he does not maintain or provide for his employees any segregated facilities at any of his establishments, and that he does not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. He certifies further that he will not maintain or provide for his employees any segregated facilities at any of his establishments, and that he will not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. The offeror, applicant or subcontractor agrees that a breach of this certification is a violation of the Equal Opportunity clause in this contract. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, rest rooms and washrooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated on the basis of race, creed, color, or national origin, because of habit, local custom, or otherwise. He further agrees that (except where he has obtained identical certifications from proposed subcontractors for specific time periods) he will obtain identical certifications from proposed subcontractors prior to the award of subcontracts exceeding $10,000 which are not exempt from the provisions of the Equal Opportunity clause; that he will retain such certification in his files; subcontractors (except where the proposed subcontractors have submitted identical certifications for specific time periods):

NOTICE TO PROSPECTIVE SUBCONTRACTORS OF REQUIREMENT FOR CERTIFICATIONS OF NONSEGREGATED FACILITIES

A Certification of Nonsegregated Facilities must be submitted prior to the award of a subcontract exceeding $10,000 which is not exempt from the provisions of the Equal Opportunity clause. The certification may be submitted either for each subcontract or for all subcontracts during a period (i.e., quarterly, semiannually, or annually).

NOTE: The penalty for making false statements in offers is prescribed in 18 U.S.C. 1001.

4. CERTIFICATION OF INDEPENDENT PRICE DETERMINATION

(a) By submission of this offer, the offeror certifies, and in the case of a joint offer each party thereto certifies as to its own organization, that in connection with this procurement: (1) The prices in this offer have been arrived at independently, without consultation, communication, or agreement, for the purpose of restricting competition, as to any matter relating to such prices with any offeror or with any competitor; (2) Unless otherwise required by law, the prices which have been quoted in this offer have not been knowingly disclosed by the offeror and will not knowingly be disclosed by the offeror prior to opening, in the case of an advertised procurement, or prior to award, in the case of a negotiated procurement, directly or indirectly to any other offeror or to any competitor; and (3) No attempt has been made or will be made by the offeror to induce any other person or firm to submit or not to submit an offer for the purpose of restricting competition.

(b) Each person signing this offer certifies that: (1) He is the person in the offeror's organization responsible within that organization for the decision as to the prices being offered herein and that he has not participated, and will not participate, in any action contrary to (a)(1) through (a)(3) above; or (2) (i) He is not the person in the offeror's organization responsible within that organization for the decision as to the prices offered herein but that he has been authorized in writing to act as agent for the persons responsible for such decision in certifying that such persons have not participated, and will not participate, in any action contrary to (a)(1) through (a)(3) above, and as their agent does hereby so certify; and (ii) He has not participated, and will not participate, in any action contrary to (a)(1) through (a)(3) above.

(c) This certification is not applicable to a foreign offeror submitting an offer for a contract which requires performance of delivery outside the United States, its possessions, and Puerto Rico.

(d) An offer will not be considered for award where (a)(1), (a)(3), or (b) above has been deleted or modified. Where (a)(2) above has been deleted or modified, the offer will not be considered for award unless the offeror furnishes with the offer a signed statement which sets forth in detail the circumstances of the disclosure and the head of the agency, or his designee, determines that such disclosure was not made for the purpose of restricting competition.

5. CERTIFICATION AS TO SMALL BUSINESS OR NONPROFIT STATUS UNDER PUBLIC LAW 96-517

PATENT TERMS AND NOTICE OF RIGHT TO REQUEST PATENT WAIVER

1. Under the provisions of P.L. 96-517 the patent terms required for contracts with Offerors in certain categories are as set forth in DOE Procurement Regulations. In order to determine the Patent Provisions applicable to this contract, please check the applicable box.

Offeror is:

[ ] (a) A small business firm as defined at section 2 of P.L. 85-536 (15 U.S.C. 632) and implementing regulations of the Administrator of the Small Business Administration. For the purpose of this definition, the size standard for small business concerns involved in Government procurement, contained in 13 CFR 121.3-8, and in subcontracting, contained in 13 CFR 121.3-12, will be used;

[ ] (b) A university or other institution of higher education or an organization of the type described in section 501(c)(3) of the Internal Revenue Code of 1954 (26 U.S.C. 501(c)) and exempt from taxation under section 501(a) of the Internal Revenue Code (26 U.S.C. 501(a)); or

[ ] (c) A nonprofit scientific or educational organization qualified under a State nonprofit organization statute.

Please identify the statute: _____

_____.

[ ] (d) None of the above.

2. Offerors who have checked (d) above have the right to request in advance of or within 30 days after execution of the contract, in accordance with applicable statutes and DOE Procurement Regulations (9-9.109-6), a waiver of all or any part of the rights of the United States in subject inventions. If the Offeror intends to request a waiver to such invention rights pursuant to DOE PR 9-9.109-6, please indicate:

[ ] I intend to request an advance waiver in accordance with DOE PR 9-9.109-6.

[ ] I do not intend to request an advance waiver.

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This is submitted with the intention that the Department of Energy rely on my representation that

_____
(organization name)

is a member of the category indicated.

Respectfully submitted.

_____
(organization name)

_____ _____
Date Submitted (signature)

_____
Name & Title of Authorized Representative

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6. ORGANIZATIONAL CONFLICTS OF INTEREST

Disclosure or Representation

A. Solicitation Document

It is Argonne National Laboratory and Department of Energy policy to avoid situations which place an Offeror in a position where its judgment may be biased because of any past, present, or currently planned interest, financial or otherwise, the Offeror may have which relates to the work to be performed pursuant to this solicitation or where the Offeror's performance of such work may provide it with an unfair competitive advantage. (As used herein, "Offeror" means the proposer or any of its affiliates or proposed consultants or subcontractors of any tier.)

Therefore:

(1) The Offeror shall provide a statement which describes in a concise manner all relevant facts concerning any past, present, or currently planned interest (financial, contractual, organizational, or otherwise) relating to the work to be performed hereunder and bearing on whether the Offeror has a possible organizational conflict of interest with respect to:

(a) being able to render impartial, technically sound, and objective assistance or advice, or

(b) being given an unfair competitive advantage. The Offeror may also provide relevant facts that show how its organizational structure and/or management systems limit its knowledge of possible organizational conflicts of interest relating to other divisions or sections of the organization and how that structure or systems would avoid or mitigate such organizational conflict.

(2) In the absence of any relevant interest referred to above, the Offeror shall submit a statement certifying that to its best knowledge and belief no such facts exist relevant to possible organizational conflicts of interest. Proposed consultants and subcontractors shall submit such information directly to the Laboratory.

(3) The Laboratory will review the statement submitted and may require additional relevant information from the Offeror. All such information, and any other relevant information known to the Laboratory, will be used to determine whether an award to the Offeror may create an organizational conflict of interest. If such organizational conflict of interest is found to exist, the Laboratory may:

(a) impose appropriate conditions which avoid such conflict;

(b) disqualify the Offeror, or

(c) determine that it is otherwise in the best interests of the United States to contract with the Offeror by including appropriate conditions mitigating such conflict in the contract awarded.

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(4) The refusal to provide the disclosure or representation and any additional information as required shall result in disqualification of the Offeror for award. The non-disclosure or misrepresentation of any relevant interest may also result in the disqualification of the Offeror for award, or if such non-disclosure or misrepresentation is discovered after award, the resulting contract may be terminated for default. The Offeror may also be disqualified from subsequent related Laboratory and Department of Energy contracts, and be subject to such other remedial action as may be permitted or provided by law or in the resulting contract. The attention of the Offeror in complying with this provision is directed to 18 U.S.C. 1001.

(5) Depending on the nature of the contract activities, the Offeror may, because of possible organizational conflicts of interest, propose to exclude specific kinds of work from the Statement of Work contained in a solicitation for a negotiated procurement, unless the solicitation specifically prohibits such exclusion. Any such proposed exclusion by an Offeror shall be considered by the Laboratory in the evaluation of proposals, and if the Laboratory considers the proposed excluded work to be essential or an integral part of the required work, the proposal may be rejected as unacceptable.

B. Disclosure Format

With respect to past, present, and currently planned interests (financial, contractual, organizational, or otherwise), the Offeror should furnish a list of past, present, and currently planned activities (including contracts which relate to the work to be performed under the solicitation.

The list may be in columnar format showing:

(1) The company (or agency) for which the work is being, has been, or will be performed;

(2) Nature of the work (a brief description);

(3) Period of performance for the work;

(4) Dollar value of the work; and

(5) Sales and marketing activity.

Similar information should be provided by the covered subcontractors and consultants relating to the work to be performed by them under the solicitation.

7. COST ACCOUNTING STANDARDS CERTIFICATION - NONDEFENSE APPLICABILITY

Any negotiated contract in excess of $100,000 resulting from this solicitation shall be subject to the requirements of the clauses entitled Cost Accounting Standards - Nondefense Contract (FPR 1-3.1204-2(0)) and Administration of Cost Accounting Standards (FPR 1-3.1204-1(b)) if it is awarded to a contractor's business unit which (i) at the time of award is performing a national defense contract or subcontract of $10 million or more subject to full (4 CFR 331) CAS coverage that was awarded during the contractor's current cost accounting period, (ii) received national defense CAS covered awards during the preceding cost accounting period of $10 million or more, or (iii) received national defense CAS covered awards during the preceding cost accounting period of under $10 million but such awards accounted for 10 percent or more of the business unit's sales for the preceding period, except contracts which are otherwise exempt (see FPR 1-3.1203-2(a) and (c)(4)). Otherwise, an award resulting from this solicitation shall be subject to the requirements of the clauses entitled Consistency of Cost Accounting Practices - Nondefense Contract (FPR 1-3.1204-2(b)) and Administration of Cost Accounting Standards (FPR 1-3.1204-1(b)) if the award is (i) the first negotiated contract over $500,000 in the event the award is to a contractor's business unit that is not performing under any CAS covered national defense or nondefense contract or subcontract, or (ii) a negotiated contract over $100,000 in the event the award is to a contractor's business unit that is performing under any CAS covered national defense or nondefense contract or subcontract, except contracts which are otherwise exempt (see FPR 1-3.1203-2(a) and (c)(4)). This solicitation notice is <u>not</u> applicable to <u>small business concerns</u>.

Certificate of CAS Applicability

The offeror hereby certifies that:

A ( ) It is currently performing a negotiated national defense contract or subcontract that contains a Cost Accounting Standards Clause (4 CFR 331), and it is currently required to accept that clause in any new negotiated national defense contracts it receives that are subject to cost accounting standards.

B ( ) It is currently performing a negotiated national defense or nondefense contract or subcontract that contains a cost accounting standards clause required by 4 CFR 331 or 332 or by FRP Subpart 1-3.12, but it is not required to accept the 4 CFR 331 clause in new negotiated national defense contracts or subcontracts which it receives that are subject to cost accounting standards.

C ( ) It is not performing any CAS covered national defense or nondefense contract or subcontract. The offeror further certifies that it will immediately notify the Authorized Laboratory Procurement Official in writing in the event that it is awarded any negotiated national defense or nondefense contract or subcontract containing any cost accounting standards clause subsequent to the date of this certificate but prior to the date of the award of a contract resulting from this solicitation.

D ( ) It is an educational institution receiving contract awards subject to FPR Subpart 1-15.3 (FMC 73-8, OMB Circular A-21).

E ( ) It is a State or local government receiving contract awards subject to FPR Subpart 1-15.7 (FMC 74-4, OMB Circular A-87).

F ( ) It is a hospital.

NOTE: Certain firm fixed price negotiated nondefense contracts awarded on the basis of price competition may be determined by the Authorized Laboratory Procurement Official (at the time of award) to be exempt from cost accounting standards (FPR 1-3.1203-2(c)(4)(iv)).

Additional Certification - CAS Applicable Offerors

G ( ) The offeror, subject to cost accounting standards but not certifying under D, E, or F above, further certifies that practices used in estimating costs in pricing this proposal are consistent with the practices disclosed in the Disclosure Statement(s) where they have been submitted pursuant to CASB regulations (4 CFR 351).

Data Required - CAS Covered Offerors

The Offeror certifying under A or B above but not under D, E, or F above, is required to furnish the name, address (including agency or department component), and telephone number of the cognizant contracting officer administering the offeror's CAS covered contracts. If A above is checked, the offeror will also identify those currently effective cost accounting standards, if any, which upon award of the next negotiated national defense, contract or subcontract will become effective upon the offeror.

NAME OF CONTRACTING OFFICER: _____

ADDRESS: _____

_____

TELEPHONE NUMBER: _____

STANDARDS NOT MET APPLICABLE: _____

8. CERTIFICATION REGARDING SUBCONTRACTING AND PLANS
(Subcontracting Representation)

(A) The offeror represents that the following conditions prevail which determine whether the firm shall be required to submit a subcontracting plan for small business concerns and small business concern owned and controlled by socially and economically disadvantaged individuals:

( ) (i) he is a small business as defined in accordance with Section 3 of the Small Business Act (15 U.S.C. 632);

( ) (ii) subcontracting possibilities are not offered with respect to this contract;

( ) (iii) the contract, including all subcontracts thereunder, will be performed entirely outside of the United States, its territories and possessions, the District of Columbi and the Commonwealth of Puerto Rico and is therefore not covered;

( ) (iv) the contract shall not exceed $1,000,000 (if solely for construction of a public facility) or $500,000 otherwise; or

( ) (v) the contract is for services which are personal in nature and is therefore not covered.

(B) The offeror represents that he is not required to submit plans for subcontracting with small and small disadvantaged businesses because he has properly executed one of the above representations.

(C) the offeror certifies that he will submit a Subcontracting Plan in accordance with the terms and conditions specified unless exempted by (A) above, and that he will require it of all appropriate subcontractors unless they certify that they are exempt.

Failure to execute this representation will be deemed a minor informality and the offeror/contractor will be permitted to correct the omission prior to award.

NAME OF OFFEROR: _____

BY: _____
(Signature of Person Authorized to Sign)

NAME AND TITLE
OF SIGNER: _____

DATE SIGNED: _____

ENCLOSURE 6

CONTRACT PRICING PROPOSAL
(RESEARCH AND DEVELOPMENT)

Office of Management and Budget Approval No. 29-R0184

This form is for use when (i) submission of cost or pricing data (see FPR 1-3.807-3) is required and (ii) substitution for the Optional Form 59 is authorized by the contracting officer.

PAGE NO. | NO OF PAGES

NAME OF OFFEROR

HOME OFFICE ADDRESS

SUPPLIES AND/OR SERVICES TO BE FURNISHED

DIVISION(S) AND LOCATION(S) WHERE WORK IS TO BE PERFORMED

TOTAL AMOUNT OF PROPOSAL $

GOV'T SOLICITATION NO

DETAIL DESCRIPTION OF COST ELEMENTS

			EST COST ($)	TOTAL EST COST[1]	REFERENCE[2]
1. DIRECT MATERIAL (Itemize on Exhibit A)					
a. PURCHASED PARTS					
b. SUBCONTRACTED ITEMS					
c. OTHER—(1) RAW MATERIAL					
(2) YOUR STANDARD COMMERCIAL ITEMS					
(3) INTERDIVISIONAL TRANSFERS (At other than cost)					
TOTAL DIRECT MATERIAL					
2. MATERIAL OVERHEAD[3] (Rate %X$ base=)					
3. DIRECT LABOR (Specify)	ESTIMATED HOURS	RATE/HOUR	EST COST ($)		
TOTAL DIRECT LABOR					
4. LABOR OVERHEAD (Specify Department or Cost Center)[3]	O H RATE	X BASE=	EST COST ($)		
TOTAL LABOR OVERHEAD					
5. SPECIAL TESTING (Including field work at Government installations)			EST COST ($)		
TOTAL SPECIAL TESTING					
6. SPECIAL EQUIPMENT (If direct charge) (Itemize on Exhibit A)					
7. TRAVEL (If direct charge) (Give details on attached Schedule)			EST COST ($)		
a. TRANSPORTATION					
b. PER DIEM OR SUBSISTENCE					
TOTAL TRAVEL					
8. CONSULTANTS (Identify—purpose—rate)			EST COST ($)		
TOTAL CONSULTANTS					
9. OTHER DIRECT COSTS (Itemize on Exhibit A)					
10. TOTAL DIRECT COST AND OVERHEAD					
11. GENERAL AND ADMINISTRATIVE EXPENSE (Rate % of cost element Nos.)[3]					
12. ROYALTIES[4]					
13. TOTAL ESTIMATED COST					
14. FEE OR PROFIT					
15. TOTAL ESTIMATED COST AND FEE OR PROFIT					

OPTIONAL FORM 60
October 1971
General Services Administration
FPR [illegible]

This proposal is submitted for use in connection with and in response to *(Describe RFP, etc.)*

and reflects our best estimates as of this date, in accordance with the Instructions to Offerors and the Footnotes which follow.

TYPED NAME AND TITLE	SIGNATURE

NAME OF FIRM	DATE OF SUBMISSION

EXHIBIT A—SUPPORTING SCHEDULE *(Specify. If more space is needed, use reverse)*

COST EL NO.	ITEM DESCRIPTION *(See footnote 5)*	EST COST *($)*

I. HAS ANY EXECUTIVE AGENCY OF THE UNITED STATES GOVERNMENT PERFORMED ANY REVIEW OF YOUR ACCOUNTS OR RECORDS IN CONNECTION WITH ANY OTHER GOVERNMENT PRIME CONTRACT OR SUBCONTRACT WITHIN THE PAST TWELVE MONTHS?

☐ YES ☐ NO *(If yes, identify below.)*

NAME AND ADDRESS OF REVIEWING OFFICE AND INDIVIDUAL	TELEPHONE NUMBER/EXTENSION

II. WILL YOU REQUIRE THE USE OF ANY GOVERNMENT PROPERTY IN THE PERFORMANCE OF THIS PROPOSED CONTRACT?

☐ YES ☐ NO *(If yes, identify on reverse or separate page)*

III. DO YOU REQUIRE GOVERNMENT CONTRACT FINANCING TO PERFORM THIS PROPOSED CONTRACT?

☐ YES ☐ NO *(If yes, identify.)*: ☐ ADVANCE PAYMENTS ☐ PROGRESS PAYMENTS OR ☐ GUARANTEED LOANS

IV. DO YOU NOW HOLD ANY CONTRACT *(Or, do you have any independently financed (IR&D) projects)* FOR THE SAME OR SIMILAR WORK CALLED FOR BY THIS PROPOSED CONTRACT?

☐ YES ☐ NO *(If yes, identify.)*:

V. DOES THIS COST SUMMARY CONFORM WITH THE COST PRINCIPLES SET FORTH IN AGENCY REGULATIONS?

☐ YES ☐ NO *(If no, explain on reverse or separate page)*

See Reverse for Instructions and Footnotes

OPTIONAL FORM 60 (10-71)

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INSTRUCTIONS TO OFFERORS

1. The purpose of this form is to provide a standard format by which the offeror submits to the Government a summary of incurred and estimated costs *(and attached supporting information)* suitable for detailed review and analysis. Prior to the award of a contract resulting from this proposal the offeror shall, under the conditions stated in FPR 1-3.807-3 be required to submit a Certificate of Current Cost or Pricing Data (See FPR 1-3.807-3(h) and 1-3.807-4).

2. In addition to the specific information required by this form, the offeror is expected, in good faith, to incorporate in and submit with this form any additional data, supporting schedules, or substantiation which are reasonably required for the conduct of an appropriate review and analysis in the light of the specific facts of this procurement. For effective negotiations, it is essential that there be a clear understanding of:

a. The existing, verifiable data.
b. The judgmental factors applied in projecting from known data to the estimate, and
c. The contingencies used by the offeror in his proposed price.

In short, the offeror's estimating process itself needs to be disclosed.

3. When attachment of supporting cost or pricing data to this form is impracticable, the data will be described *(with schedules as appropriate)*, and made available to the contracting officer or his representative upon request.

4. The formats for the "Cost Elements" and the "Proposed Contract Estimate" are not intended as rigid requirements. These may be presented in different format with the prior approval of the Contracting Officer if required for more effective and efficient presentation. In all other respects this form will be completed and submitted without change.

5. By submission of this proposal the offeror grants to the Contracting Officer, or his authorized representative, the right to examine, for the purpose of verifying the cost or pricing data submitted, those books, records, documents and other supporting data which will permit adequate evaluation of such cost or pricing data, along with the computations and projections used therein. This right may be exercised in connection with any negotiations prior to contract award.

FOOTNOTES

1 *Enter in this column those necessary and reasonable costs which in the judgment of the offeror will properly be incurred in the efficient performance of the contract. When any of the costs in this column have already been incurred (e.g., on a letter contract or change order), describe them on an attached supporting schedule. Identify all sales and transfers between your plants, divisions, or organizations under a common control, which are included at other than the lower of cost to the original transferror or current market price.*

2 *When space in addition to that available in Exhibit A is required, attach separate pages as necessary and identify in this "Reference" column the attachment in which the information supporting the specific cost element may be found. No standard format is prescribed; however, the cost or pricing data must be accurate, complete and current, and the judgment factors used in projecting from the data to the estimates must be stated in sufficient detail to enable the Contracting Officer to evaluate the proposal. For example, provide the basis used for pricing materials such as by vendor quotations, shop estimates, or invoice prices; the reason for use of overhead rates which depart significantly from experienced rates (reduced volume, a planned major re-arrangement, etc.); or justification for an increase in labor rates (anticipated wage and salary increases, etc.). Identify and explain any contingencies which are included in the proposed price, such as anticipated costs of rejects and defective work, or anticipated technical difficulties.*

3 *Indicate the rates used and provide an appropriate explanation. Where agreement has been reached with Government representatives on the use of forward pricing rates, describe the nature of the agreement. Provide the method of computation and application of your overhead expense, including cost breakdown and showing trends and budgetary data as necessary to provide a basis for evaluation of the reasonableness of proposed rates.*

4 *If the total cost entered here is in excess of $250, provide on a separate page the following information on each separate item of royalty or license fee: name and address of licensor; date of license agreement; patent numbers, patent application serial numbers, or other basis on which the royalty is payable; brief description, including any part or model numbers of each contract item or component on which the royalty is payable; percentage or dollar rate of royalty per unit; unit price of contract item; number of units; and total dollar amount of royalties. In addition, if specifically requested by the contracting officer, a copy of the current license agreement and identification of applicable clauses of specific patents shall be provided.*

5 *Provide a list of principal items within each category indicating known or anticipated source, quantity, unit price, competition obtained, and basis of establishing source and reasonableness of cost.*

CONTINUATION OF EXHIBIT A—SUPPORTING SCHEDULE AND REPLIES TO QUESTIONS II AND V.

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logy and Infectious Diseases Program, National Institute of Allergy and Infectious Diseases (NIAID) is soliciting contract proposals from organizations having the capabilities and facilities for the identification, biological characterization and preparation of candidate cold-adapted (ca), live, attenuated influenza A and B viruses for use as attenuated influenza vaccines. RFP will be issued o/a Mar 23, 1984. Closing date tentatively set May 11, 1984. To receive a copy of the RFP, supply this office with two self-addressed mailing labels. The RFP package will be available upon written request. Reference RFP NIH-NIAID-MIDP-84-19. This advertisement does not commit the government to make awards.

A — TESTING OF RESPIRATORY, ENTERIC AND BACTERIAL VACCINES AND EPIDEMIOLOGY OF INFECTIOUS DISEASES IN ADOLESCENTS AND ADULTS. The Development and Applications Branch of the Microbiology and Infectious Diseases Program, National Institute of Allergy and Infectious Diseases (NIAID) has a need for a vaccine evaluation unit to conduct clinical trials of new or existing vaccines in either adolescents or adults. RFP issued o/a Mar 23, 1984 with a closing date tentatively set Jun 28, 1984. To receive a copy of the RFP, supply this office with two self-addressed mailing labels. The RFP package will be available upon written request. Reference RFP NIH-NIAID-MIDP-84-18. This advertisement does not commit the government to make awards.

A — TESTING OF RESPIRATORY, ENTERIC AND BACTERIAL VACCINES AND EPIDEMIOLOGY OF INFECTIOUS DISEASES IN CHILDREN. The Development and Applications Branch of the Microbiology and Infectious Diseases Program, National Institute of Allergy and Infectious Diseases (NIAID), has a need for two vaccine evaluation units to conduct clinical trials of new or existing vaccines in children. RFP issued o/a Mar 23, 1984, with a closing date tentatively set Jun 28, 1984. To receive a copy of the RFP, supply this office with two self-addressed mailing labels. The RFP package will be available upon written request to Mrs Toni Sutherland, National Institute of Allergy and Infectious Diseases, NIH, 5333 Westbard Ave, Rm 707, Bethesda, MD. Reference RFP NIH-NIAID-MIDP-84-17. This advertisement does not commit the government to make awards. (045)

Naval Surface Weapons Center, Silver Spring MD 20910

A — DEVELOP ALUMINUM-LITHIUM ALLOY. Negotiations will be conducted on a sole-source basis with Alcoa Laboratories, Alcoa Center PA. See note 22, 46. For additional info call Linda L Perretta on 202/394-2336. (046)

U.S. Army Missile Command, Directorate of Procurement and Production, Redstone Arsenal AL 35898

A — PERSHING II BASE SITE TECHNICAL MANUAL. Sole source Martin Marietta Corporation, Sand Lake Rd, Orlando FL 32855. No RFP. Modification to Contract DAAK40-79-C-0064. See note 27, 22. Point of contact Terry Rodgers, Attn: DRSMI-IWB, 205/876-1038.

A — FIELDGUARD RADAR SYSTEM FIELD TEST AND OPERATIONAL SUPPORT FOR WFFR PHASE III, Eglin AFB, Rocket Firing Program. See note 27. Negotiations with Contraves Goerz Corporation, 610 Epsilon Dr, Pittsburg PA 15238. Point of contact R Welch, Attn: DRSMI-ICDB, 205/876-3740.

A — PERSHING II OR III DESIGN AND DOCUMENTATION CHANGES. Sole source Martin Marietta Corporation, Sand Lake Rd, Orlando FL 32855. No RFP. Modification to Contract DAAK40-79-C-0064. See notes 27, 22. Point of contact Terry Rodgers, address above. Attn: DRSMI-IWB, 205/876-1038.

A — PERSHING II EXTENSION RAM DATA BASE. Sole source Martin Marietta Corporation, Sand Lake Rd, Orlando FL 32855. No RFP. Modification to Contract DAAK40-79-C-0064. See notes 27, 22. Point of contact Terry Rodgers, Attn: DRSMI-IWB, 205/876-1038.

A — PERSHING II ENGINEERING AND PROVISIONING CHANGES TO PERSHING RPSTL'S. Sole source Martin Marietta Corporation, Sand Lake Rd, Orlando FL 32855. No RFP. Modification to Contract DAAK40-79-C-0064. See notes 27, 22. Point of contact Terry Rodgers, Attn: DRSMI-IWB, 205/876-1038. (046)

H Export and Consultant Service

U.S. Army Aviation Systems Command, Directorate for Procurement and Production, 4300 Goodfellow Blvd, St Louis, MO 63120

★ H — MAIN ROTOR BLADE DEICING AND FLUID TEST ON K747—Restricted to Kaman Aerospace Corporation, Old Windsor Road, PO Box 2, Bloomfield, CT 06002-0002.—RFQ DAAJ09-84-Q-A147—Note 40 applies—Point of contact is Anthony Hotak, DRSAV-PAOM, 314/263-3323. (046)

U.S. Army Armament Munitions and Chemical Command, Attn DRSAR-PCP-SP 309/794-4664 or 4166, Rock Island, IL 61299

H — CONTRACTOR LOGISTICS SUPPORT (CLS) for the multiple integrated laser engagement system (MILES) in Mar 1984—MILES is a training device developed by the Army to simulate the realism of actual combat into training exercises. It is used world-wide by the Army, and to a lesser extent, the Marine Corps, Air Force and Navy. Laser transmitters that shoot pulses of infrared laser energy simulate the effects and signature of ground combat, aircraft and air defense weapons. Individual soldiers, vehicles and acft have laser detectors installed on them to register whether or not they have been engaged by attacking weapons with its corresponding transmitter.—CLS for MILES involves providing competent repair technicians at 25 military installations to maintain the MILES equipment. It includes management and physical distribution of the inventory of government furnished repair parts. The successful contractor will be awarded a basic contract to provide CLS during the period 1 Dec 84-30 Nov 85 with two 1-year options—Contractors interested in receiving the RFP are asked to submit their name, address and tel No. Interested contractors with questions regarding the nature and scope of CLS and MILES may contact the AMCCOM MILES Logistics Manager at the above address, attn DRSMC-MAT-D (R)/Bob Coral, 309/794-6729. (046)

Dept of State, Contracts Branch, PO Box 9244, Rosslyn Station, Arlington, VA 22209, Attn Mildred R Carothers, Contract Officer, tel 703/235-9511

★ H — COMMUNICATIONS SPECIALIST SERVICES to the Dept's Security Enhancement Program on an urgent basis. Negotiations are being conducted with Edward L Peters. It is anticipated to acquire this service through sources for the FY84. See note 46. (046)

Argonne National Laboratory, Procurement Dept, 9700 S Cass Ave, Argonne, IL 60439

H — INDUSTRIAL ENERGY AUDITS AND AUDIT TRAINING IN EGYPT. Conduct industrial energy audits and energy audit training in the Arab Republic of Egypt. It is expected that the contracts will be awarded under a BOA. This activity is part of an energy policy planning program with the government of the Arab Republic of Egypt sponsored by the U.S. Agency for International Development. The object of the industrial energy audit training is to instruct selected Egyptian nationals to participate in the audit process. The selected contractors must have the necessary approach capability and experience to meet these objectives. RFP issued o/a Feb 20, 1984. Info contact Frank W Foster, 312/972-7081. (046)

U.S. International Development Cooperation Agency, Agency for International Development, USAID Mission to Sudan, Attn Health Office, American Embassy, Khartoum, Sudan, APO NY 09668

H — HEALTH CONSTRAINTS TO RURAL PRODUCTION (698-0408.21). U.S. Agency for International Development USAID seeks an individual to work as a biostatistician with the USAID Mission in Khartoum, Sudan under a two-year personal services contract beginning May-July 1984. The position requires a PH D, DPR PH H, SC D or degree candidate in biostatistics and epidemiology, two-three years experience in the international health field in developing countries, and work experience in the control of water-borne diseases, especially schistosomiasis. Experience in mathematical modelling of infectious disease as well as programming in basic computer language is important. Duties include (1) advising government of Sudan scientists in the design of research, (2) assisting in the analysis of data on schistosomiasis research and on various intervention measures presently underway in a 55,000 acre study zone in the Gezira irrigated farm scheme located 120 miles from Khartoum; (3) managing an HP 87-XM computer and peripherals (8" x 5¼") disc drives, printer and plotter and (4) training key punch operators and providing on-the-job supervision for other data management personnel. Salary is negotiable based on salary history, qualifications and experience. Individual and dependents, if any, will be provided in-kind with housing and basic household furniture, a 25% post differential and other allowances and benefits customarily provided by USAID to personal services contractors. Individual must be a U.S. citizen or permanent resident and be able to pass a security clearance. Individual and any accompanying dependents must pass a medical clearance. To apply send resume and three refs to USAID Health Office, American Embassy, Khartoum Sudan, APO New York. Applications should be received prior to 31 Mar 1984. (046)

NAVAIRSYSCOM (A-02E1), Washington, DC 20361/G Fell, 202/692-1729/21

H — CHANGE KITS FOR THE AN/AAM-60(V); FOR RELATED ENGINEERING FOR PROTOTYPING AND TESTING OF CHANGE KITS; technical data and engineering services for change kits. Negotiations will be conducted with Boeing Military Airplane Co., Div of the Boeing Co, 220 Wynn Drive, NW, PO Box 1470, Huntsville, AL 35807, the designer, developer and sole manufacturer of the AN/AAM-60(V) electro-optical system test set (EOSTS)—BOA. See note 22—NAVAIR synopsis 172-84. (046)

Naval Regional Contracting Center, U.S. Naval Base, Bldg 600, Philadelphia, PA 19112

H — INDEPENDENT VALIDATION AND VERIFICATION (IV & V), of the development and implementation of the standard automated financial system (STAFS) by Computer Sciences Corp under contract N09140-83-C-1370. Approx 60,000 man-hours over a five year period are anticipated. Services to include verification and validation of STAFS systems engineering, support of the STAFS test and evaluation effort and assistance of the STAF program development analysis. This is not a formal sol but a request for interested sources. Any resultant sol/contract will contain an organizational conflict of interest clause governing the disclosure of info. Info contact Mr RR Colot, Code P21..., tel 215/897-5426. Ref control 84-3848. (046)

Commander, Naval Sea System Command, Washington, DC 20362

H — AMENDMENT—RFP N00024-83-R-7105 (Q) for the engineering technical support to develop shipboard combat computer program/software, the modification of functions and operations and the simulation/stimulation of existing systems and subsystems as may be modified to perform in the modified operational modes for new ship design and modernization/overhaul programs. This amendment reflects a decrease in the period of performance from 48 months to 12 months and in the level of effort from 31,511 technical man-days to 8,607 technical man-days. See notes 4, 49 and 59.

★ H — TECHNICAL AND ENGINEERING SERVICES IN SUPPORT OF THE HULL, MECHANICAL AND ELECTRICAL AREAS FOR SURFACE COMBATANT SHIP CLASSES. RFP N00024-84-R-6239 (s) will be issued to Booz, Allen & Hamilton, Arlington, VA since this firm has performed precedent work and has the necessary background and knowledge required for this effort. Info contact Mark Thomas, Code 56..., tel 692-5138. See notes 46 and 22.

★ H — ENGINEERING AND TECHNICAL SUPPORT FOR THE CONDUCT OF STUDIES, ANALYSIS, REVIEWS AND PLANNING IN SUPPORT SURFACE WARFARE SYSTEM PROGRAMS—IAW specs in the schedule—RFP N-24-84-R-70.. will be issued to Syscon Corp, 1054 31st St, NW, Washington, DC 20007, since this firm has performed precedent work and therefore has the background and experience necessary to meet this requirement. See note 46.

★ H — ENGINEERING AND TECHNICAL SUPPORT FOR THE CONDUCT OF STUDIES, ANALYSIS, REVIEWS AND PLANNING IN SUPPORT SURFACE WARFARE SYSTEM PROGRAMS—IAW specs in the schedule—RFP N0004-84-R-70.. will be issued to Syscon Corp, 1054 31st St, NW, Washington, DC 20007, since this firm has performed precedent work and therefore has the background and experience necessary to meet this requirement. See note 46.

★ H — ENGINEERING AND TECHNICAL SUPPORT FOR THE CONDUCT OF STUDIES, ANALYSIS, REVIEWS AND PLANNING IN SUPPORT SURFACE WARFARE SYSTEM PROGRAMS—IAW specs in the schedule—RFP N00024-84-R-70.. will be issued to Syscon Corp, 1054 31st St, NW, Washington, DC 20007, since this firm has performed precedent work and therefore has the background and experience necessary to meet this requirement. See note 46. (046)

Rome Air Development Center, Attn PKRM, Griffiss AFB NY, Tel 315/330-3820

H — MODULAR ARCHITECTURE FOR EXCHANGE OF INTELLIGENCE (MAXI). The government intends to negotiate with Inco Inc, 8620 Greensboro Drive, McLean, ... (703/442-7960) for engineering services to develop a Dept of Defense Intelligence ... System (DODIIS) network access subsystem (DNAS) as an integral part of the MAXI terminal support system (TSS). The work to be performed will require integration of the DNAS design into the TSS design, integration of the TSS software being designed and developed under CATIS host upgrade for the CATIS terminal support processor into the MAXI TSS, and modification of MAXI applications software to interface to the Telnet protocol. As a minimum, sources must possess intimate knowledge of the MAXI TSS design and necessary expertise to complete the design, the CATIS TSS design, and can provide the necessary expertise to integrate it into the MAXI TSS design, the Telnet protocol developed for Defense Intelligence Agency (DIA) and the necessary expertise to interface it to the MAXI TSS, the DIA designed network front-end processor (NFE), and the TCP and IP protocols, the MAXI baseline and demonstrate this knowledge by starting steps that must be taken to integrate the TSS into the baseline, and overall knowledge of the DODIIS network. The government contract negotiator is M... Lovett, RADC/PKRM, 314/330-7060. Responses must be received within twenty days of publication. For additional technical info contact Nicholas DiFondi, RADC ..., 314/330-7657. See notes 22 and 49. Responses must ref Code 1-4-4388M. (046)

HUD, Contracting Officer, Rm 702, 547 W Jackson Blvd, Chicago, IL 60606

H — MANAGEMENT SERVICES of the following HUD controlled project. RFP 25-...-071. Michigan Towers South Apartments, Project 071-44084, 3814/2 S Michigan ..., Chicago, IL. Bidders are cautioned that they must have a HUD Form 9733 at the Regional Office or must submit a HUD Form 9733 with their proposal or their proposal may be determined to be non-responsible. A tentative schedule has been established for this procurement: 1) RFP package will be issued; 2) RFP due Mar 8, 1984; 3) Contract award ... 27, 1984. RFP package must be requested in writing. (046)

U.S. Dept of Transportation, Federal Railroad Administration, Office of Procurement, RAD-31, 400 7th St, SW, Rm 8226, Washington, DC 20590

H — MAINTENANCE AND ENHANCEMENT OF FINANCIAL ACCOUNTING SYSTEM PROGRAMS. The Federal Railroad Admin (FRA) plans to contract for support to maintain and enhance accounting systems, with a view towards reducing the procurement effort and achieving economies of scale. RFP DTFR53-84-R-00017/vd will be available on or before Mar 2, 1984 upon written request. Attn Vivian Dempesio. See notes 24 and ... (046)

J Maintenance and/or Repair of Equipment

GSA, Business Service Center, 819 Taylor Street, Fort Worth, TX 76102

Ⓢ J — TIRE RETREADING AND REPAIRING—7PSF-52530/P5/758 requirements contract federal supply schedule—For the period 7/1/84 or date of award, whichever is later, thru 6/30/85—For the states of Louisiana, New Mexico, Oklahoma and Texas ... — Opening date 20 Mar 84. (046)

NASA, Attn: Industry Assistance Office M/S 144, Langley Research Center, Hampton, VA 23665, 804/865-3925

J — SUPPORT SERVICES FOR FORCE AND STRAIN MEASURING INSTRUMENTATION —Modification to Contract NAS1-16912. NASA Langley Research Center intends to negotiate with Modern Machine and Tool Co., Inc., Newport News, VA on a sole source basis for the renewal of the contract for an additional two year period. This procurement will involve the acquisition of one additional year of contractor performance in concert with the exercise of the final one year option. Sol 1-21-1281.0506. See note ... (044)

U.S. Postal Service, Procurement Services Office, Attn: Manager, BOS 38100, Denver CO 80283-0100

J — VEHICLE REPAIR AND MAINTENANCE AGREEMENT for approx (52) ... owned vehicles. Vehicles located at the U.S. Postal Office, Casper WY. Maintenance to include lubrications, engine oil, mechanical labor, paint touch-up, labor and ... services and washing. Request for sol must be in writing and received within 10 days of the date of this notice or until supply is exhausted. Offers are due 21 Feb 84. Firms ... to pick up sol packages should first call 303/837-5151 to assure availability. Reference 072359-84-B-0157. (046)

Commander, U.S. Army White Sands Missile Range, Attn: STEWS-... (Mrs. Angie Sutton, 505/678-1735), White Sands Missile Range, NM 88002

J — AMENDMENT—Maintenance, calibration, repair, design, fabrication, and ... cation services of five SADS-VI/M systems to include antenna, gimbals, radio frequency, intermediate frequency electronics ... and logic circuits ... and ...

The Commerce Business Daily (USPS 965-360) is published daily except Saturdays, Sundays and holidays, for $160 a year (1st Class mailing) or $81 a year (2nd Class mailing) by the U.S. Government Printing Office, Washington, DC 20402. Second Class postage paid at Washington, DC, and additional mailing offices. POSTMASTER: Send address changes to Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402, with entire mailing label from last issue received.

The Secretary of Commerce has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through 31 July 1985.

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APPENDIX

3.8.1-13

HISTORY OF EGYPT ENERGY AUDIT PROCUREMENT

ARGONNE
NATIONAL
LABORATORY

INTRA-LABORATORY MEMO

October 31, 1985

TO: T. Wolsko

FROM: M. Monarch MRM

SUBJECT: History of Egypt Energy Audit Procurement

BACKGROUND

Argonne National Laboratory went through a lengthy process to select the best qualified consultants to perform energy audits and audit training in Egypt. The evaluation process allowed for open competition among bidders and a comprehensive two-stage technical and cost examination of all responses inclusive of personal interview of the bidder finalists. As a result of this selection process, Argonne National Laboratory takes the position that the best qualified firms were selected to perform the tasks of industrial audits and audit training in Egypt. Argonne National Laboratory established Basic Ordering Agreements (BOAs) with three firms. The three firms are:

- Hagler, Bailly & Co.
- Foster Wheeler Energy Corporation
- Stanley Consultants, Inc.

The BOAs established the technical and cost parameters of the audit and audit training work to be performed in Egypt. One of the most important cost parameters established was the billing or fee schedules for different job classifications to perform the work. These fee schedules were established for the term of the BOAs, approximately three years.

The following describes the process that Argonne National Laboratory went through to secure BOAs with the three consulting firms.

PUBLICATION OF RFP

On February 21, 1984 ANL published an RFP for Industrial Energy Audits and Audit Training in Egypt. Bidders were instructed to respond by April 13, 1984. Attachment 1 contains a complete copy of the RFP submitted to bidders.

A total of 16 bids were received in response to the RFP. Attachment 2 lists the bidders. No late bids were received and all 16 were included for review.

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PRIMARY REVIEW OF RFP

A primary review of the technical proposals was conducted for all 16 bidders. Attachment 3 shows the review form that was used, the weights used for each of the items in the review, and the results of the review for all 16 bidders. There were three technical personnel involved in the review. Attachment 3 indicates the results of the primary review as follows:

- Raw scores (based on a 1-5 ranking for each item considered),
- Normalized scores (using the weighting factors for each item considered) and,
- A total score for each task.

The normalized score for each specified task includes the following:

- Normalized score for approach,
- Normalized score for experience and capability,
- Total normalized score for approach, experience and capability, and
- A composite score that includes credit for how well the bidder did in the other task.

The composite score for each task is normalized to a value of 100. Each task was considered separately. In evaluating the results of the primary review it was agreed that a difference in scores of less than 3 points was insignificant. It was agreed that the bidders who would be considered for evaluation in the second screening, the Detailed Technical Review, would include the two that scored the highest in the estimation of each evaluator in each task. Consideration was taken for ties (i.e., less than 3 points difference). Table 3-4 in Attachment 3 gives the rankings for the bidders. There were eight bidders who qualified for consideration in the Detailed Technical Review.

DETAILED TECHNICAL REVIEW

In carrying out the Detailed Technical Review it was decided that the eight bidders would be divided into three groups as follows:

- Priority 1 - All bidders that were scored as the top-ranked by at least one evaluator in either Task 1 or 2. This included Hagler, Foster, Stanley, and Weston,
- Priority 2 - All bidders that received a second place rank by more than one reviewer. This included EDI and USS and,
- Priority 3 - All bidders that received a second place rank by only one reviewer. This included CDC and Daniel.

The approach was to conduct the Detailed Technical Review on the Priority 1 group first, the Priority 2 group next and the Priority 3 group last only if the first two groups did not lead to a clear decision. The forms used in the Detailed Technical Review are contained in Attachment 4. The results as shown in Attachment 4, indicate that there were three bidders that received a first place ranking by at least one reviewer. These three bidders are Hagler, Foster and Stanley.

INTERVIEW OF TOP SCORING FIRMS AT ANL

It was determined that the top scorers would be invited to ANL for an interview. The reviewers felt that it would be desirable to have four interviews to get a broader picture of capabilities available and to allow for a contingency in the event one or more bidders were rejected as a result of the interview. Therefore the three top ranking bidders, Hagler, Foster and Stanley and a fourth bidder with a high ranking, EDI, were asked to come to ANL for an interview.

EVALUATION OF FINALIST BIDDER COST PROPOSALS

The cost proposals for the four bidders invited for interview were included in the overall final evaluation process. Attachment 5 contains the format and results of the cost evaluation for bidders Hagler, Foster, Stanley and EDI.

Although all the bidders were asked to prepare a cost estimate for the same hypothetical situation described in the RFP (i.e., 3 training courses and 15 industrial audits), the results of the cost analysis are not easily comparable. On the basis of the total project cost estimate, Stanley is the most expensive ($763,000) and Hagler is the least expensive ($226,309). However there were significant differences in the level of effort to be applied to perform the same tasks. For example, in Task 2 Stanley proposes 211 person-weeks of effort to perform the 15 audits while Hagler proposes only 41 person-weeks. If the comparison is made on the basis of cost per person-week of effort, then Stanley is the least expensive ($2707 per person-week) and EDI is the most expensive ($3425 per person-week).

FINAL EVALUATION

Interviews with Stanley, Foster, and EDI were held May 1, 1984. An interview with Hagler was held on May 2, 1984. All three ANL technical reviewers were present during the interviews. In addition, Dr. Hussein Abdallah, Chairman and Chief Executive of the Organization for Energy Planning and Thomas Wolsko ANL Project Officer for the entire Egypt project also sat in on the interviews. As a result of the interview process the review team concluded that Basic Ordering Agreements (BOAs) should be drawn up with Hagler, Foster, and Stanley. Each demonstrated the ability to carry out the program successfully (with the exception of Stanley in Task 1, Training). The team felt that Hagler could provide service to do overview or preliminary audits. They offered the availability of an existing introductory training course in the audit process. They were, however, the most expensive on a cost per person-week of effort basis. Stanley and Foster could both provide more detailed engineering audits. Stanley has broad industrial experience, while Foster's experience is more refinery-related. Foster could be utilized to develop training materials that are more advanced than what Hagler currently has. Both Stanley and Foster are less expensive on a cost per person-week than is Hagler.

SELECTION OF FIRMS FOR BOAS

The technical review team submitted their recommendations for the award of Basic Ordering Agreements to the ANL Procurement Division on May 14, 1984. As a result of these recommendations ANL executed BOAs as follows:

- Hagler, Bailly & Co.-September 26, 1984
- Foster Wheeler Energy Corp.-October 12, 1984
- Stanley Consultants, Inc.- September 27, 1984

The length of the BOA Contract for each firm is as follows:

- Hagler, Bailly & Co. - October 31, 1986
- Foster Wheeler Energy Corp. - October 31, 1986
- Stanley Consultants, Inc. - April 30, 1985

The fee or billing schedules for personnel to perform the audit and audit training work was established for the effective life of each BOA.

MM/dd

Attachments

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ATTACHMENT I

RFP - INDUSTRIAL ENERGY AUDITS/TRAINING
UNDER SEPARATE COVER IN APPENDIX 3.8

Attachment 2

LIST OF BIDDERS

Table 2-1. List of Bidders

No.	Bidder	Designation Code
1	ABI Engineering Coonsultants	ABI
2	ANCO Engineers, Inc.	ANCO
3	Bentley Engineering Co.	Bentley
4	CITM Group, Ltd.	CITM
5	Control Data Corp. and Resource Management Associates	CDC
6	Daniel International Corp.	Daniel
7	Development Sciences Inc.	DSI
8	Energy/Development International, Georgia Tech Research Institute, Xenergy	EDI
9	Foster Wheeler Energy Corp.	Foster
10	Gibbs & Hill, Inc.	Gibbs
11	Hagler, Bailly & Company, Reliance Energy Services, and Arthur D. Little, Inc.	Hagler
12	Larry L. Schedin Associates	Schedin
13	Stanley Consultants, Inc., Kinetics Consulting Group, Pacer Consultants	Stanley
14	Syska & Hennessy Engineers	Syska
15	USS Engineers and Consultants, Inc. and Southern Electric International, Inc.	USS
16	Weston International, Inc.	Weston

Note: Designation Code used in all references to bidders.

Attachment 3

PRIMARY TECHNICAL REVIEW

1. Sample Evaluation Sheets

   Task 1

   Task 2

2. Algorithms for Computing Normalized Score from Raw Scores

3. Table 3-1. Raw Scores for Each Bidder

4. Table 3-2. Normalized Scores Ranked by Task 1 Composite Score

5. Table 3-3. Normalized Scores Ranked by Task 2 Composite Score

6. Table 3-4. Primary Technical Review Results

RFP EVALUATION

TASK 1 - INDUSTRIAL ENERGY AUDIT TRAINING

ACTOR _____ EVALUATOR _____

EVALUATION RATING POINTS:

5 - Excellent
4 - Good
3 - Adequate
2 - Marginal
1 - Poor

	WT./%	POINTS	NORMALIZED SCORE
APPROACH			
1.11 Overall technical content and completeness of proposed course material.....	50%	(1-5)_____	_____
1.12 Use of textbooks, workbooks, demonstration instrumentation and other training aids.....	50%	(1-5)_____	_____
1.13 Total Normalized Score.....			_____
EXPERIENCE AND CAPABILITY			
1.21 Overall technical, audit and instructional experience of individual instructors.....	45%	(1-5)_____	_____
1.22 Demonstration of existing course structure with course material and training aids.....	40%	(1-5) _____	_____
1.23 Demonstration that organization has a record of successful audit course instruction.....	15%	(1-5) _____	_____
1.24 Total Normalized Score.....			_____
3 TOTAL TASK 1 NORMALIZED SCORE			
tal 1.13 (Approach) + 1.24 (Experience & Capability) Normalized Score.....			_____
4 TOTAL TASK 1 AND CREDIT FOR TASK 2 NORMALIZED SCORE			
Total (1.3 + 2.3) Normalized Score.....			_____

PLACE WRITTEN SUMMARY COMMENTS ON BACK OF FORM

RFP EVALUATION
TASK 2 - INDUSTRIAL ENERGY AUDITS

ACTOR _____ EVALUATOR _____

EVALUATION RATING POINTS:

5 - Excellent
4 - Good
3 - Adequate
2 - Marginal
1 - Poor

	WT./%	POINTS	NORMALIZED SCORE
APPROACH			
2.11 Pre-Audit Procedures Overall completeness and technical structure of pre-audit procedures that allow for a good plant profile and pave the way toward implementing a successful audit.....	30%	(1-5)_____	_____
2.12 Audit Procedures Overall completeness and technical structure of audit procedures inclusive of employment of instrumentation and data collection and management procedures.....	35%	(1-5)_____	_____
2.13 Post Audit Procedures Overall completeness and technical structure of the post-audit procedures inclusive of (computer-license available) data analysis procedures and audit report structure/content.....	35%	(1-5)_____	_____
2.14 Total Normalized Score.....			_____
EXPERIENCE AND CAPABILITY			
2.21 Overall technical qualifications and audit experience of individual audit team members.....	35%	(1-5)_____	_____
2.22 Demonstration of existing pre-audit, audit, and post-audit capability inclusive of measurement equipment, data gathering, management and analysis procedures	45%	(1-5)_____	_____
2.23 Demonstration of specific successful industrial audit accomplishments leading to documented industrial energy savings.....	20	(1-5)_____	_____
2.24 Total Normalized Score.....			_____
3 TOTAL TASK 2 NORMALIZED SCORE			
Total 2.14 (Approach) + 2.24 (Experience & Capability) Normalized Score.			_____
4 TOTAL TASK 2 AND CREDIT FOR TASK 1 NORMALIZED SCORE Total (2.3 + 1.3) Normalized Score			_____

PLACE WRITTEN SUMMARY COMMENTS ON BACK OF FORM

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EVALUATION CRITERIA

A contractor proposal evaluation panel will be established to evaluate proposals and recommend the selection of contractor(s). Contractors are invited to submit proposals for Task 1 and/or Task 2 or both Task 1 and Task 2. Tasks 1 and 2 will be evaluated independently of each other. Credit is available for proposals that include a response to both Task 1 and Task 2.

For each task, proposals will be evaluated for approach, capability, experience, and organizational qualifications using the following criteria with their respective weights (i.e. points):

Task 1 - Industrial Energy Audit Training	WT. PTS.
Approach	40
Capability, Experience and Organizational Qualifications	40
Available Credit for Task 2 Response	20
TOTAL	100

Task 2 - Industrial Energy Audits	WT. PTS
Approach	40
Capability, Experience and Organizational Qualifications	40
Available Credit for Task 1 Response	20
TOTAL	100

For each Task 1 and 2 there are 100 points available. Each task is divided into three components for evaluation: Approach, Capability, and Credit for the other task. There are a total of 80 points available for the Approach and Capability for each task and 20 points available based on the score of the other task. Credit for the score of the other task is computed as follows:

$$\text{Task 1 credit for Task 2} = \frac{\text{Task 2 Approach \& Capability Score}}{80} \quad (20)$$

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For example, a perfect Task 1 and Task 2 Approach and Capability Score is 80 points for each task, and if this is the case, the Task 1 normalized score is:

$$\text{Task 1} = 80 + \frac{20}{80}(80) = 100 \text{ points}$$

If the Task 1 Approach and Capability scores were 80 but the Task 2 Approach and Capability scores were 60, the Task 1 Normalized Score would be:

$$\text{Task 1} = 80 + \frac{20}{80}(60) = 80 + 15 = 95$$

Each Approach and Capability component is evaluated by two or more elements (e.g. overall technical approach). Each element is assigned a wt% of the total component points. For example, under Task 1 Approach, the overall technical approach has a weight of 50% (i.e. 50% x 40 points = 20 points). The sum percent weights for all elements under a component (e.g. Approach) is 100%.

As an aid to grading, the evaluators are requested to grade each element under a component with a number score from 1 to 5 points. The element evaluation points are defined below:

5 - Excellent	2 - Marginal
4 - Good	1 - Poor
3 - Adequate	

For example, under Task 1 Approach, the overall technical approach has a weight of 50% (i.e. .5 x 40 = 20 points maximum). The grader gives a score of 4. The normalized score is:

$$\text{Normalized Score} = \frac{4}{5}(.5)(40) = \frac{4}{5}(20) = 16 \text{ points}$$

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ALGORITHMS FOR NORMALIZED SCORE (NS)
SHORT FORM

TASK 1 - INDUSTRIAL ENERGY AUDIT TRAINING

1.1 APPROACH

NS (1.11) = ((P1 points)(.50)(40))/5 = (P1)(4)

NS (1.12) = ((P2 points)(.50)(40))/5 = (P2)(4)

NS (1.13) = NS (1.11) + NS (1.12) = 4 (P1 + P2)

1.2 EXPERIENCE AND CAPABILITY

NS (1.21) = ((P3)(.45)(40))/5 = 3.6 P3

NS (1.22) = ((P4)(.40)(40))/5 = 3.2 P4

NS (1.23) = ((P5)(.15)(40))/5 = 1.2 P5

NS (1.24) = 3.6 P3 + 3.2 P4 + 1.2 P5

1.3 TOTAL TASK 1 NORMALIZED SCORE

NS (1.3) = NS (1.13) + NS (1.24)

NS (1.3) = 4 (P1 + P2) + 3.6 P3 + 3.2 P4 + 1.2 P5

1.4 TOTAL TASK 1 NORMALIZED SCORE

$$NS\ (1.4) = NS\ (1.3) + NS\ (2.3)\ \frac{20}{80} = NS(1.3) + NS\ (2.3)\ .25$$

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ALGORITHMS FOR NORMALIZED SCORE (NS)

SHORT FORM

TASK 2 - INDUSTRIAL ENERGY AUDITS

2.1 APPROACH

$$NS\ (2.11) = ((P1')(.30)(40))/5 = (P1')(2.4)$$

$$NS\ (2.12) = ((P2')(.35)(40))/5 = (P2')(2.8)$$

$$NS\ (2.13) = ((P3')(.35)(40))/5 = (P3')(2.8)$$

$$NS\ (2.14) = (P1')(2.4) + (P2')(2.8) + (P3')(2.8)$$

$$= P1'\ (2.4) + 2.8\ (P2' + P3')$$

2.2 EXPERIENCE AND CAPABILITY

$$NS\ (2.21) = ((P4')(.35)(40))/5 = (P4')(2.8)$$

$$NS\ (2.22) = ((P5')(.45)(40))/5 = (P5')(3.6)$$

$$NS\ (2.23) = ((P6')(.20)(40))/5 = (P6')(1.6)$$

$$NS\ (2.24) = (P4')(2.8) + (P5')(3.6) + (P6')(1.6)$$

2.3 TOTAL TASK 2 NORMALIZED SCORE

$$NS\ (2.3) = NS\ (2.14) + NS\ (2.24)$$

$$= (P1')(2.4) + 2.8\ (P2' + P3')$$

$$+ (P4')(2.8) + (P5')(3.6) + (P6')(1.6)$$

2.4 TOTAL TASK 2 + CREDIT FOR TASK 1

$$NS\ (2.4) = NS\ (2.3) + NS\ (1.3)\ \frac{20}{80} = NS(2.3) + NS\ (2.3)(.25)$$

Table 3-1. Raw Scores for Each Bidder

			TASK1					TASK 2					
			Approach		Ex/Cap			Approach			Ex/cap		
			50%	50%	45%	40%	15%	30%	35%	35%	35%	45%	20%
			Raw	Raw	Raw	Raw	Raw	Raw	Raw	Raw	Raw	Raw	Raw
NO.	BIDDER	EVAL	111	112	121	122	123	211	212	213	221	222	223
1	ABI	RRC	2	2	2	2	1	3	2	2	2	1	1
2	ANCO	RRC	3	2	2	2	1	2	2	2	3	3	3
3	BENTLEY	RRC	3	1	2	1	1	2	2	2	2	2	1
4	CITM	RRC	2	2	2	1	1	1	1	1	2	2	2
5	CDC	RRC	3	3	3	4	4	3	3	3	3	4	3
6	DANIEL	RRC	3	3	2	2	2	4	3	3	3	3	3
7	DSI	RRC	2	2	3	2	3	2	1	2	3	3	3
8	EDI	RRC	3	3	4	3	4	3	3	3	4	3	4
9	FOSTER	RRC	4	3	2	2	2	3	3	2	3	2	2
10	GIBBS	RRC	2	2	2	2	2	2	2	2	2	2	2
11	HAGLER	RRC	4	4	3	4	4	3	5	5	4	5	4
12	SCHEDIN	RRC	2	2	2	1	1	2	1	2	2	2	3
13	STANLEY	RRC	2	2	2	1	1	2	2	2	2	2	2
14	SYSKA	RRC	1	1	1	1	1	1	1	1	1	1	1
15	USS	RRC	3	3	3	2	3	4	4	4	4	3	3
16	WESTON	RRC	4	3	2	3	3	3	2	2	3	3	4
1	ABI	MRM	3	2	3	2	2	3	3	4	4	3	3
2	ANCO	MRM	2	2	3	2	3	2	2	2	2	2	2
3	BENTLEY	MRM	2	2	2	2	2	2	2	2	3	2	3
4	CITM	MRM	2	2	2	2	1	2	2	2	3	2	2
5	CDC	MRM	3	2	2	3	3	3	3	3	3	2	2
6	DANIEL	MRM	4	3	4	2	4	4	3	2	4	3	4
7	DSI	MRM	2	3	3	2	4	4	2	2	3	3	2
8	EDI	MRM	3	2	3	4	4	4	3	3	3	4	2
9	FOSTER	MRM	5	4	3	4	3	5	4	4	4	4	3
10	GIBBS	MRM	3	3	3	2	2	2	2	2	2	2	2
11	HAGLER	MRM	3	4	3	4	5	4	4	4	3	4	4
12	SCHEDIN	MRM	2	2	2	1	2	2	2	2	2	2	2
13	STANLEY	MRM	3	3	4	3	3	5	5	5	4	5	4
14	SYSKA	MRM	1	1	1	1	1	1	1	1	1	1	1
15	USS	MRM	4	4	4	3	3	4	4	4	3	3	3
16	WESTON	MRM	3	3	3	4	3	4	3	4	3	4	4
1	ABI	MAH	2	2	2	3	3	3	3	2	3	2	2
2	ANCO	MAH	2	2	3	3	3	2	3	3	3	3	3
3	BENTLEY	MAH	2	2	3	2	2	2	2	2	3	2	2
4	CITM	MAH	2	2	2	1	1	1	1	1	3	1	2
5	CDC	MAH	4	3	3	4	4	4	3	4	3	3	3
6	DANIEL	MAH	5	4	4	3	2	3	4	4	5	5	4
7	DSI	MAH	3	3	3	3	3	2	2	3	3	3	3
8	EDI	MAH	4	4	4	4	4	4	4	4	4	4	5
9	FOSTER	MAH	4	3	4	3	2	4	5	4	4	4	3
10	GIBBS	MAH	3	3	4	3	3	3	3	3	4	3	4
11	HAGLER	MAH	5	4	3	4	4	4	4	4	4	4	5
12	SCHEIDAN	MAH	3	3	3	3	2	3	2	2	3	3	3
13	STANLEY	MAH	3	3	3	2	2	4	5	3	4	4	3
14	SYSKA	MAH	1	1	1	1	1	1	1	1	1	1	1
15	USS	MAH	3	4	3	3	3	3	4	4	4	4	5
16	WESTON	MAH	5	4	3	4	5	4	4	5	5	5	5

Table 3-2 Normalized Scores Ranked by Task 1
Composite Scores

NO.	BIDDER	EVAL	Task 1 App	Task 1 Ex/C	Task 1 Tot	Task 1 Comp	Task 2 App	Task 2 Ex/C	Task 2 Tot	Task 2 Comp
11	HAGLER	RRC	32.0	28.4	60.4	78.1	35.2	35.6	70.8	85.9
8	EDI	RRC	24.0	28.8	52.8	65.9	24.0	28.4	52.4	65.6
5	CDC	RRC	24.0	28.4	52.4	65.3	24.0	27.6	51.6	64.7
15	USS	RRC	24.0	20.8	44.8	59.5	32.0	26.8	58.8	70.0
16	WESTON	RRC	28.0	20.4	48.4	59.4	18.4	25.6	44.0	56.1
9	FOSTER	RRC	28.0	16.0	44.0	54.0	21.2	18.8	40.0	51.0
6	DANIEL	RRC	24.0	16.0	40.0	52.6	26.4	24.0	50.4	60.4
7	DSI	RRC	16.0	20.8	36.8	46.1	13.2	24.0	37.2	46.4
2	ANCO	RRC	20.0	14.8	34.8	44.8	16.0	24.0	40.0	48.7
10	GIBBS	RRC	16.0	16.0	32.0	40.0	16.0	16.0	32.0	40.0
1	ABI	RRC	16.0	14.8	30.8	38.1	18.4	10.8	29.2	36.9
13	STANLEY	RRC	16.0	11.6	27.6	35.6	16.0	16.0	32.0	38.9
12	SCHEDIN	RRC	16.0	11.6	27.6	35.3	13.2	17.6	30.8	37.7
3	BENTLEY	RRC	16.0	11.6	27.6	35.2	16.0	14.4	30.4	37.3
4	CITM	RRC	16.0	11.6	27.6	33.6	8.0	16.0	24.0	30.9
14	SYSKA	RRC	8.0	8.0	16.0	20.0	8.0	8.0	16.0	20.0
9	FOSTER	MRM	36.0	27.2	63.2	79.4	34.4	30.4	64.8	80.6
15	USS	MRM	32.0	27.6	59.6	73.6	32.0	24.0	56.0	70.9
11	HAGLER	MRM	28.0	29.6	57.6	72.9	32.0	29.2	61.2	75.6
13	STANLEY	MRM	24.0	27.6	51.6	70.5	40.0	35.6	75.6	88.5
6	DANIEL	MRM	28.0	25.6	53.6	66.6	23.6	28.4	52.0	65.4
16	WESTON	MRM	24.0	27.2	51.2	65.8	29.2	29.2	58.4	71.2
8	EDI	MRM	20.0	28.4	48.4	61.5	26.4	26.0	52.4	64.5
1	ABI	MRM	20.0	19.6	39.6	53.0	26.8	26.8	53.6	63.5
7	DSI	MRM	20.0	22.0	42.0	52.8	20.8	22.4	43.2	53.7
10	GIBBS	MRM	24.0	19.6	43.6	51.6	16.0	16.0	32.0	42.9
5	CDC	MRM	20.0	20.4	40.4	51.1	24.0	18.8	42.8	52.9
2	ANCO	MRM	16.0	20.8	36.8	44.8	16.0	16.0	32.0	41.2
3	BENTLEY	MRM	16.0	16.0	32.0	41.1	16.0	20.4	36.4	44.4
4	CITM	MRM	16.0	14.8	30.8	39.5	16.0	18.8	34.8	42.5
12	SCHEDIN	MRM	16.0	12.8	28.8	36.8	16.0	16.0	32.0	39.2
14	SYSKA	MRM	8.0	8.0	16.0	20.0	8.0	8.0	16.0	20.0
16	WESTON	MAH	36.0	29.6	65.6	84.3	34.8	40.0	74.8	91.2
11	HAGLER	MAH	36.0	28.4	64.4	80.8	32.0	33.6	65.6	81.7
8	EDI	MAH	32.0	32.0	64.0	80.4	32.0	33.6	65.6	81.6
6	DANIEL	MAH	36.0	26.4	62.4	79.4	29.6	38.4	68.0	83.6
9	FOSTER	MAH	28.0	26.4	54.4	70.7	34.8	30.4	65.2	78.8
5	CDC	MAH	28.0	28.4	56.4	69.7	29.2	24.0	53.2	67.3
15	USS	MAH	28.0	24.0	52.0	67.8	29.6	33.6	63.2	76.2
10	GIBBS	MAH	24.0	27.6	51.6	64.7	24.0	28.4	52.4	65.3
13	STANLEY	MAH	24.0	19.6	43.6	59.2	32.0	30.4	62.4	73.3
7	DSI	MAH	24.0	24.0	48.0	58.7	18.8	24.0	42.8	54.8
12	SCHEIDAN	MAH	24.0	22.8	46.8	57.4	18.4	24.0	42.4	54.1
2	ANCO	MAH	16.0	24.0	40.0	51.4	21.6	24.0	45.6	55.6
1	ABI	MAH	16.0	20.4	36.4	46.4	21.2	18.8	40.0	49.1
3	BENTLEY	MAH	16.0	19.6	35.6	44.3	16.0	18.8	34.8	43.7
4	CITM	MAH	16.0	11.6	27.6	33.4	8.0	15.2	23.2	30.1
14	SYSKA	MAH	8.0	8.0	16.0	20.0	8.0	8.0	16.0	20.0

Table 3-3 Normalized Scores Ranked by Task 2 Composite Score

NO.	BIDDER	EVAL	Task 1 App	Task 1 Ex/C	Task 1 Tot	Task 1 Comp	Task 2 App	Task 2 Ex/C	Task 2 Tot	Task 2 Comp
11	HAGLER	RRC	32.0	28.4	60.4	78.1	35.2	35.6	70.8	85.9
15	USS	RRC	24.0	20.8	44.8	57.5	32.0	26.8	58.8	70.0
8	EDI	RRC	24.0	28.8	52.8	65.9	24.0	28.4	52.4	65.6
5	CDC	RRC	24.0	28.4	52.4	65.3	24.0	27.6	51.6	64.7
6	DANIEL	RRC	24.0	16.0	40.0	52.3	26.4	24.0	50.4	60.4
16	WESTON	RRC	28.0	20.4	48.4	59.4	18.4	25.6	44.0	56.1
9	FOSTER	RRC	28.0	16.0	44.0	54.0	21.2	18.8	40.0	51.0
2	ANCO	RRC	20.0	14.8	34.8	44.8	16.0	24.0	40.0	48.7
7	DSI	RRC	16.0	20.8	36.8	46.1	13.2	24.0	37.2	46.4
10	GIBBS	RRC	16.0	16.0	32.0	40.0	16.0	16.0	32.0	40.0
13	STANLEY	RRC	16.0	11.6	27.6	35.6	16.0	16.0	32.0	38.9
12	SCHEDIN	RRC	16.0	11.6	27.6	35.3	13.2	17.6	30.8	37.7
3	BENTLEY	RRC	16.0	11.6	27.6	35.2	16.0	14.4	30.4	37.3
1	ABI	RRC	16.0	14.8	30.8	38.1	18.4	10.8	29.2	36.9
4	CITM	RRC	16.0	11.6	27.6	33.6	8.0	16.0	24.0	30.9
14	SYSKA	RRC	8.0	8.0	16.0	20.0	8.0	8.0	16.0	20.0
13	STANLEY	MRM	24.0	27.6	51.6	70.5	40.0	35.6	75.6	88.5
9	FOSTER	MRM	36.0	27.2	63.2	79.4	34.4	30.4	64.8	80.6
11	HAGLER	MRM	28.0	29.6	57.6	72.9	32.0	29.2	61.2	75.6
16	WESTON	MRM	24.0	27.2	51.2	65.8	29.2	29.2	58.4	71.2
15	USS	MRM	32.0	27.6	59.6	73.6	32.0	24.0	56.0	70.9
6	DANIEL	MRM	28.0	25.6	53.6	66.6	33.6	28.4	52.0	65.4
8	EDI	MRM	20.0	28.4	48.4	61.5	26.4	26.0	52.4	64.5
1	ABI	MRM	20.0	19.6	39.6	53.0	26.8	26.8	53.6	63.5
7	DSI	MRM	20.0	22.0	42.0	52.8	20.8	22.4	43.2	53.7
5	CDC	MRM	20.0	20.4	40.4	51.1	24.0	18.8	42.8	52.9
3	BENTLEY	MRM	16.0	16.0	32.0	41.1	16.0	20.4	36.4	44.4
10	GIBBS	MRM	24.0	19.6	43.6	51.6	16.0	16.0	32.0	42.9
4	CITM	MRM	16.0	14.8	30.8	39.5	16.0	18.8	34.8	42.5
2	ANCO	MRM	16.0	20.8	36.8	44.8	16.0	16.0	32.0	41.2
12	SCHEDIN	MRM	16.0	12.8	28.8	36.8	16.0	16.0	32.0	39.2
14	SYSKA	MRM	8.0	8.0	16.0	20.0	8.0	8.0	16.0	20.0
16	WESTON	MAH	36.0	29.6	65.6	84.3	34.8	40.0	74.8	91.2
6	DANIEL	MAH	36.0	26.4	62.4	79.4	29.6	38.4	68.0	83.6
11	HAGLER	MAH	36.0	28.4	64.4	80.8	32.0	33.6	65.6	81.7
8	EDI	MAH	32.0	32.0	64.0	80.4	32.0	33.6	65.6	81.6
9	FOSTER	MAH	28.0	26.4	54.4	70.7	34.8	30.4	65.2	78.8
15	USS	MAH	28.0	24.0	52.0	67.8	29.6	33.6	63.2	76.2
13	STANLEY	MAH	24.0	19.6	43.6	59.2	32.0	30.4	62.4	73.3
5	CDC	MAH	28.0	28.4	56.4	69.7	29.2	24.0	53.2	67.3
10	GIBBS	MAH	24.0	27.6	51.6	64.7	24.0	28.4	52.4	65.3
2	ANCO	MAH	16.0	24.0	40.0	51.4	21.6	24.0	45.6	55.6
7	DSI	MAH	24.0	24.0	48.0	58.7	18.8	24.0	42.8	54.8
12	SCHEIDAN	MAH	24.0	22.8	46.8	57.4	18.4	24.0	42.4	54.1
1	ABI	MAH	16.0	20.4	36.4	46.4	21.2	18.8	40.0	49.1
3	BENTLEY	MAH	16.0	19.6	35.6	44.3	16.0	18.8	34.8	43.7
4	CITM	MAH	15.0	11.6	27.6	33.4	8.0	15.2	23.2	30.1
14	SYSKA	MAH	8.0	8.0	16.0	20.0	8.0	8.0	16.0	20.0

Table 3-4 Primary Technical Review Results

	Task 1 Rank Based on Composite Score			Task 2 Rank Based on Composite Score		
	Cirillo	Monarch	Hoult	Cirillo	Monarch	Hoult
DC	2					
Daniel			2			2
EDI	2		2			2
Foster		1			2	
Hagler	1	2	2	1		2
Stanley		2			1	
USS		2		2		
Weston			1			1

Note: Repeated rank indicates a tie (i.e., less than 3 points difference in composite score).

Attachment 4

DETAILED TECHNICAL REVIEW

1. Sample Detailed Evaluation Sheets

   Task 1

   Task 2

2. Algorithms for Computing Normalized Score from Raw Scores

3. Table 4-1. Raw Scores for Each Bidder

4. Table 4-2. Normalized Scores Ranked by Task 1 Composite Score

5. Table 4-3. Normalized Scores Ranked by Task 2 Composite Score

6. Table 4-4. Detailed Technical Review Results

RFP DETAILED EVALUATION

TASK 1 - INDUSTRIAL ENERGY AUDIT TRAINING

TRACTOR _____ EVALUATOR _____

EVALUATION RATING POINTS:

5 - Excellent
4 - Good
3 - Adequate
2 - Marginal
1 - Poor

	WT./%	POINTS	NORMALIZED SCORE
APPROACH			
1.11 Overall technical content of proposed course Logical and complete coverage of information and adequate time devoted to subject areas exemplified by course outlines.....	35%	(1-5)_____	_____
1.12 Coverage of or flexibility of proposed course outline(s) to accommodate classes of trainees with varied technical background.....	10%	(1-5)_____	_____
1.13 Proposed approach to use of study materials (e.g. textbooks, workbooks).....	15%	(1-5)_____	_____
1.14 Proposed approach to use of teaching aids such as films, video tapes, etc.....	10%	(1-5)_____	_____
1.15 Proposed approach to use of instrumentation especially designed for training purposes such as boiler training simulator, measurement equipment rigs, etc.....	15%	(1-5)_____	_____
1.16 Proposed use of special approaches to training.....	5%	(1-5)_____	_____
1.17 Proposed approach in the use of test procedures to grade students.....	5%	(1-5)_____	_____
1.18 Proposed approach to evaluate course performance...	5%	(1-5)_____	_____
1.19 Total Approach Normalized Score.....			_____

PLACE WRITTEN SUMMARY COMMENTS ON BACK OF FORM

TASK 1 - Page 2

RFP DETAILED EVALUATION

RACTOR _____ EVALUATO _____

EVALUATION RATING POINTS:

5 - Excellent
4 - Good
3 - Adequate
2 - Marginal
1 - Poor

CAPABILITIES, EXPERIENCE, & ORGANIZATIONAL QUALIFICATIONS	WT/%	POINTS	NORMALIZED SCORE
1 Experience of individual instructors as follows:			
a. Technical and instructional experience.....	30%	(1-5)_____	_____
b. Developing country experience.....	10%	(1-5)_____	_____
c. Egypt experience.....	5%	(1-5)_____	_____
1.22 Availability of existing training course material (e.g. workbooks, textbooks, established course outline, visual aids).....	25%	(1-5)_____	_____
1.23 Availability of audit survey measurement equipment for instruction purposes.....	15%	(1-5)_____	_____
1.24 Organization - experience in the performance of energy audit training courses (i.e. distinguished from individual experience).....	05%	(1-5)_____	_____
1.25 Overall organizational qualifications and management structure to perform task	10%	(1-5)_____	_____
1.26 Total Capability Normalized Score.....			_____
3 TOTAL TASK 1 NORMALIZED SCORE			
Total 1.19 (Approach) + 1.26 (Experience & Capability) Normalized Score.....			_____
4 TOTAL TASK 1 & CREDIT FOR TASK 2 NORMALIZED SCORE			
Total (1.3 + .25 (2.3)) Normalized Score.....			_____

PLACE WRITTEN SUMMARY COMMENTS ON BACK OF FORM

RFP DETAILED EVALUATION
TASK 2 - INDUSTRIAL ENERGY AUDITS

CONTRACTOR _____ EVALUATOR _____

EVALUATION RATING POINTS:

5 - Excellent
4 - Good
3 - Adequate
2 - Marginal
1 - Poor

APPROACH	WT%	POINTS	NORMALIZED SCORE
(PRE-AUDIT)			
2.11 The proposed approach to plant selection (e.g. screening plants for pre-audit interview based on a range of situations of data availability).....	5%	(1-5)_____	_____
2.12 The proposed approach to a pre-audit data collection (e.g. procedures, plant examination, interface with plant personnel).....	10%	(1-5)_____	_____
2.13 The proposed approach to pre-audit plant evaluation (e.g. data processing, recommendations for audit, estimation procedures for audit effort level requirements, set-up procedures for audit).....	15%	(1-5)_____	_____
(AUDIT)			
2.14 The proposed approach to the plant audit as follows:			
a. The proposed structure of a typical audit team (e.g. number of people, division of labor, backgrounds).....	5%	(1-5)_____	_____
b. The proposed use of survey measurement equipment and their application (e.g. types of instrumentation, calibration procedures, variable load analysis).....	10%	(1-5)_____	_____
c. The proposed use of data collection procedures (e.g. format of data collection, data log forms, computer hardware/software systems with licensing availability information).....	10%	(1-5)_____	_____
(POST AUDIT)			
2.15 The proposed approach to audit data processing, analysis and evaluation (e.g. specific computer hardware/software system and availability of licensing, data processing routines).....	15%	(1-5)_____	_____
2.16 The proposed approach to developing specific operational and hardware-related recommendations for energy conservation from an evaluation of audit data (e.g. technical and economic analysis routines, computer hardware/software systems inclusive of licensing availability).....	15%	(1-5)_____	_____
2.17 The proposed approach to the preparation and presentation of a comprehensive audit report.....	5%	(1-5)_____	_____
2.18 Total Approach Normalized Score.....			_____

PLACE WRITTEN SUMMARY COMMENTS ON BACK OF FORM

RFP DETAILED EVALUATION

CTOR _____ EVALUATOR _____

	WT/%	POINTS	NORMALIZED SCORE
XPERIENCE AND CAPABILITY			
.21 Experience of members of audit team as follows:			
a. Technical experience in industrial audits.....	25% (1-5)	_____	_____
b. Developing country experience in industrial audits	5% (1-5)	_____	_____
c. Egypt experience in industrial audits.....	5% (1-5)	_____	_____
2.22 Existing capability to perform plant screening and pre-audit evaluation for the variety of industries and process equipment specified in the Scope of Work (data collection forms, etc., in place).....	10% (1-5)	_____	_____
2.23 Existing audit capability and experience as follows:			
a. Existing procedures to collect in-plant data in an organized manner that lends itself to subsequent analysis (i.e. data collection forms, etc.).	10% (1-5)	_____	_____
b. Existing capability to perform in-plant measurements from available survey measurement equipment (i.e. demonstration of existing instrumentation, parts calibration procedures).....	10% (1-5)	_____	_____
2.24 Existing capability to analyze a variety of processes by established analysis procedures (inclusive of computer-based systems with licensing information).	15% (1-5)	_____	_____
2.25 Organization's experience in the performance of industrial energy audits for a variety of process and equipment (i.e. distinguished from individual audit team member experience).....	5% (1-5)	_____	_____
2.26 Demonstrated capability to make workable, specific energy conservation recommendations (e.g. process modification, hardware addition) demonstrated by previous experience where such recommendations have been successfully implemented.....	10% (1-5)	_____	_____
2.27 Overall organizational qualifications and management structure to perform task.....	5% (1-5)	_____	_____
2.28 Total Capability Normalized Score.....			_____
3 TOTAL TASK 2 NORMALIZED SCORE			
Total 2.18 (Approach) + 2.28 (Capability).....			_____
4 TOTAL TASK 2 AND CREDIT FOR TASK 1 NORMALIZED SCORE			
Total ((2.3) + .25 (1.3)) Normalized Score.....			_____

PLACE WRITTEN SUMMARY COMMENTS ON BACK OF FORM

497

ALGORITHMS FOR NORMALIZED SCORE (NS)

DETAILED EVALUATION

TASK 1 - INDUSTRIAL ENERGY AUDIT TRAINING

1.1 APPROACH

$$NS(1.11) = \frac{(P_1 \text{ Points})(.35)(40)}{5} = P_1(.35)(8) = 2.8\ P_1$$

$$NS(1.12) = P_2(.10)(8) = .8\ P_1$$

$$NS(1.13) = P_3(.15)(8) = 1.2\ P_3$$

$$NS(1.14) = P_4(.10)(8) = .8\ P_4$$

$$NS(1.15) = P_5(.15)(8) = 1.2\ P_5$$

$$NS(1.16) = P_6(.05)(8) = .4\ P_6$$

$$NS(1.17) = P_7(.05)(8) = .4\ P_7$$

$$NS(1.18) = P_8(.05)(8) = .4\ P_8$$

$$NS(1.19) = .4\ (P_6 + P_7 + P_8) + .8(P_1 + P_4) + 1.2\ (P_3 + P_5)$$

ALGORITHMS FOR NORMALIZED SCORE (NS)

DETAILED EVALUATION

ASK 1 - INDUSTRIAL ENERGY AUDIT TRAINING

.2 CAPABILITY

$NS(1.21a) = P_9(.30)(8) = 2.4\ P_9$

$NS(1.21b) = P_{10}(.10)(8) = 0.8\ P_{10}$

$NS(1.21c) = P_{11}(.05)(8) = 0.4\ P_{11}$

$NS(1.22) = P_{12}(.25)(8) = 2\ P_{12}$

$NS(1.23) = P_{13}(.15)(8) = 1.2\ P_{13}$

$NS(1.24) = P_{14}(.05)(8) = 0.4\ P_{14}$

$NS(1.25) = P_{15}(.10)(8) = 0.8\ P_{15}$

$NS(1.26) = 2.4\ P_9 + 1.2\ P_{13} + 0.8(P_{10} + P_{15}) + 0.4(P_{11} + P_{14})$

1.3 TOTAL TASK 1 NORMALIZED SCORE

$$\begin{aligned}\text{Total } NS(1.19) + NS(1.26) &= 1.2(P_{13} + P_5) + .8(P_1 + P_2) + .4(P_6 + P_7 + P_8) \\ &\quad + 2.4\ P_9 + 1.2\ P_{13} + 0.8(P_{10} + P_{15}) \\ &\quad + 0.4(P_{11} + P_{14}) \\ &= 1.2(P_3 + P_5 + P_{13}) + .4(P_6 + P_7 + P_8 + P_{14}) \\ &\quad + 0.8(P_1 + P_2 + P_{10} + P_{15}) + 2.4\ P_9\end{aligned}$$

ALGORITHMS FOR NORMALIZED SCORE (NS)

DETAILED EVALUATION

TASK 2 - INDUSTRIAL ENERGY AUDITS

2.1 APPROACH

$$NS(2.11) = P_1'(.05)(8) = 0.4\ P_1'$$

$$NS(2.12) = P_2'(.10)(8) = 0.8\ P_1'$$

$$NS(2.13) = P_3'(.15)(8) = 1.2\ P_3'$$

$$NS(2.14a) = P_4'(.05)(8) = 0.4\ P_4'$$

$$NS(2.14b) = P_5'(.20)(8) = 1.6\ P_5'$$

$$NS(2.14c) = P_6'(.10)(8) = 0.8\ P_6'$$

$$NS(2.15) = P_7'(.15)(8) = 1.2\ P_7'$$

$$NS(2.16) = P_8'(.15)(8) = 1.2\ P_8'$$

$$NS(2.17) = P_9'(.05)(8) = 0.4\ P_9'$$

$$NS(2.18) = \sum_{1}^{10} P' = 1.6\ P_5' + 1.2(P_3' + P_7' + P_8') + 0.8(P_6' + P_2') + 0.4(P_9' + P_4' + P_1')$$

ALGORITHMS FOR NORMALIZED SCORE (NS)

DETAILED EVALUATION

K 2 - INDUSTRIAL ENERGY AUDITS

CAPABILITY

$NS(2.21a) = P_{10}'(.25)(8) = 2.0P_{10}'$

$NS(2.21b) = P_{11}'(.05)(8) = 0.4\ P_{11}'$

$NS(2.21c) = P_{12}'(.05)(8) = 0.4\ P_{12}'$

$NS(2.22) = P_{13}'(.10)(8) = 0.8\ P_{13}'$

$NS(2.23a) = P_{14}'(.10)(8) = 0.8\ P_{14}'$

$NS(2.23b) = P_{15}'(.10)(8) = 0.8\ P_{15}'$

$NS(2.24) = P_{16}'(.15)(8) = 1.2\ P_{16}'$

$NS(2.25) = P_{17}'(.05)(8) = 0.4\ P_{17}'$

$NS(2.26) = P_{18}'(.10)(8) = 0.8\ P_{18}'$

$NS(2.27) = P_{19}'(.05)(8) = 0.4\ P_{19}'$

$$NS(2.28) = \sum_{10}^{19} P' = 2\ P_{10}' + 1.2\ P_{16}' + .8(P_{13}' + P_{15}' + P_{18}') + .4(P_{11}' + P_{12}' + P_{17}' + P_{19}')$$

3 TOTAL TASK 2 NORMALIZED SCORE

$$TOTAL = NS(2.18) + NS(2.28) = 2\ P_{10}' + 1.6\ P_5' + 1.2(P_3' + P_7' + P_8' + P_{16}') + .8(P_{13}' + P_{14}' + P_{15}' + P_{18}' + P_6 + P_{12}') + .4(P_{11}' + P_{12}' + P_{17}' + P_{19}' + P_9' + P_4' + P_1')$$

Table 4-1. Raw Scores for Each Bidder

NO.	BIDDER	EVAL	TASK 1 APPROACH							
			35%	10%	15%	10%	15%	5%	5%	5% 100%
			Raw	Raw	Raw	Raw	Raw	Raw	Raw	
			111	112	113	114	115	116	117	118
8	EDI	RRC	3	3	3	3	3	1	2	1
9	FOSTER	RRC	4	2	3	2	3	1	1	3
11	HAGLER	RRC	4	3	4	3	4	4	2	4
13	STANLEY	RRC	2	3	3	1	1	1	4	1
15	USS	RRC	3	3	2	3	3	1	3	1
16	WESTON	RRC	3	2	3	2	3	1	1	1
8	EDI	MRM	3	4	2	3	3	3	3	4
9	FOSTER	MRM	5	3	4	3	3	4	2	4
11	HAGLER	MRM	3	3	4	4	5	4	3	4
13	STANLEY	MRM	3	3	3	4	2	4	3	2
15	USS	MRM	4	4	3	4	4	4	3	2
16	WESTON	MRM	3	2	3	3	3	2	2	2
8	EDI	MAH	4	4	3	3	1	3	3	2
9	FOSTER	MAH	5	4	3	3	4	3	2	4
11	HAGLER	MAH	4	3	4	4	3	4	4	4
13	STANLEY	MAH	3	3	3	3	3	2	3	2
15	USS	MAH	4	3	3	4	4	3	3	2
16	WESTON	MAH	3	3	3	2	2	2	2	2

NO.	BIDDER	EVAL	TASK 1 CAPAB/EXPER							
			30%	10%	5%	25%	15%	5%	10%	100%
			Raw	Raw	Raw	Raw	Raw	Raw	Raw	
			121a	121b	121c	122	123	124	125	
8	EDI	RRC	3	4	3	3	2	4	2	
9	FOSTER	RRC	3	2	1	3	1	2	3	
11	HAGLER	RRC	4	5	3	4	4	4	3	
13	STANLEY	RRC	2	3	5	3	3	2	3	
15	USS	RRC	2	2	1	2	4	2	2	
16	WESTON	RRC	3	2	1	3	3	4	5	
8	EDI	MRM	3	4	4	3	3	5	3	
9	FOSTER	MRM	4	3	1	4	3	4	3	
11	HAGLER	MRM	4	3	2	4	4	5	3	
13	STANLEY	MRM	4	4	3	3	3	3	4	
15	USS	MRM	3	3	1	4	3	2	2	
16	WESTON	MRM	3	2	1	4	4	5	3	
8	EDI	MAH	3	4	3	3	4	3	4	
9	FOSTER	MAH	3	3	3	4	3	2	4	
11	HAGLER	MAH	4	4	3	4	4	5	4	
13	STANLEY	MAH	3	3	3	3	5	2	3	
15	USS	MAH	3	3	3	2	2	2	4	
16	WESTON	MAH	3	1	1	3	5	3	3	

Table 4-1. (Cont'd)

			TASK 2 APPROACH									
			5%	10%	15%	5%	20%	10%	15%	15%	5%	100%
			Raw	Raw	Raw	Raw	Raw	Raw	Raw	Raw	Raw	
NO.	BIDDER	EVAL	211	212	213	214a	214b	214c	215	216	217	
8	EDI	RRC	3	3	3	3	3	3	3	3	3	
9	FOSTER	RRC	3	2	2	4	3	3	4	2	1	
11	HAGLER	RRC	3	4	4	5	4	3	4	4	4	
13	STANLLEY	RRC	3	4	3	3	3	4	3	3	3	
15	USS	RRC	3	3	2	4	4	2	4	2	2	
16	WESTON	RRC	3	4	2	2	3	2	3	3	3	
8	EDI	MRM	4	3	3	2	3	2	3	3	3	
9	FOSTER	MRM	3	4	3	4	2	5	4	3	3	
11	HAGLER	MRM	4	3	4	4	3	3	3	3	4	
13	STANLEY	MRM	4	5	4	3	4	5	5	5	3	
15	USS	MRM	4	3	3	4	3	3	4	5	4	
16	WESTON	MRM	4	4	3	2	3	1	3	3	4	
8	EDI	MAH	4	4	3	3	3	3	3	3	4	
9	FOSTER	MAH	3	3	3	3	3	4	3	3	4	
11	HAGLER	MAH	5	4	5	4	4	4	4	4	4	
13	STANLEY	MAH	2	3	2	3	4	5	5	3	3	
15	USS	MAH	4	3	3	3	4	3	3	3	3	
16	WESTON	MAH	4	3	3	2	2	1	3	3	3	

			TASK 2 CAPAB/EXPER									
			25%	5%	5%	10%	10%	10%	15%	5%	10%	5%	100%
			Raw	Raw	Raw	Raw	Raw	Raw	Raw	Raw	Raw	Raw	
NO.	BIDDER	EVAL	221a	221b	221c	222	223a	223b	224	225	226	227	
8	EDI	RRC	1	3	3	3	3	3	3	3	3	2	
9	FOSTER	RRC	3	1	1	2	3	2	4	3	3	4	
11	HAGLER	RRC	4	5	2	3	4	5	4	5	4	3	
13	STANLEY	RRC	4	2	2	4	3	3	3	3	3	3	
15	USS	RRC	1	1	2	2	2	4	4	3	3	2	
16	WESTON	RRC	3	2	1	4	2	4	3	5	4	3	
8	EDI	MRM	3	3	3	3	2	3	3	4	3	3	
9	FOSTER	MRM	3	3	1	4	3	3	4	4	4	3	
11	HAGLER	MRM	3	4	2	4	3	4	3	3	3	4	
13	STANLEY	MRM	5	4	3	5	5	5	4	3	4	5	
15	USS	MRM	3	2	1	3	3	3	4	3	3	3	
16	WESTON	MRM	3	3	1	4	2	4	3	4	4	3	
8	EDI	MAH	4	4	2	3	4	4	4	5	4	4	
9	FOSTER	MAH	4	3	2	4	3	4	3	3	3	3	
11	HAGLER	MAH	4	5	4	5	4	4	4	5	4	4	
13	STANLEY	MAH	4	4	2	4	5	5	4	4	4	4	
15	USS	MAH	4	2	3	2	1	2	2	2	3	3	
16	WESTON	MAH	4	4	3	3	1	4	3	4	5	3	

Table 4-2. Normalized Scores Ranked by Task 1 Composite Score

			DETAILED EVALUATION							
			Task 1				Task 2			
NO.	BIDDER	EVAL	App	Ex/C	Tot	Comp	App	Ex/C	Tot	Comp
11	HAGLER	RRC	29.6	31.6	61.2	76.9	31.2	31.6	62.8	78.1
16	WESTON	RRC	20.0	24.4	44.4	56.3	22.4	25.2	47.6	58.7
8	EDI	RRC	22.0	23.2	45.2	56.1	24.0	19.6	43.6	54.9
9	FOSTER	RRC	23.6	19.6	43.2	54.2	21.6	22.4	44.0	54.8
13	STANLEY	RRC	16.0	22.0	38.0	50.9	25.6	26.0	51.6	61.1
15	USS	RRC	21.2	18.0	39.2	49.8	23.6	18.8	42.4	52.2
9	FOSTER	MRM	31.2	28.0	59.2	72.4	26.4	26.4	52.8	67.6
11	HAGLER	MRM	29.2	30.0	59.2	72.3	26.4	26.0	52.4	67.2
13	STANLEY	MRM	23.6	28.0	51.6	69.4	35.2	36.0	71.2	84.1
15	USS	MRM	29.6	24.0	53.6	66.8	28.8	24.0	52.8	66.2
8	EDI	MRM	24.0	26.0	50.0	61.7	23.2	23.6	46.8	59.3
16	WESTON	MRM	22.0	26.4	48.4	60.6	23.6	25.2	48.8	60.9
11	HAGLER	MAH	30.0	32.0	62.0	78.8	33.6	33.6	67.2	82.7
9	FOSTER	MAH	31.6	26.4	58.0	71.1	25.2	27.2	52.4	66.9
8	EDI	MAH	24.8	26.8	51.6	65.7	25.6	30.8	56.4	69.3
13	STANLEY	MAH	23.2	26.0	49.2	64.4	28.0	32.8	60.8	73.1
15	USS	MAH	28.4	21.2	49.6	61.3	26.0	20.8	46.8	59.2
16	WESTON	MAH	20.8	24.0	44.8	56.9	20.8	27.6	48.4	59.6

Table 4-3. Normalized Scores Ranked by Task 2 Composite Score

			DETAILED EVALUATION							
			Task 1				Task 2			
NO.	BIDDER	EVAL	App	Ex/C	Tot	Comp	App	Ex/C	Tot	Comp
11	HAGLER	RRC	29.6	31.6	61.2	76.9	31.2	31.6	62.8	78.1
13	STANLEY	RRC	16.0	22.0	38.0	50.9	25.6	26.0	51.6	61.1
16	WESTON	RRC	20.0	24.4	44.4	56.3	22.4	25.2	47.6	58.7
8	EDI	RRC	22.0	23.2	45.2	56.1	24.0	19.6	43.6	54.9
9	FOSTER	RRC	23.6	19.6	43.2	54.2	21.6	22.4	44.0	54.8
15	USS	RRC	21.2	18.0	39.2	49.8	23.6	18.8	42.4	52.2
13	STANLEY	MRM	23.6	28.0	51.6	69.4	35.2	36.0	71.2	84.1
9	FOSTER	MRM	31.2	28.0	59.2	72.4	26.4	26.4	52.8	67.6
11	HAGLER	MRM	29.2	30.0	59.2	72.3	26.4	26.0	52.4	67.2
15	USS	MRM	29.6	24.0	53.6	66.8	28.8	24.0	52.8	66.2
16	WESTON	MRM	22.0	26.4	48.4	60.6	23.6	25.2	48.8	60.9
8	EDI	MRM	24.0	26.0	50.0	61.7	23.2	23.6	46.8	59.3
11	HAGLER	MAH	30.0	32.0	62.0	78.8	33.6	33.6	67.2	82.7
13	STANLEY	MAH	23.2	26.0	49.2	64.4	28.0	32.8	60.8	73.1
8	EDI	MAH	24.8	26.8	51.6	65.7	25.6	30.8	56.4	69.3
9	FOSTER	MAH	31.6	26.4	58.0	71.1	25.2	27.2	52.4	66.9
16	WESTON	MAH	20.8	24.0	44.8	56.9	20.8	27.6	48.4	59.6
15	USS	MAH	28.4	21.2	49.6	61.3	26.0	20.8	46.8	59.2

Table 4-4 Detailed Technical Review Results

	Task 1 Rank Based on Composite Score			Task 2 Rank Based on Composite Score		
	Cirillo	Monarch	Hoult	Cirillo	Monarch	Hoult
	2	5	3	4	5	3
er	2	1	2	4	2	3
er	1	1	1	1	2	1
nley	5	1	3	2	1	2
	5	4	4	4	2	5
ton	2	5	5	2	5	5

e: Repeated rank indicates a tie (i.e., less than 3 points difference in composite score).

Attachment 5

COST REVIEW

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Table 5-1. Cost Review

TASK 1: TRAINING	EDI	Foster	Hagl[illegible]	Stanley
EFFORT				
Person-weeks	31.4	100	2[illegible].4	71
Cost	$52,002	$200,000	$68,[illegible]	$155,481
Cost/p-w	$1,656	$2,000	$2,[illegible]	$2,190
TRAVEL				
No. RT	2	7	2	5
Days per diem	117	444	[illegible]46	350
Cost	$21,700	$68,300	$20,[illegible]	$41,500
MATERIALS	$1,929	$17,500	$15,[illegible]	$30,000
OVERHEAD	$27,864	Incl	Incl	Incl
FEE	$8,280	Incl	Incl	$6,019
TASK 1 TOTAL COST	$111,775	$285,800	$103,[illegible]04	$233,000
TOTAL COST PER P-W	$3,560	$2,858	$3,[illegible]32	$3,282
INCREMENTAL COSTS	$46,479	$[illegible]7,800	$33,373	$46,000

TASK 2: AUDITS	EDI	Foster	Hagler	Stanley
EFFORT				
Person-weeks	68.4	138	42	211
Cost	$120,024	$276,000	$88,[illegible]54	$381,246
Cost/p-w	$1,755	$2,000	$2,[illegible]11	$1,812
TRAVEL				
No. RT	7	8	2	25
Days per diem	250	1006	[illegible]96	700
Cost	$35,945	$137,300	$33,[illegible]16	$108,000
MATERIALS	$9,818	$11,100	635	$28,500
OVERHEAD	$52,212	Incl	Incl	Incl
FEE	$12,067	Incl	Incl	$11,554
TASK 2 TOTAL COST	$230,066	$424,400	$12[illegible],505	$530,300
TOTAL COST PER P-W	$3,364	$3,075	$[illegible],917	$2,513
INCREMENTAL COSTS	$40,328	$44,000	$1[illegible],036	$23,000

GRAND TOTAL	EDI	Foster	Hagler	Stanley
TOTAL PROJECT COSTS	$341,841	$710,200	$22[illegible],309	$763,300
TOTAL EFFORT: P-W	99.8	238	68.4	282
TOTAL COST PER P-W	$3,425	$2,964	$[illegible],309	$2,707

APPENDIX

3.8.1-14

ANL BASIC ORDERING AGREEMENTS

FOR

EGYPT INDUSTRIAL AUDITS/AUDIT TRAINING

WITH

- Hagler Bailly & Company
- Foster Wheeler Energy Corporation
- Stanley Consultants, Inc.

ARGONNE
NATIONAL
LABORATORY

INTRA-LABORATORY MEMO

CENTER FOR INTERNATIONAL
ENERGY DEVELOPMENT
ARGONNE NATIONAL LABORATORY
ESD 362
OCT 1 1984

October 1, 1984

To: E. J. Croke — Division Director ESD 362
A. G. Nisius — Accounting Department 209

From: F. W. Foster — ASD/PRO 201

Subject: Contract No. 44006401

Hagler Bailly & Company
2301 M. Street
Washington, D.C. 20037

Cost Code: 8N124-00-190-404

Requisition No. 931602

Enclosed for your information and use is a fully executed copy of above-mentioned contract.

FWF/jl

Encs.

cc: M. Frances Adams TIS/TPS 2
Patents DOE 201 w/ reps. & certs.
H. Jurgensen MAT 5
C. F. File
J. Waters
ASD Ref. File w/o
FF File

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ARGONNE NATIONAL LABORATORY
Argonne, Illinois 60439

Contract No. 44006401

AGREEMENT BETWEEN

THE UNIVERSITY OF CHICAGO
(Operator of Argonne National Laboratory)

and

HAGLER BAILLY & COMPANY
2301 M. Street
Washington, D.C. 20037

The University of Chicago, an Illinois not-for-profit corporation, operator of Argonne National Laboratory and herein called the "Laboratory", acting under Prime Contract No. 31-109-Eng-38 with the United States Government (called the "Government"), represented by the U. S. Department of Energy (called the "Department"), desires HAGLER BAILLY & COMPANY (called the "Contractor"), a Corporation, organized under the laws of the District of Columbia, to perform the services set forth under Article 1 of this contract and the Contractor is willing to perform such services. The effective date of this contract is October 1, 1984.

THEREFORE, the parties mutually agree as follows:

ARTICLE I - DESCRIPTION OF WORK

A. The Contractor shall furnish the personnel, facilities, equipment, materials and supplies necessary to perform the work described in Enclosure 1, Description of Work dated July 15, 1984, attached hereto and hereby made a part of this contract.

1. Each task will be performed in accordance with an agreed time schedule, work product and cost schedule. The Contractor's senior staff will direct and participate in the execution of all tasks. The services to be performed shall be described and set forth from time to time in separate work orders issued pursuant to the terms of this agreement in the form attached hereto as Exhibit "A". No work shall proceed until a work order has been signed by both parties.

   The Contractor will consult with the Laboratory, by telephone or otherwise, at monthly intervals and at such other times as may be deemed desirable by the Laboratory or the Contractor, with respect to progress on outstanding work orders.

STO

2. The services herein provided for shall be furnished from time to time, as required by the Laboratory, commencing on October 1, 1984 and continuing through March 31, 1985 or through the period of any extension of this agreement, provided however, that this agreement is not sooner terminated as hereinafter provided.

3. It is agreed that the Laboratory is not required to request any minimum dollar amount of service or, for that matter, any service whatsoever and that the Contractor is not required to fill an order if he has no personnel able to meet the particular requirement.

ARTICLE II - COMPENSATION FOR SERVICES

1. The Contractor shall receive as full compensation for all services performed hereunder, including necessary travel, and as full reimbursement for travel and living expenses incurred in connection with the performance of such services:

   A. Amounts computed by multiplying the appropriate hourly rate, or rates, set forth in Exhibit B - Billing Rates attached hereto by the number of direct labor or travel hours performed, which rates shall include wages, overhead, general and administrative expense and profit. Vouchers may be submitted once each month to the Assistant Controller of the Laboratory. The Contractor will substantiate vouchers by evidence of actual payment and by individual daily job timecards or such other substantiation approved by the Laboratory. Promptly after receipt of each substantiated voucher, the Laboratory shall, except as otherwise provided in this agreement, and subject to the provisions of 4, below, make payment thereon.

   B. For purposes of computation of amounts due, a day shall be considered as eight (8) hours; for fractions of days worked or spent in necessary travel, said rate will be paid on an hourly basis. In no event, however, shall more than one day's (8 hours) pay be paid for any one calendar day, nor more than 40 hours for any one calendar week.

      The rates set forth in Exhibit B shall not vary by virtue of work performed on an overtime basis.

   C. A Two & One Half Percent (2-1/2%) material handling markup shall apply to total direct material including purchased parts, subcontracted items and interdivisional transfers. Items subject to this markup shall be identified on the individual work orders as issued.

   D. Cost of necessary telephone, telegraph and postal services, and computer charges, when authorized by work order.

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E. Travel expenses for Laboratory-directed travel reimbursable in accordance with Appendix C, "Travel Policy for Contractor Personnel", dated 7/6/82, which is attached hereto. Such travel will be detailed in the applicable work order and approved by the Laboratory's cognizant technical representative for each work order where travel is indicated.

F. It is understood that certain of the work may be subcontracted, which fact shall also be indicated on the Work Order. In this event, the amounts to be charged will be those amounts set forth in Exhibit B - Billing Rates.

2. The total amount to be paid by the Laboratory under this contract shall not exceed Three Hundred Thousand Dollars ($300,000.00) and the Contractor (and its employees performing services hereunder shall not incur or be required by the Laboratory to incur costs under this contract which will aggregate in excess of this amount unless the parties agree in writing to authorize such additional expenditures.

3. Work releases will be issued for each task required in accordance with Exhibit A, "Work Order" form, signed by the authorized Laboratory Procurement official on behalf of the Laboratory and the appropriate corporate official on behalf of the Contractor.

4. At any time or times prior to final payment under this agreement, the Laboratory may cause to be made such audit of the invoices or vouchers and substantiating material as shall be deemed necessary. Each payment theretofore made shall be subject to reduction to the extent of amounts which are found by the Laboratory not to have been properly payable and shall also be subject to increase for underpayments on preceding invoices or vouchers.

ARTICLE III - MANNER OF PAYMENT

1. The Contractor shall be paid monthly upon submission of properly certified and correct invoices bearing the work order number and code description of the Agreement No. 44006401 to the Assistant Controller of the Laboratory. Such invoices must be sufficiently detailed to permit the identification of the various compensable items under this agreement.

2. Attached to each billing and copy thereof, there must be furnished the following certification which must be manually signed by an authorized representative of the Contractor:

"I certify that the above bill is correct and just; that the amounts claimed represent fair charges against Argonne National Laboratory and that reimbursement has not and will not be received therefor under any other Government contract or other source of Government funds."

3. The Contractor agrees to furnish the Laboratory by the twenty-fifth (25th) day of each month, an approximation of accrued expenditures for that month.

4. Terms: Net 30 days.

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ARTICLE IV - DISCONTINUANCE

Discontinuance of future application of this Basic Ordering Agreement can be accomplished upon thirty (30) days written notice by either party. Discontinuance of the Basic Ordering Agreement will not affect any individual work order(s) referencing the Basic Ordering Agreement entered into prior to the effective date of the discontinuance, and all provisions of the Basic Ordering Agreement shall pertain thereto until completed or otherwise terminated.

ARTICLE V - CONTRACTOR EMPLOYEES

It is understood and agreed that Contractor and Contractor's employees are not employees of the Laboratory and are entitled to no employee benefits or privileges nor to any payment from the Laboratory, except such payments as set forth in Article II - COMPENSATION FOR SERVICES of the Schedule of this Agreement. All such payments shall be made to the Contractor and no payment shall be made to any of the Contractor's employees.

ARTICLE VI - COMPLETION OF WORK ORDER

Any work order issued during the effective period of this agreement and not completed within the period shall be completed by the Contractor within the time specified in the order and the rights and obligations of the Contractor and the Laboratory respecting that work order shall be governed by the terms of the agreement as fully and to the same extent as if completed during the effective period of this agreement, provided that the Contractor shall not be required to perform any work under this agreement after October 31, 1986.

ARTICLE VII - KEY PERSONNEL

The personnel specified in each work order under this agreement are considered to be essential to the work being performed. Prior to diverting any of the specified individuals to other programs, the Contractor shall notify the cognizant Procurement Official of Argonne National Laboratory reasonably in advance and shall submit justification (including proposed substitutions) in sufficient detail to permit evaluation of the impact on the program. No diversion shall be made by the Contractor without the written consent of the cognizant Procurement Official of Argonne National Laboratory: Provided, that the cognizant Procurement Official of Argonne National Laboratory may ratify in writing such diversion and such ratification shall consitute the consent of the cognizant Procurement Official of Argonne National Laboratory required by this clause. The work order may be amended from time to time during the course of the agreement either to add or delete personnel, as appropriate.

ARTICLE VIII - RIGHTS TO PROPOSAL DATA

Except for technical data listed below of the Contractor's proposal dated April 1984, which are asserted by the Contractor as being proprietary data, it is agreed that, as a condition of the award of this agreement, and notwithstanding the provisions of any notice appearing on the proposal, the Government shall have the right to use, duplicate, disclose and have others do so for any purpose whatsoever, the technical data contained in the proposal upon which this agreement is based.

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- Chapter 1 & Technical Appendices
- Private Sector Client names in Chapter 3
- Specific names of personnel assigned to the project in Chapter 4.

ARTICLE IX - APPLICABLE DOCUMENTATION

The following documents are attached hereto and are hereby made a part of this agreement:

1. Appendix "A", Argonne Terms and Conditions for Fixed-Price Contracts, dated 4-84.

2. Appendix "C", Travel Policy for Contractor Personnel, dated 7/6/82 except that section 11.D is hereby amended to provide for payment of Thirty Dollars ($30.00) per day for per diem in Egypt.

3. Appendix "D-1", Intellectual Property Provisions Research, Development, Demonstration Contract - General Contractor, dated November 1, 1982, except:

A. As amended by the addition of the following paragraphs to the Rights in Technical Data Clause:

(g) Limited rights in proprietary data

Except as may be otherwise specified in this contract as technical data which are not subject to this paragraph, the Contractor shall, upon written request from the Laboratory of the Government at any time prior to three (3) years after final payment under this contract, promptly deliver to the Government through the Laboratory any "proprietary data" withheld pursuant to paragraph (3) of the "Rights in Technical Data" clause of this contract. The following legend and no other is authorized to be affixed on any "proprietary data" delivered pursuant to this provision, provided the "proprietary data" meets the conditions for initial withholding under paragraph (e) of the "Rights in Technical Data" clause. The Government and the Laboratory will thereafter treat the "proprietary data" in accordance with such legend.

LIMITED RIGHTS LEGEND

This "proprietary data", furnished under Contract No. 44006401 with the University of Chicago, operator of Argonne National Laboratory, acting under Prime Contract No. 31-109-ENG-38 with the United States Government as represented by the United States Department of Energy may be duplicated and used by the Laboratory or the Government with the express limitations that the "proprietary data" may not be used for purposes of manufacture without prior permission of the Contractor, except that further disclosure or use may be made solely for the following purposes.

(a) This "proprietary data" may be disclosed for evaluation purposes under the restriction that the "proprietary data" be retained in confidence and not be further disclosed;

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(b) This "proprietary data" may be disclosed to other Contractors participating in the Government's program of which this contract is a part for information or use in connection with the work performed under their contracts and under the restriction that the "proprietary data" be retained in confidence and not be further disclosed; or

(c) This "proprietary data" may be used by the Government or others on its behalf for emergency repair or overhaul work under the restriction that the "proprietary data" be retained in confidence and not be further disclosed.

This legend shall be marked on any reproduction of this data in whole or in part.

(h) Software Licensing

The contractor shall take such steps as are necessary to insure that all proprietary software used in the performance of the work under the contract will be available for licensing with full documentation under reasonable terms and conditions to responsible parties.

(i) Release of Data

The contractor shall not publish, disseminate or reproduce any data first produced or composed in the course of or under this contract in whole or in part or in any manner or form, or authorize others to do so without the written consent of the Laboratory or until such time as the Laboratory and DOE may have released such data to the public.

B. ARTICLE IV "Patent Rights - Long Form" is hereby deleted in its entirety and is replaced by "Patent Rights - (Small Business Firms or Non-Profit Organizations)".

4. Enclosure 1 Description of Work dated July 15, 1984.

5. Exhibit "B" Billing Rates.

6. Exhibit A, Work Order

ARTICLE X - CONFLICTS IN DOCUMENTATION

Any discrepancy, inconsistency, or conflict in one or more of the documents identified in Article IX which can reasonably be ascertained by the Contractor shall be immediately submitted to the Laboratory for its written decision. Any work undertaken by the Contractor without such decision shall be at the Contractor's own risk.

ARTICLE XI - LABORATORY REPRESENTATIVES

1. The authorized Laboratory Procurement Official will be the only person at the Laboratory who is authorized to change the scope of work or any other part of this contract.

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2. All letters and notices from the Contractor shall be submitted to the attention of the Laboratory's Contract Specialist.

3. Unless the Contractor is otherwise notified in writing, technical questions relating to the work may be discussed with M. Monarch (312) 972-7632 who is the Laboratory's Technical Representative on this Contract.

ARTICLE XII - ORGANIZATIONAL CONFLICTS OF INTEREST

a. General

(1) It is Laboratory and DOE policy to avoid situations which place a Contractor in a position where its judgment may be biased because of any past, present, or currently planned interest, financial or otherwise, the Contractor may have which relates to the work to be performed under its contract or where the Contractor's performance of such work may provide it with an unfair competitive advantage. Accordingly, the Contractor agrees that it will conduct its activities with the intention of (i) avoiding bias in performance of work under this contract and (ii) avoiding any unfair competitive advantage by virtue of its performance of work under this contract. The Contractor, however, is entitled to the normal flow of benefits from performance of this contract.

(2) In the event the Contractor is of the opinion that the activities of the Contractor create or reasonably give the appearance of creating a conflict of interest with the Contractor's performance of work under the contract, (i) the Contractor will notify the Laboratory and supply information requested by the Laboratory or DOE based on such potential conflict of interest, subject to proprietary rights of others, and (ii) if the Laboratory or DOE finds that any such activity creates a conflict of interest under applicable law or under the criteria in the DOE regulations, the Laboratory or DOE will promptly inform the Contractor. The Laboratory or DOE and the Contractor will enter into good faith discussions concerning appropriate measures to be taken to eliminate, avoid or mitigate such conflict. Such measures may include appropriate restrictions on the Contractor's future participation in Laboratory or DOE contracts or deletion of the activities creating the potential conflict from work under this contract.

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b. Access to and Use of Information

(1) If the Contractor, in the performance of technical consulting and management support services or evaluation services, obtains access to information, such as Laboratory or DOE plans, policies, reports, studies, financial plans, internal data protected by the Privacy Act of 1974 (P.L.93-579), or data which has not been released or otherwise made available to the public, the Contractor understands that without prior written approval of the Laboratory or DOE it may not (i) use such information so obtained for any purpose, other than the performance of this contract, unless the information has been released or otherwise made available to the public; (ii) compete for work for the Laboratory or DOE based on such information so obtained for a period of six (6) months after either the completion of this contract, or until such information is released or otherwise made available to the public by the Laboratory or DOE. Nothing in this paragraph (b) shall be construed to limit the Contractor from (i) competing for work for the Laboratory or DOE, or (ii) submitting unsolicited proposals to the Laboratory or the Government.

(2) In addition, the Contractor agrees that to the extent it receives or is given access to appropriately marked or identified (i) proprietary data, (ii) data protected by the Privacy Act of 1974 (P.L.93-579), or (iii) other confidential or priviledged technical, business, or financial information and the Contractor accepts such data or information in accordance with any written restrictions imposed on such information.

(3) The Contractor shall have, subject to patent and security provisions of this contract, the right to use technical data it first produces under this contract for its private purpose provided that, as of the date of such use, all reporting requirements of this contract have been met or the Contractor has reported such information or data in writing to the Laboratory or DOE.

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c. Personnel Access to Contract Operations

The Contractor will establish procedures to control access of Contractor personnel not engaged in the performance of this contract to facilities in which performance of this contract is in progress on the same basis as the access of U.S. citizens employed by U.S. organizations is controlled.

d. Subcontract Disclosure

If a subcontract is to be issued for evaluation services or activities, technical consulting or management support services as defined in DEAR 909.570-3, the Contractor shall obtain for the Laboratory or DOE a disclosure statement or representation, in accordance with DOE regulations in effect at the time, from each intended subcontractor or consultant. The Contractor shall not enter into any subcontract nor engage any such consultant unless the Laboratory or DOE shall have first notified the Contractor that there is little or no likelihood that an organizational conflict of interest exists or that despite the existence of a conflict of interest the award is in the best interest of the Government.

e. Subcontracts

The Contractor shall include this clause, including this Paragraph e., in subcontracts of any tier which involve performance or work of the type specified in b.(1) above or access to information of the type covered in b. above The terms "contract", "Contractor" and "Laboratory" shall be appropriately modified to preserve the Laboratory's and the Government's rights.

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IN WITNESS WHEREOF, the parties hereto have executed this Agreement on the 26th day of September, 1984.

THE UNIVERSITY OF CHICAGO
(Operator of Argonne National Laboratory)

By: _____
H. L. Kyle

Title: Director
Administrative Services Division

HAGLER, BAILLY & CO.

By Howard Hagler

Title: Chairman

I, Sandy Young, certify that I am the Assistant Secretary of the Corporation named as "Contractor" in the within Agreement, that Howard Hagler who signed the said Agreement was then Chairman of said Corporation; that I know his signature and his signature thereto is genuine; and that said Agreement was duly signed for in behalf of said Corporation by authority of its governing body.

By Sandy Young

Title Assistant Secretary

CORPORATE SEAL

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Enclosure No. 1
Contract No. 44006401

DESCRIPTION OF WORK

July 15, 1984

1 BACKGROUND

Argonne National Laboratory (ANL) is assisting the Agency for International Development (AID) in an energy policy planning activity with the Government of the Arab Republic of Egypt (AID Energy Planning Sub-Project No. 263-0123.1). In this activity ANL will be working with the Organization for Energy Planning (OEP) established by Egyptian Presidential Decree #112 of 1983. OEP's mission is to provide technical support for national energy planning and analysis. The Director of OEP reports to the Egyptian Supreme Council on Energy (SCE) through a Board of Directors representing five organizations in Egypt that affect and are affected by energy planning and policy. The makeup of the council is such that the work of OEP will be presented to the highest level of Egyptian government officials.

A list of priority projects has been established under the energy policy planning activity. Of highest priority is the development of an industrial energy conservation program. The list was developed with the caveat that work performed exclusively or primarily by foreign consultants was to be discouraged. Therefore each effort will include as part of its planning and resource requirements the training of Egyptian personnel.

The first task of the industrial energy conservation program calls for the establishment of a training program for the conduct of industrial energy audits. The second task requires the performance of a number of industrial energy audits that result in specific recommendations for cost-effective steps to reduce energy consumption. Recommendations for energy conservation will include low-cost measures such as insulation and maintenance and operation changes, medium-cost measures such as combustion control and heat exchangers, and may include capital-intensive technology change. The training program may be structured so that industrial energy audits are accomplished while the final phases of field training takes place.

The industrial energy audits and training of personnel will be performed under a basic ordering agreement (BOA). Under the auspice of the BOA, Argonne National Laboratory may choose to contract with more than one firm in both the conduct of industrial energy audits and energy audit training.

For both Tasks 1 and 2 the contractor is expected to make all necessary arrangements for lodging and meals; passports and visas; international travel; reproduction of reports; office supplies; and other materials, tools and aids specified elsewhere in the description of work.

2 SCOPE OF WORK

The scope of work is comprised of two major tasks: the training ram and the actual industrial audits.

1. Industrial Energy Audit Training Program

The contractor will develop and conduct an industrial energy audit ining program in Egypt for Egyptian nationals. In addition to items viously specified, the contractor is responsible for teaching aids, text-ks, instructional equipment and all other materials required to perform the k. Training will be in English, giving appropriate consideration that lish is a second language for the trainees. OEP/ANL will have the ponsibility for selecting the trainees and arranging for classroom accom-ations. Each class size is expected to be from 10-20 trainees. It is icipated that the training program will commence with a one- to two-week ssroom session followed by a one- to two-week session of field work where h trainee will participate in an actual or practice audit at a plant ility. OEP/ANL, in consultation with the contractor, will select an propriate plant site for the field training. It is expected that as many as ree classroom/field sessions will be conducted in the course of a twelve nth period.

The objective of the training program is to prepare the trainees for nducting in-plant industrial energy audits for a wide range of industrial ocesses (e.g. cement manufacture, textiles, food processing) and equipment .g. boilers, dryers, motors) that is pervasive in many different types of dustries. Therefore, the training program must emphasize the practical and plied aspects of energy audit performance rather than only the theoretical pects. Both classroom and field training must emphasize the use of survey strumentation to collect data.

At the conclusion of the training session it is expected that the rainee will have the capability, using appropriate instrumentation, to erform in-plant measurements that will result in an accounting of energy lows for, at a minimum, the following systems:

- o Boiler, furnace and oven combustion systems;
- o Process steam systems including boiler, steam line, steam traps, etc.;
- o Electric motors and motor-coupled mechanical systems; and
- o Waste heat discharge systems (i.e. hot water, steam and hot exhaust gas).

It is anticipated that graduates of the training program will participate in the actual audits of Task 2.

Task 2. Industrial Energy Audits

The contractor will be responsible for conducting a number of industrial energy audits in Egypt. The contractor will be responsible for all instrumentation, analytical hardware/software systems, and similar support necessary to perform all phases of the audit process. It should be noted that rights in all information and data obtained or processed in the audit or audit-related procedures are governed by the Rights in Data clause of Appendix D-1 of this contract.

The industrial energy audit will include the following sequential steps:

- o Plant selection from a list of candidate plants,
- o Scheduling of pre-audit evaluation,
- o Pre-audit data collection and consultation with plant management,
- o Preparation and presentation of pre-audit evaluation to OEP/ANL,
- o Scheduling of plant audits,
- o Plant audits,
- o Analysis and evaluation of audit data,
- o Development of recommendations,
- o Preparation of written reports,
- o Presentation of results, and
- o Post-audit support and consultation.

Each of the above tasks is described below in greater detail.

Plant Selection. OEP/ANL will be responsible for developing a list of candidate plants for energy audit. The contractor will be responsible for assisting OEP/ANL in this task. The list will contain all energy-related information that is currently available. The contractor will assist OEP/ANL

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in screening the information and selecting the most favorable candidates for energy audit.

Plants expected to be chosen for industrial audit during the first twelve-month period will be primarily medium-sized industries (e.g. textiles and food processing). This may change, however, to includesome larger industries as the plant selection data are reviewed. Therefore, the audit program should be geared to analysis of, at a minimum, the following process systems and equipment:

- o Boiler, furnace and oven combustion systems,
- o Process steam systems including boiler, steam lines, steam traps, etc.,
- o Electric motors and motor-coupled mechanical systems, and
- o Waste heat discharge systems (i.e. hot water, steam and hot exhaust gas).

Schedule Pre-Audit Plant Interview. OEP/ANL will be responsible for arranging for a pre-audit visit to the plant and conference with plant management based on the contractor's requirements for pre-audit evaluation. The contractor will provide OEP/ANL with a full set of criteria for the pre-audit evaluation.

Pre-Audit Information Gathering and Consultation with Plant Management. The contractor will be accompanied by one or more member(s) of the OEP/ANL observer team and possibly one or two energy audit trainees (see Task 1). The contractor will be responsible for utilizing a pre-audit procedure to gather information that will allow a subsequent determination of the suitability of conducting a full-scale plant audit. The contractor will be responsible for pre-audit information gathering and pre-audit consultation with plant management. OEP/ANL will be responsible for obtaining the cooperation of plant management.

Presentation of Pre-Audit Evaluation to OEP/ANL. As a result of the pre-audit plant visit and analysis of pre-audit information, the contractor will report to OEP/ANL as to the advisability of performing an industrial energy audit. The report will include the proposed scope of the overall audit, target areas where energy savings might be found, estimated time to complete the audit, disposition of management/operators and any other information supportive of a recommendation. Based on the contractors' recommendations, it will be an OEP/ANL responsibility to decide whether an energy audit should be performed at a particular plant. In the determination of the disposition of a plant for industrial audit, OEP/ANL may require that the contractor return to the plant to secure additional information.

Schedule Plant Audit. It will be an OEP/ANL responsibility (with contractor assistance) to schedule an industrial energy audit with plant management. It will be the contractor's responsibility to brief plant management on the audit strategy, make arrangements to connect instrumentation and obtain signature approval for any modifications or hookups to plant facilities as well as any instructions to plant operating personnel regarding plant operations during the audit.

Plant Audit. It will be the contractor's responsibility to perform the complete plant audit and advise plant management and OEP/ANL of audit progress on a regular basis. The contractor will also be responsible for not only general insurance of their audit personnel but any special coverage required for working in a variety of plant environments. The contractor may be responsible for field training of Egyptian personnel that have completed the classroom portion of the training course in energy audits (see Task 1) by including them in the audit activity. The contractor will be responsible for advanced training of Egyptian personnel that have successfully completed both the classroom and field portions of the training program.

It is the responsibility of the contractor to perform the audit in such a manner as to cause minimum disruption to the plant process. Where variable load conditions are significant in a plant operation, the contractor is responsible for collecting audit data that suitably reflects these conditions. The contractor is responsible for documenting the calibration and proper working order of all instrumentation used in the audit process. The contractor is expected to have an adequate supply of spare survey instrument parts to assure non-interrupted collection of data.

Analysis and Evaluation of Audit Data. The contractor will have full responsibility for processing and analyzing the audit data. The contractor is also responsible for any supportive analytical tools such as computer hardware/software systems. The contractor will be responsible for instructing the Egyptian trainees in the data processing and analysis activity. If computer-based software systems are used, the contractor will provide instruction on the use of the systems and advise trainees on the basic algorithms used to perform the analysis and the significance of results. It may be required that the analysis and evaluation of audit data be performed entirely in Egypt.

Development of Recommendations. The contractor will be responsible for developing specific recommendations for energy conservation or management based on the processing and analysis of audit data. The recommendations would include both operational and hardware modifications. Each energy conservation recommendation should be specific and include quantitative estimates of energy savings and an economic analysis based on capital and operating costs. If computer-based software systems are used, the contractor will advise trainees on the basic algorithms used to perform the analysis and the significance of

results. It may be required that the analysis of energy conservation measures be performed entirely in Egypt.

Audit Report. The contractor will be responsible for the preparation of a written audit report in English that provides specific energy conservation recommendations that can be readily implemented. An economic analysis must be performed for each recommendation. The audit report will include all raw data in an appendix, documentation as to calibration of instrumentation, indicate all assumptions made, algorithms used in the analyses, and all other pertinent data necessary to support the energy conservation recommendations. The contractor will be responsible for submitting a draft report to OEP/ANL in a timely manner prior to submission to plant management. OEP/ANL reserves the right of review and edit prior to submission of the report to plant management. Upon approval of the audit report by OEP/ANL, the contractor will be responsible for submission of an adequate number of copies of the report to plant management.

Oral Presentation. The contractor will be responsible for an oral presentation/discussion of the audit report before OEP officials, government officials, and plant management. During the presentation the contractor is expected to be in a position to adequately defend the analyses and recommendations contained in the audit report. OEP/ANL, in consultation with the contractor, will schedule the meeting with plant management. The contractor will be responsible for any audio-visual materials necessary for the oral presentation.

Post-Audit Support and Consultation. The audit process calls for specific recommendations for energy conservation measures that can actually be implemented. Hagler, Bailly & Co. will be responsible for followup work with plant management regarding operation and maintenance and general housekeeping energy conservation measures. Hagler, Bailly & Co. may also be called upon to assist OEP/ANL in the preparation of competitive bid packages for each capital cost energy conservation measure recommended in the audit report. Hagler, Bailly & Co. may also be asked to interact with the engineering firm or vendor designated to perform the work in order that a smooth and orderly transfer of information takes place that would assure a successful, cost-effective completion of the project. OEP/ANL will have the responsibility of coordinating discussion between the audit contractor and firms contracted to carry out the audit recommendation.

EXHIBIT "B"

Contract No. 44006401

BILLING RATES

Hagler, Bailly & Company	July 1984 - Dec. 1984	Jan. 85 - Dec. 85	Jan. 86 - Sept. 86
Principal Officer	$ 103.14	$ 109.33	$ 115.89
Vice President	79.68	84.46	89.53
Associate I	64.85	68.74	72.86
Associate II	50.47	53.50	56.71
Associate III	39.00	41.34	43.82
Research Associate	23.57	24.98	26.48
Clerical	26.98	28.60	30.32

Plus Material Handling Cost of 2-1/2% on all other Direct Costs.

	July 1984- December 1984	January 1985- December 1985	January 1986- September 1986
Reliance Energy Services (Sub.)			
Officer	$109.72	$116.30	$121.53
Management Consultant	59.54	63.11	65.95
Senior Consultant	54.14	57.39	59.97
Consultant	43.88	46.51	48.60

Plus Material Handling Cost of 3% on all other Direct Costs.

Gb

Arthur D. Little, Inc. (Sub.)

Rates Applicable for Entire Contract Period.

Labor Classification	Total Price Per Hour
Executive	198.69
Management Staff	167.65
Management Staff Associate	150.56
Supervisory Staff	135.14
Supervisory Staff Associate	121.32
Principal Staff	107.73
Principal Staff Associate	94.47
Senior Staff	82.87
Senior Staff Associate	72.66
Project Staff	63.77
Project Staff Associate	55.94
Staff Associate	49.04
Senior Specialist	43.01
Staff Specialist	37.68
Associate Specialist	33.06
Senior Analyst	29.02
Staff Analyst	25.42
Associate Analyst	22.29
Professional	19.54
Associate Professional	17.12
Assistant Professional	15.03
Technician	13.15
Consultants:	

Consultants, when needed, will be subject to Hagler, Bailly & Company's prior approval.

MATERIALS (INCLUDING SUBCONTRACTS AND INTERDIVISIONSL TRANSFERS) - will be charged at actual cost including material overhead applicable thereto at the fixed rate of 6.2 percent.

OTHER DIRECT COSTS -- Other direct costs such as, but not limited to, supplies, travel and subsistence, communications (telephone, telex, FAX, postage, etc.) report reproduction, computer use, word processor use, etc., will be charged at actual cost including general and administrative expense (composite) applicable thereto at the fixed rate of 21 percent.

ARGONNE NATIONAL LABORATORY EXHIBIT "A"

WORK ORDER Contract No. 44006401

Date _____

Work Order No. _____ Cost Code _____

(Note: Work Order and Cost Code information must appear on all invoices.)

To:

Pursuant to Contract # _____, the Contractor will perform the following services:

1.

2. Period of Performance:

3. Dollar Ceiling: The total amount to be paid by the Laboratory under this Work Order shall not exceed _____.

4. Budget: The budget for the effort described in paragraph 1 above is as follows:

5. Technical Representatives:

ANL _____ Contractor _____

6. Terms and Conditions:

This Work Order, the performance of the services described herein and the rights and obligations of the parties with respect thereto are governed by Contract No. _____ between the parties dated _____, including all supplements thereto, and such terms and conditions as are set forth in this Work Order pursuant to such contract. The terms and conditions set forth in such Contract are hereby incorporated herein by reference.

Accepted and Agreed to:

ARGONNE NATIONAL LABORATORY CONTRACTOR:

By _____ _____

Title _____ _____

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3. The term "United States" includes the fifty states, Commonwealth of Puerto Rico, possessions of the United States, and the District of Columbia.

E. The Contractor shall include the substance of this article, including this Paragragh E, in each subcontract or purchase hereunder which may involve international air transportation.

ARGONNE NATIONAL LABORATORY
Argonne, Illinois 60439

Contract No. 44006402

AGREEMENT BETWEEN

THE UNIVERSITY OF CHICAGO
(Operator of Argonne National Laboratory)

and

FOSTER WHEELER ENERGY CORP.
110 South Orange Avenue
Livingston, NJ 07039

The University of Chicago, an Illinois not-for-profit corporation, operator of Argonne National Laboratory and herein called the "Laboratory", acting under Prime Contract No. 31-109-Eng-38 with the United States Government (called the "Government"), represented by the U. S. Department of Energy (called the "Department"), desires FOSTER WHEELER ENERGY CORP. (called the "Contractor"), a Corporation, organized under the laws of the State of Delaware, to perform the services set forth under Article 1 of this contract and the Contractor is willing to perform such services. The effective date of this contract is October 1, 1984.

THEREFORE, the parties mutually agree as follows:

ARTICLE I - DESCRIPTION OF WORK

A. The Contractor shall furnish the personnel, facilities, equipment, materials and supplies necessary to perform the work described in Appendix E, Description of Work dated February 9, 1984, attached hereto and hereby made a part of this contract.

1. Each task will be performed in accordance with an agreed time schedule, work product and cost schedule. The Contractor's senior staff will direct and participate in the execution of all tasks. The services to be performed shall be described and set forth from time to time in separate work orders issued pursuant to the terms of this agreement in the form attached hereto as Exhibit "A". No work shall proceed until a work order has been signed by both parties.

2. The services herein provided for shall be furnished from time to time, as required by the Laboratory, commencing on October 1, 1984 and continuing through March 31, 1985 or through the period of any extension of this agreement, provided however, that this agreement is not sooner terminated as hereinafter provided.

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3. It is agreed that the Laboratory is not required to request any minimum dollar amount of service or, for that matter, any service whatsoever and that the Contractor is not required to fill an order if he has no personnel able to meet the particular requirement.

ARTICLE II - COMPENSATION FOR SERVICES

1. The Contractor shall receive as full compensation for all services performed hereunder, including necessary travel, and as full reimbursement for travel and living expenses incurred in connection with the performance of such services:

   A. Amounts computed by multiplying the appropriate hourly rate, or rates, set forth in Exhibit F - Billing Rates attached hereto by the number of direct labor or travel hours performed, which rates shall include wages, overhead, general and administrative expense and profit. Vouchers may be submitted once each month to the Assistant Controller of the Laboratory. The Contractor will substantiate vouchers by evidence of actual payment and by individual daily job timecards or such other substantiation approved by the Laboratory. Promptly after receipt of each substantiated voucher, the Laboratory shall, except as otherwise provided in this agreement, and subject to the provisions of 4, below, make payment thereon.

   B. For purposes or computation of amounts due, a day shall be considered as eight (8) hours; for fractions of days worked or spent in necessary travel, said rate will be paid on an hourly basis. In no event, however, shall more than one day's (8 hours) pay be paid for any one calendar day, nor more than 40 hours for any one calendar week.

   The rates set forth in Exhibit F shall not vary by virtue of work performed on an overtime basis.

   C Other direct costs shall be invoiced in accordance with contractor's commercial practices numbers C-23G and C-24G.

   D. Travel expenses for Laboratory-directed travel reimbursable in accordance with Appendix C, "Travel Policy for Contractor Personnel", dated 7/6/82, which is attached hereto, except that per diem in Egypt shall be $30/day. Such travel will be detailed in the applicable work order and approved by the Laboratory's cognizant technical representative for each work order where travel is indicated.

2. The total amount to be paid by the Laboratory under this contract shall not exceed Three Hundred Thousand Dollars ($300,000.00) and the Contractor (and its employees performing services hereunder shall not incur or be required by the Laboratory to incur costs under this contract which will aggregate in excess of this amount unless the parties agree in writing to authorize such additional expenditures.

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3. Work releases will be issued for each task required in accordance with Exhibit A, "Work Order" form, signed by the authorized Laboratory Procurement official on behalf of the Laboratory and the appropriate corporate official on behalf of the Contractor.

4. At any time or times prior to final payment under this agreement, the Laboratory may cause to be made such audit of the invoices or vouchers and substantiating material as shall be deemed necessary. Each payment theretofore made shall be subject to reduction to the extent of amounts which are found by the Laboratory not to have been properly payable and shall also be subject to increase for underpayments on preceding invoices or vouchers.

ARTICLE III - MANNER OF PAYMENT

1. The Contractor shall be paid monthly upon submission of properly certified and correct invoices bearing the work order number and code description of the Agreement No. 44006402 to the Assistant Controller of the Laboratory. Such invoices must be sufficiently detailed to permit the identification of the various compensable items under this agreement.

2. Attached to each billing and copy thereof, there must be furnished the following certification which must be manually signed by an authorized representative of the Contractor:

   "I certify that the above bill is correct and just; that the amounts claimed represent fair charges against Argonne National Laboratory and that reimbursement has not and will not be received therefor under any other Government contract or other source of Government funds."

3. The Contractor agrees to furnish the Laboratory by the twenty-fifth (25th) day of each month, an approximation of accrued expenditures for that month.

4. Terms: Net 30 days.

ARTICLE IV - DISCONTINUANCE

Discontinuance of future application of this Basic Ordering Agreement can be accomplished upon thirty (30) days written notice by either party. Discontinuance of the Basic Ordering Agreement will not affect any individual work order(s) referencing the Basic Ordering Agreement entered into prior to the effective date of the discontinuance, and all provisions of the Basic Ordering Agreement shall pertain thereto until completed or otherwise terminated.

ARTICLE V - CONTRACTOR EMPLOYEES

It is understood and agreed that Contractor and Contractor's employees are not employees of the Laboratory and are entitled to no employee benefits or privileges nor to any payment from the Laboratory, except such payments as set forth in Article II - COMPENSATION FOR SERVICES of the Schedule of this Agreement. All such payments shall be made to the Contractor and no payment shall be made to any of the Contractor's employees.

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ARTICLE VI - COMPLETION OF WORK ORDER

Any work order issued during the effective period of this agreement and not completed within the period shall be completed by the Contractor within the time specified in the order and the rights and obligations of the Contractor and the Laboratory respecting that work order shall be governed by the terms of the agreement as fully and to the same extent as if completed during the effective period of this agreement, provided that the Contractor shall not be required to perform any work under this agreement after October 31, 1986.

ARTICLE VII - KEY PERSONNEL

The personnel specified in each work order under this agreement are considered to be essential to the work being performed. Prior to diverting any of the specified individuals to other programs, the Contractor shall notify the cognizant Procurement Official of Argonne National Laboratory reasonably in advance and shall submit justification (including proposed substitutions) in sufficient detail to permit evaluation of the impact on the program. No diversion shall be made by the Contractor without the written consent of the cognizant Procurement Official of Argonne National Laboratory: Provided, that the cognizant Procurement Official of Argonne National Laboratory may ratify in writing such diversion and such ratification shall consitute the consent of the cognizant Procurement Official of Argonne National Laboratory required by this clause. The work order may be amended from time to time during the course of the agreement either to add or delete personnel, as appropriate.

ARTICLE VIII - RIGHTS TO PROPOSAL DATA

Except for technical data listed on Attachment No. 1 hereto, it is agreed that, as a condition of the award of this agreement, and notwithstanding the provisions of any notice appearing on the proposal, the Government shall have the right to use, duplicate, disclose and have others do so for any purpose whatsoever, the technical data contained in the proposal upon which this agreement is based.

ARTICLE IX - APPLICABLE DOCUMENTATION

The following documents are attached hereto and are hereby made a part of this agreement:

1. Appendix "A", Argonne Terms and Conditions for Fixed-Price Contracts, dated 4-84.

2. Appendix "C", Travel Policy for Contractor Personnel, dated 7/6/82.

3. Appendix "D-1", Intellectual Property Provisions Research, Development, Demonstration Contract - General Contractor, dated November 1, 1982, except as amended by the addition of the following paragraphs to the Rights in Technical Data Clause.

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(g) Limited rights in proprietary data

Except as may be otherwise specified in this contract as technical data which are not subject to this paragraph, the Contractor shall, upon written request from the Laboratory of the Government at any time prior to three (3) years after final payment under this contract, promptly deliver to the Government through the Laboratory any "proprietary data" withheld pursuant to paragraph (3) of the "Rights in Technical Data" clause of this contract. The following legend and no other is authorized to be affixed on any "proprietary data" delivered pursuant to this provision, provided the "proprietary data" meets the conditions for initial withholding under paragraph (e) of the "Rights in Technical Data" clause. The Government and the Laboratory will thereafter treat the "proprietary data" in accordance with such legend.

LIMITED RIGHTS LEGEND

This "proprietary data", furnished under Contract No. 44006401 with the University of Chicago, operator of Argonne National Laboratory, acting under Prime Contract No. 31-109-ENG-38 with the United States Government as represented by the United States Department of Energy may be duplicated and used by the Laboratory or the Government with the express limitations that the "proprietary data" may not be used for purposes of manufacture without prior permission of the Contractor, except that further disclosure or use may be made solely for the following purposes.

(a) This "proprietary data" may be disclosed for evaluation purposes under the restriction that the "proprietary data" be retained in confidence and not be further disclosed;

(b) This "proprietary data" may be disclosed to other Contractors participating in the Government's program of which this contract is a part for information or use in connection with the work performed under their contracts and under the restriction that the "proprietary data" be retained in confidence and not be further disclosed; or

(c) This "proprietary data" may be used by the Government or others on its behalf for emergency repair or overhaul work under the restriction that the "proprietary data" be retained in confidence and not be further disclosed.

This legend shall be marked on any reproduction of this data in whole or in part.

(h) Software Licensing

The contractor shall take such steps as are necessary to insure that all proprietary software used in the performance of the work under the contract will be available for licensing with full documentation under reasonable terms and conditions to responsible parties.

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(i) Release of Data

The contractor shall not publish, disseminate or reproduce any data first produced or composed in the course of or under this contract in whole or in part or in any manner or form, or authorize others to do so without the written consent of the Laboratory or until such time as the Laboratory and DOE may have released such data to the public.

4. Appendix "E" Description of Work dated February 9, 1984.

5. Exhibit "F" Hourly Fee Schedules.

6. Appendix "G" Additional Terms & Conditions

7. Appendix "H" - Foster Wheeler Commercial Practice # C-23G

8. Appendix "I" - Foster Wheeler Commercial Practice # C-24G

9. Exhibit A, Work Order.

10. Attachment 1 - Listing of Proposal Forms.

ARTICLE X - CONFLICTS IN DOCUMENTATION

Any discrepancy, inconsistency, or conflict in one or more of the documents identified in Article IX which can reasonably be ascertained by the Contractor shall be immediately submitted to the Laboratory for its written decision. Any work undertaken by the Contractor without such decision shall be at the Contractor's own risk.

ARTICLE XI - LABORATORY REPRESENTATIVES

1. The authorized Laboratory Procurement Official will be the only person at the Laboratory who is authorized to change the scope of work or any other part of this contract.

2. All letters and notices from the Contractor shall be submitted to the attention of the Laboratory's Contract Specialist.

3. Unless the Contractor is otherwise notified in writing, technical questions relating to the work may be discussed with M. Monarch (312) 972-7632 who is the Laboratory's Technical Representative on this Contract.

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ARTICLE XII - ORGANIZATIONAL CONFLICTS OF INTEREST - GENERAL

1. The Contractor warrants that, to the best of its knowledge and belief, and except as otherwise disclosed, there are no relevant facts which would give rise to organizational conflicts of interest, as defined in 41 CFR § 9-1.5403(a) or that the Contractor has disclosed all relevant information.

2. The Contractor agrees that, if after award, an organizational conflict of interest with respect to this contract, is discovered, an immediate and full disclosure in writing shall be made to the Laboratory which shall include a description of the action which the Contractor has taken or proposes to take to avoid or mitigate such conflicts. The Laboratory may, however, terminate the contract for its convenience if it deems such termination to be in the best interests of the Laboratory or the Government.

3. In the event that the Contractor was aware of an organizational conflict of interest prior to the award of this contract and did not disclose the conflict to the Laboratory, the Laboratory may terminate the contract for default.

4. The provisions of this clause shall be included in all subcontracts for work to be performed similar to the services provided by the Contractor, and the terms "contract", "Contractor", and "Laboratory" modified appropriately to preserve the Laboratory's and the Government's rights.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement on the 12th day of OCTOBER, 1984.

THE UNIVERSITY OF CHICAGO
(Operator of Argonne National Laboratory)

By: M. L. Kyle

Director

Title: Administrative Services Division

FOSTER WHEELER ENERGY CORP.

By: R. J. Burgin

Title: SENIOR VICE PRESIDENT

I, JAMES T. SAMUEL, certify that I am the SECRETARY of the Corporation named as "Contractor" in the within Agreement; that R. J. BURGIN who signed the said Agreement was then SR VICE PRESIDENT of said Corporation; that I know his signature and his signature thereto is genuine that said Agreement was duly signed for in behalf of said Corporation by authority of its governing body.

By James T. Samuel

Title Secretary

CORPORATE SEAL

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ARGONNE NATIONAL LABORATORY EXHIBIT "A"

WORK ORDER Contract No. 44006402

Date _____

ork Order No. _____ Cost Code _____

ote: Work Order and Cost Code information must appear on all invoices.)

:

ursuant to Contract # _____, the Contractor will perform the following ervices:

. Period of Performance:

. Dollar Ceiling: The total amount to be paid by the Laboratory under this Work Order shall not exceed _____.

. Budget: The budget for the effort described in paragraph 1 above is as follows:

5. Technical Representatives:

ANL _____ Contractor _____

6. Terms and Conditions:

This Work Order, the performance of the services described herein and the rights and obligations of the parties with respect thereto are governed by Contract No. between the parties dated _____, including all supplements thereto, and such terms and conditions as are set forth in this Work Order pursuant to such contract. The terms and conditions set forth in such Contract are hereby incorporated herein by reference.

Accepted and Agreed to:

ARGONNE NATIONAL LABORATORY CONTRACTOR:

By _____ _____

Title _____ _____

ADMINISTRATION OF COST ACCOUNTING STANDARDS - NONDEFENSE CONTRACT

For the purpose of administrating Cost Accounting Standards requirements under this contract, the Contractor shall:

(a) Submit to the Laboratory a description of the accounting change and the general dollar magnitude of the change to reflect the sum of all increases and the sum of all decreases for all contracts containing a Cost Accounting Standards clause, a Disclosure and Consistency of Cost Accounting Practices clause, or a Consistency of Cost Accounting Practices clause:

(1) For any change in cost accounting practices required to comply with a new Cost Accounting Standard in accordance with paragraphs (a)(2) and (a)(3)(A) of the Cost Accounting Standards - Nondefense Contract clause within sixty (60) days (or such other date as may be mutually agreed to) after award of a contract requiring such change;

(2) For any change to cost accounting practices proposed in accordance with paragraph (a)(3)(B) or (a)(3)(C) of the Cost Accounting Standards - Nondefense Contract clause or with paragraph (a)(2) of the Consistency of Cost Accounting Practices - Nondefense Contract clause not less than sixty (60) days (or such other date as may be mutually agreed to) prior to the effective date of the proposed change; or

(3) For any failure to comply with an applicable Cost Accounting Standard or to follow a disclosed practice as contemplated by paragraph (a)(4) of the Cost Accounting Standards - Nondefense Contract clause of this contract or with paragraph (a)(3) of the Consistency or Cost Accounting Practices - Nondefense Contract clause within sixty (60) days (or such other date as may be mutually agreed to) after the date of agreement of such non-compliance by the Contractor.

(b) Submit a cost impact proposal in the form and manner specified by the Laboratory within sixty (60) days (or such other date as may be mutually agreed to) after the date of determination of the adequacy and compliance of a change submitted pursuant to (a)(1), (2), or (3) above.

(c) Agree to appropriate contract and subcontract amendments to reflect adjustments established in accordance with paragraphs (a)(3) and (a)(4) of the Cost Accounting Standards - Nondefense Contract clause or with paragraphs (a)(2) and (a)(3) of the Consistency of Cost Accounting Practices - Nondefense Contract clause.

(d) When the subcontract is subject to either the Cost Accounting Standards - Nondefense Contract clause or the Consistency of Cost Accounting Practices - Nondefense Contract clause, so state in the body of the subcontract and/or in the letter of award. Self-deleting clauses shall not be used.

(e) Include the substance of this clause in all negotiated subcontracts containing the Cost Accounting Standards - Nondefense Contract clause or the Consistency of Cost Accounting Practices - Nondefense Contract clause. In addition, within thirty (30) days after award of such subcontract, submit the following information to the Contract Administration Office cognizant of the subcontractor's facility:

(1) Subcontractor's name and subcontract number;

(2) Dollar amount and date of award;

(3) Name of Contractor making the award; and

(4) A statement as to whether the subcontractor has made or proposes to make any changes to accounting practices that affect prime contracts or subcontracts containing defense or nondefense full or modified coverage clauses because of the award of this subcontract, unless such changes have already been reported.

(f) For negotiated subcontracts containing the Cost Accounting Standards - Nondefense Contract clause, require the subcontractor to comply with all standards in effect on the date of final agreement on price as shown on the subcontractor's signed Certificate of Current Cost or Pricing Data or date of award, whichever is earlier, of the subcontractor's most recent negotiated defense contract or subcontract containing the Cost Accounting Standards clause.

(g) In the event an adjustment is required to be made to any subcontract hereunder, notify the Laboratory in writing of such adjustment and agree to an adjustment in the price or estimated cost and fee of this contract, as appropriate, based upon the adjustment established under the subcontract. Such notice shall be given within thirty (30) days after receipt of the proposed subcontract adjustment, or such other dates as may be mutually agreed to, and shall include a proposal for adjustment to such higher tier subcontract or prime contract, as appropriate.

(h) When either the Cost Accounting Standards - Nondefense Contract clause or the Consistency of Cost Accounting Practices - Nondefense Contract clause and this clause are included in subcontracts, the term "Laboratory" shall be suitably altered to identify the purchaser.

CONSISTENCY OF COST ACCOUNTING PRACTICES - NONDEFENSE CONTRACT

(a) Unless the General Services Administration has prescribed rules or regulations exempting the Contractor or his contract from standards, rules and regulations promulgated by the Cost Accounting Standards Board, the Contractor, in connection with this contract, shall:

(1) Comply with the requirements of 4 CFR Parts 401 - Consistency in Estimating, Accumulating and Reporting Costs, and 402 - Consistency in Allocating Costs Incurred for the Same Purpose, in effect on the date of award of this contract and administered under the Administration of Cost Accounting Standards clause. Compliance shall continue until the Contractor completes performance of work under this contract.

(2) Follow consistently the cost accounting practices established or disclosed as required by regulations of the Cost Accounting Standards Board and administered under the Administration of Cost Accounting Standards clause. If any change is made in established practices or in disclosed practices for purposes of any contract or subcontract subject to those disclosure requirements, the change must be applied in a consistent manner to this contract. A change to these practices may be proposed, however, by either the Laboratory or the Contractor, and the Contractor agrees to negotiate with the Laboratory the terms and conditions under which a change may be made. After the terms and conditions under which the change is to be made have been agreed to, the change must be applied prospectively to this contract. The Contractor shall, when the parties agree to a change to a cost accounting practice and the Laboratory has made the finding required in §332.51 of the Cost Accounting Standards Board's regulations, negotiate an equitable adjustment as provided in the Changes clause of the contract. In the absence of the required finding, no agreement may be made under this provision that will increase costs paid by the United States.

(3) Agree to an adjustment of the contract price or cost allowance, as appropriate, if he or a subcontractor fails to comply with an applicable Cost Accounting Standard or to follow any cost accounting practice disclosed pursuant to subparagraph (a)(1) and (a)(2) above, and such failure results in any increased costs paid by the Laboratory. Such adjustment shall provide for recovery of the increased costs to the Laboratory together with interest thereon computed at the rate determined by the Secretary of the Treasury pursuant to P.L. 92-41, 85 Stat. 97, or seven (7) percent per annum, whichever is less, from the time the payment by the Laboratory was made to the time the adjustment is effected.

(b) The Contractor shall permit any authorized representative of the head of the Laboratory, of the Department, of the Cost Accounting Standards Board, or of the Comptroller General of the United States to examine and make copies of any documents, papers, or records relating to compliance with the requirements of this clause, until the expiration of three (3) years after final payment under this contract or such lesser time specified in the Federal Procurement Regulations (FPR) Part 1-20.

(c) Unless a subcontract or subcontractor is exempt under rules or regulations prescribed by the Administrator of General Services, the Contractor shall include the substance of this clause including this paragraph (c) in all negotiated subcontracts under this contract except that it shall include the substance of the Cost Accounting Standards - Nondefense Contract clause set forth in §1-3.1204-2(a) of the FPR in negotiated subcontracts under this contract with subcontractors that are currently performing a national defense contract or subcontract that contains the clause entitled Cost Accounting Standards and that are currently required to accept that article in applicable negotiated national defense contracts. The Contractor may elect to use the substance of the solicitation notice set forth in §1-3.1203-3(b) of the FPR in his determination of applicability of cost accounting standards to subcontracts.

(d) The administration of this clause by the Laboratory shall be accomplished in conjunction with the administration of the Contractor's national defense contracts and subcontracts, if any, subject to rules and regulations of the Cost Accounting Standards Board, pursuant to the Administration of Cost Accounting Standards clause. For the purposes of the Administration of Cost Accounting Standards clause contained in this contract, references to the Disclosure and Consistency of Cost Accounting Practices clause shall be deemed to include this Consistency of Cost Accounting Practices - Nondefense Contract clause and references to the Cost Accounting Standards clause shall be deemed to include the Cost Accounting Standards - Nondefense Contract clause.

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ARGONNE NATIONAL LABORATORY EXHIBIT "A"

WORK ORDER Contract No. 44006403

Date_____

Work Order No. _____ Cost Code_____

(Note: Work Order and Cost Code information must appear on all invoices.)

To:

Pursuant to Contract # _____, the Contractor will perform the following services:

1.

2. Period of Performance:

3. Dollar Ceiling: The total amount to be paid by the Laboratory under this Work Order shall not exceed _____.

4. Budget: The budget for the effort described in paragraph 1 above is as follows:

5. Technical Representatives:

ANL_____ Contractor_____

6. Terms and Conditions:

This Work Order, the performance of the services described herein and the rights and obligations of the parties with respect thereto are governed by Contract No. between the parties dated _____, including all supplements thereto, and such terms and conditions as are set forth in this Work Order pursuant to such contract. The terms and conditions set forth in such Contract are hereby incorporated herein by reference.

Accepted and Agreed to:

ARGONNE NATIONAL LABORATORY CONTRACTOR:

By_____ _____

-042

ARGONNE
NATICNAL
LABORATORY

INTRA-LABORATORY MEMO

CENTER FOR INTERNATIONAL ENERGY DEVELOPMENT
OCT 1984
ARGONNE NATIONAL LABORATORY

October 1, 1984

To: E. J. Croke — Division Director EES 362
A. G. Nisius — Accounting Department 201

From: F. W. Foster — ASD/PRO 201

Subject: Contract No. 44006403

Stanley Consultants, Inc.
Stanley Building
Muscatine, Iowa 52761

Cost Code: 8N424-00-190-404

Requisition No. 931602

Enclosed for your information and use is a fully executed copy of above-mentioned contract.

FWF/jl

Encs.

cc: M. Frances Adams TIS/TPS 2
Patents DOE 201 w/ reps. & certs.
H. Jurgensen MAT 5
C. F. File
J. Waters
ASD Ref. File w/o
FF File

ARGONNE NATIONAL LABORATORY
Argonne, Illinois 60439

Contract No. 44006403

AGREEMENT BETWEEN

THE UNIVERSITY OF CHICAGO
(Operator of Argonne National Laboratory)

and

STANLEY CONSULTANTS, INC.
Stanley Building
Muscatine, Iowa 52761

The University of Chicago, an Illinois not-for-profit corporation, operator of Argonne National Laboratory and herein called the "Laboratory", acting under Prime Contract No. 31-109-Eng-38 with the United States Government (called the "Government"), represented by the U. S. Department of Energy (called the "Department"), desires STANLEY CONSULTANTS, INC. (called the "Contractor"), Corporation, organized under the laws of the State of Iowa, to perform the services set forth under Article 1 of this contract and the Contractor is willing to perform such services. The effective date of this contract is October 1, 1984.

THEREFORE, the parties mutually agree as follows:

ARTICLE I - DESCRIPTION OF WORK

A. The Contractor shall furnish the personnel, facilities, equipment, materials and supplies necessary to perform the work described in Appendix "E" Description of Work dated February 9, 1984, attached hereto and hereby made a part of this contract.

1. Each task will be performed in accordance with an agreed time schedule, work product and cost schedule. The Contractor's senior staff will direct and participate in the execution of all tasks. The services to be performed shall be described and set forth from time to time in separate work orders issued pursuant to the terms of this agreement in the form attached hereto as Exhibit "A". No work shall proceed until a work order has been signed by both parties.

The Contractor will consult with the Laboratory, by telephone or otherwise, at monthly intervals and at such other times as may be deemed desirable by the Laboratory or the Contractor, with respect to progress on outstanding work orders. The Contractor is to notify promptly and discuss with the Laboratory any anticipated need to deviate from an agreed upon time schedule, work product, cost schedule or assignment of personnel.

2. The services herein provided for shall be furnished from time to time, as required by the Laboratory, commencing on October 1, 1984 and continuing through March 31, 1985 or through the period of any extension of this agreement, provided however, that this agreement is not sooner terminated as hereinafter provided.

3. It is agreed that the Laboratory is not required to request any minimum dollar amount of service or, for that matter, any service whatsoever and that the Contractor is not required to fill an order if he has n personnel able to meet the particular requirement.

ARTICLE II - COMPENSATION FOR SERVICES

1. The Contractor shall receive as full compensation for all services performed hereunder, including necessary travel, and as full reimbursement for travel and living expenses incurred in connection with the performance of such services:

   A. Amounts computed by multiplying the appropriate hourly rate, or rates, set forth in the Hourly Fee Schedules attached hereto by the number of direct labor or travel hours performed, which rates shall include wages, overhead, general and administrative expense and profit. Vouchers may be submitted once each month to the Assistant Controller of the Laboratory. The Contractor will substantiate vouchers by evidence of actual payment and by individual daily job timecards or such other substantiation approved by the Laboratory. Promptly after receipt of each substantiated voucher, the Laboratory shall, except as otherwise provided in this agreement, and subject to the provisions of 3, below, make payment thereon.

   B. For purposes or computation of amounts due, a day shall be considered as eight (8) hours; for fractions of days worked or spent in necessary travel, said rate will be paid on an hourly basis. In no event, however, shall more than one day's (8 hours) pay be paid for any one calendar day, nor more than 40 hours for any one calendar week.

      The rates set forth in Exhibit F shall not vary by virtue of work performed on an overtime basis.

   C. A Ten Percent (10%) material handling markup shall apply to total direct material including purchased parts, subcontracted items and interdivisional transfers. Items subject to this markup shall be identified on the individual work orders as issued.

   D. Cost of necessary telephone, telegraph and postal services, and computer charges, when authorized by work order.

E. Travel expenses for Laboratory-directed travel reimbursable in accordance with Appendix C, "Travel Policy for Contractor Personnel", dated 7/6/82, which is attached hereto. Such travel will be detailed in the applicable work order and approved by the Laboratory's cognizant technical representative for each work order where travel is indicated.

F. It is understood that certain of the work may be subcontracted, which fact shall also be indicated on the Work Order. In this event, the amounts to be charged will be those amounts set forth in Appendix G - Consultant Fee Schedule.

2. The total amount to be paid by the Laboratory under this contract shall not exceed Three Hundred Thousand Dollars ($300,000.00) and the Contractor (and its employees performing services hereunder shall not incur or be required by the Laboratory to incur costs under this contract which will aggregate in excess of this amount unless the parties agree in writing to authorize such additional expenditures.

   Work releases will be issued for each task required in accordance with Exhibit A, "Work Order" form, signed by the authorized Laboratory Procurement official on behalf of the Laboratory and the appropriate corporate official on behalf of the Contractor.

3. At any time or times prior to final payment under this agreement, the Laboratory may cause to be made such audit of the invoices or vouchers and substantiating material as shall be deemed necessary. Each payment theretofore made shall be subject to reduction to the extent of amounts which are found by the Laboratory not to have been properly payable and shall also be subject to increase for underpayments on preceding invoices or vouchers.

ARTICLE III - MANNER OF PAYMENT

1. The Contractor shall be paid monthly upon submission of properly certified and correct invoices bearing the work order number and code description of the Agreement No. 44006403 to the Assistant Controller of the Laboratory. Such invoices must be sufficiently detailed to permit the identification of the various compensable items under this agreement.

2. Attached to each billing and copy thereof, there must be furnished the following certification which must be manually signed by an authorized representative of the Contractor:

   "I certify that the above bill is correct and just; that the amounts claimed represent fair charges against Argonne National Laboratory and that reimbursement has not and will not be received therefor under any other Government contract or other source of Government funds."

3. The Contractor agrees to furnish the Laboratory by the twenty-fifth (25th) day of each month, an approximation of accrued expenditures for that month.

4. Terms: Net 30 days.

ARTICLE IV - DISCONTINUANCE

Discontinuance of future application of this Basic Ordering Agreement can be accomplished upon thirty (30) days written notice by either party. Discontinuance of the Basic Ordering Agreement will not affect any individual work order(s) referencing the Basic Ordering Agreement entered into prior to the effective date of the discontinuance, and all provisions of the Basic Ordering Agreement shall pertain thereto until completed or otherwise terminated.

ARTICLE V - CONTRACTOR EMPLOYEES

It is understood and agreed that Contractor and Contractor's employees are not employees of the Laboratory and are entitled to no employee benefits or privileges nor to any payment from the Laboratory, except such payments as set forth in Article II - COMPENSATION FOR SERVICES of the Schedule of this Agreement. All such payments shall be made to the Contractor and no payment shall be made to any of the Contractor's employees.

ARTICLE VI - COMPLETION OF WORK ORDER

Any work order issued during the effective period of this agreement and not completed within the period shall be completed by the Contractor within the time specified in the order and the rights and obligations of the Contractor and the Laboratory respecting that work order shall be governed by the terms of the agreement as fully and to the same extent as if completed during the effective period of this agreement, provided that the Contractor shall not be required to perform any work under this agreement after April 30, 1985.

ARTICLE VII - KEY PERSONNEL

The personnel specified in each work order under this agreement are considered to be essential to the work being performed. Prior to diverting any of the specified individuals to other programs, the Contractor shall notify the cognizant Procurement Official of Argonne National Laboratory reasonably in advance and shall submit justification (including proposed substitutions) in sufficient detail to permit evaluation of the impact on the program. No diversion shall be made by the Contractor without the written consent of the cognizant Procurement Official of Argonne National Laboratory: Provided, that the cognizant Procurement Official of Argonne National Laboratory may ratify in writing such diversion and such ratification shall constitute the consent of the cognizant Procurement Official of Argonne National Laboratory required by this clause. The work order may be amended from time to time during the course of the agreement either to add or delete personnel, as appropriate.

ARTICLE VIII - RIGHTS TO PROPOSAL DATA

It is agreed that, as a condition of the award of this agreement, and notwithstanding the provisions of any notice appearing on the proposal, the Government shall have the right to use, duplicate, disclose and have others do so for any purpose whatsoever, the technical data contained in the proposal upon which this agreement is based.

ARTICLE IX - APPLICABLE DOCUMENTATION

The following documents are attached hereto and are hereby made a part of this agreement:

1. Appendix "A", Argonne Terms and Conditions for Fixed-Price Contracts, dated 4-84, except that Section 30 Key Personnel is hereby deleted in its entirety.

2. Appendix "C", Travel Policy for Contractor Personnel, dated 7/6/82.

3. Apendix "D-1", Intellectual Property Provisions Research, Development, Demonstration Contract - General Contractor, dated November 1, 1982, except as amended by the addition of the following paragraphs to the Rights in Technical Data Clause.

(g) Limited rights in properietary data

Except as may be otherwise specified in this contract as technical data which are not subject to this paragraph, the Contractor shall, upon written request from the Laboratory or the Government at any time prior to three (3) years after final payment under this contract, promptly deliver to the Government through the Laboratory any "proprietary data" withheld pursuant to paragraph (e) of the "Rights in Technical Data" clause of this contract. The following legend and no other is authorized to be affixed on any "proprietary data" delivered pursuant to this provision, provided the "proprietary data" meets the conditions for initial withholding under paragraph (e) of the "Rights in Technical Data" clause. The Government and the Laboratory will thereafter treat the "proprietary data" in accordance with such legend.

LIMITED RIGHTS LEGEND

This "proprietary data", furnished under Contract No. 44006403 with the University of Chicago, operator of Argonne National Laboratory, acting under Prime Contract No. 31-109-ENG-38 with the United States Government as represented by the United States Department of Energy may be duplicated and used by the Laboratory or the Government with the express limitations that the "proprietary data" may not be used for purposes of manufacture without prior permission of the Contractor, except that further disclosure or use may be made solely for the following purposes.

(a) This "proprietary data" may be disclosed for evaluation purposes under the restriction that the "proprietary data" be retained in confidence and not be further disclosed;

(b) This "proprietary data" may be disclosed to other Contractors participating in the Government's program of which this contract is a part for information or use in connection with the work performed under their contracts and under the restriction that the "proprietary data" be retained in confidence and not be further disclosed; or

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(c) This "proprietary data" may be used by the Government or others on its behalf for emergency repair or overhaul work under the restriction that the "proprietary data" be retained in confidence and not be further disclosed.

This legend shall be marked on any reproduction of this data in whole or in part.

(h) Software Licensing

The contractor shall take such steps as are necessary to insure that all proprietary software used in the performance of the work under the contract will be available for licensing with full documentation under reasonable terms and conditions to responsible parties.

(i) Release of Data

The contractor shall not publish, disseminate or reproduce any data first produced or composed in the course of or under this contract in whole or in part or in any manner or form, or authorize others to do so without the written consent of the Laboratory or until such time as the Laboratory and DOE may have released such data to the public.

4. Appendix "E" Description of Work dated February 9, 1984.

5. Appendix "F" Hourly Fee Schedules.

6. Appendix "G" Consultant Fee Schedules.

7. Appendix "H" Additional Terms & Conditions dated July 1984.

8. Exhibit A, Work Order.

ARTICLE X - CONFLICTS IN DOCUMENTATION

Any discrepancy, inconsistency, or conflict in one or more of the documents identified in Article IX which can reasonably be ascertained by the Contractor shall be immediately submitted to the Laboratory for its written decision. Any work undertaken by the Contractor without such decision shall be at the Contractor's own risk.

ARTICLE XI - LABORATORY REPRESENTATIVES

1. The authorized Laboratory Procurement Official will be the only person at the Laboratory who is authorized to change the scope of work or any other part of this contract.

2. All letters and notices from the Contractor will be submitted to the attention of the Laboratory's Contract Specialist.

3. Unless the Contractor is otherwise notified in writing, technical questions relating to the work may be discussed with M. Monarch (312) 972-7632 who is the Laboratory's Technical Representative on this contract.

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ARTICLE XII - ORGANIZATIONAL CONFLICTS OF INTEREST

a. General

(1) It is Laboratory and DOE policy to avoid situations which place a Contractor in a position where its judgment may be biased because of any past, present, or currently planned interest, financial or otherwise, the Contractor may have which relates to the work to be performed under its contract or where the Contractor's performance of such work may provide it with an unfair competitive advantage. Accordingly, the Contractor agrees that it will conduct its activities with the intention of (i) avoiding bias in performance of work under this contract and (ii) avoiding any unfair competitive advantage by virtue of its performance of work under this contract. The Contractor, however, is entitled to the normal flow of benefits from performance of this contract.

(2) In the event the Contractor is of the opinion that the activities of the Contractor create or reasonably give the appearance of creating a conflict of interest with the Contractor's performance of work under the contract, (i) the Contractor will notify the Laboratory and supply information requested by the Laboratory or DOE based on such potential conflict of interest, subject to proprietary rights of others, and (ii) if the Laboratory or DOE finds that any such activity creates a conflict of interest under applicable law or under the criteria in the DOE regulations, the Laboratory or DOE will promptly inform the Contractor. The Laboratory or DOE and the Contractor will enter into good faith discussions concerning appropriate measures to be taken to eliminate, avoid or mitigate such conflict. Such measures may include appropriate restrictions on the Contractor's future participation in Laboratory or DOE contracts or deletion of the activities creating the potential conflict from work under this contract.

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b. Access to and Use of Information

(1) If the Contractor, in the performance of technical consulting and management support services or evaluation services, obtains access to information, such as Laboratory or DOE plans, policies, reports, studies, financial plans, internal data protected by the Privacy Act of 1974 (P.L.93-579), or data which has not been released or otherwise made available to the public, the Contractor understands that without prior written approval of the Laboratory or DOE it may not (i) use such information so obtained for any purpose, other than the performance of this contract, unless the information has been released or otherwise made available to the public; (ii) compete for work for the Laboratory or DOE based on such information so obtained for a period of six (6) months after either the completion of this contract, or until such information is released or otherwise made available to the public by the Laboratory or DOE. Nothing in this paragraph (b) shall be construed to limit the Contractor from (i) competing for work for the Laboratory or DOE, or (ii) submitting unsolicited proposals to the Laboratory or the Government.

(2) In addition, the Contractor agrees that to the extent it receives or is given access to appropriately marked or identified (i) proprietary data, (ii) data protected by the Privacy Act of 1974 (P.L.93-579), or (iii) other confidential or priviledged technical, business, or financial information and the Contractor accepts such data or information in accordance with any written restrictions imposed on such information.

(3) The Contractor shall have, subject to patent and security provisions of this contract, the right to use technical data it first produces under this contract for its private purpose provided that, as of the date of such use, all reporting requirements of this contract have been met or the Contractor has reported such information or data in writing to the Laboratory or DOE.

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c. Personnel Access to Contract Operations

The Contractor will establish procedures to control access of Contractor personnel not engaged in the performance of this contract to facilities in which performance of this contract is in progress on the same basis as the access of U.S. citizens employed by U.S. organizations is controlled.

d. Subcontract Disclosure

If a subcontract is to be issued for evaluation services or activities, technical consulting or management support services as defined in DEAR 909.570-3, the Contractor shall obtain for the Laboratory or DOE a disclosure statement or representation, in accordance with DOE regulations in effect at the time, from each intended subcontractor or consultant. The Contractor shall not enter into any subcontract nor engage any such consultant unless the Laboratory or DOE shall have first notified the Contractor that there is little or no likelihood that an organizational conflict of interest exists or that despite the existence of a conflict of interest the award is in the best interest of the Government.

e. Subcontracts

The Contractor shall include this clause, including this Paragraph e., in subcontracts of any tier which involve performance or work of the type specified in b.(1) above or access to information of the type covered in b. above The terms "contract", "Contractor" and "Laboratory" shall be appropriately modified to preserve the Laboratory's and the Government's rights.

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IN WITNESS WHEREOF, the parties hereto have executed this Agreement on the 27th day of September, 1984.

THE UNIVERSITY OF CHICAGO
(Operator of Argonne National Laboratory)

By: M. L. Kyle

Title: Director
Administrative Services Division

STANLEY CONSULTANTS, INC.

By Richard L. Lord

Title: Vice President

I, Kathleen S. Johnson certify that I am the Secretary of the Corporation named as "Contractor" in the within Agreement, that Richard L. Lord who signed the said Agreement was then Vice President of said Corporation; that I know his signature and his signature thereto is genuine; and that said Agreement was duly signed for in behalf of said Corporation by authority of its governing body.

By Kathleen S. Johnson

Title Secretary

CORPORATE SEAL

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APPENDIX "E"

Contract No. 44006403

DESCRIPTION OF WORK

February 3, 1984

1 BACKGROUND

Argonne National Laboratory (ANL) is assisting the Agency for International Development (AID) in an energy policy planning activity with the Government of the Arab Republic of Egypt (AID Energy Planning Sub-Project No. 263-0123.1). In this activity ANL will be working with the Organization for Energy Planning (OEP) established by Egyptian Presidential Decree #112 of 1983. OEP's mission is to provide technical support for national energy planning and analysis. The Director of OEP reports to the Egyptian Supreme Council on Energy (SCE) through a Board of Directors representing five organizations in Egypt that affect and are affected by energy planning and policy. The makeup of the council is such that the work of OEP will be presented to the highest level of Egyptian government officials.

A list of priority projects has been established under the energy policy planning activity. Of highest priority is the development of an industrial energy conservation program. The list was developed with the caveat that work performed exclusively or primarily by foreign consultants was to be discouraged. Therefore each effort will include as part of its planning and resource requirements the training of Egyptian personnel.

The first task of the industrial energy conservation program calls for the establishment of a training program for the conduct of industrial energy audits. The second task requires the performance of a number of industrial energy audits that result in specific recommendations for cost-effective steps to reduce energy consumption. Recommendations for energy conservation will include low-cost measures such as insulation and maintenance and operation changes, medium-cost measures such as combustion controls and heat exchangers, and may include capital-intensive technology change. The training program may be structured so that industrial energy audits are accomplished while the final phases of field training takes place.

The industrial energy audits and training of personnel will be performed under a basic ordering agreement (BOA). Under the auspice of the BOA, Argonne National Laboratory may choose to contract with more than one firm in both the conduct of industrial energy audits and energy audit training.

For both Tasks 1 and 2 the contractor is expected to make all necessary arrangements for lodging and meals; passports and visas; international travel; reproduction of reports; office supplies; and other materials, tools and aids specified elsewhere in the description of work.

2 SCOPE OF WORK

The scope of work is comprised of two major tasks: the training program and the actual industrial audits.

Task 1. Industrial Energy Audit Training Program

The contractor will develop and conduct an industrial energy audit training program in Egypt for Egyptian nationals. In addition to items previously specified, the contractor is responsible for teaching aids, textbooks, instructional equipment and all other materials required to perform the task. Training will be in English, giving appropriate consideration that English is a second language for the trainees. OEP/ANL will have the responsibility for selecting the trainees and arranging for classroom accommodations. Each class size is expected to be from 10-20 trainees. It is anticipated that the training program will commence with a one- to two-week classroom session followed by a one- to two-week session of field work where each trainee will participate in an actual or practice audit at a plant facility. OEP/ANL, in consultation with the contractor, will select an appropriate plant site for the field training. It is expected that as many as three classroom/field sessions will be conducted in the course of a twelve month period.

The objective of the training program is to prepare the trainees for conducting in-plant industrial energy audits for a wide range of industrial processes (e.g. cement manufacture, textiles, food processing) and equipment (e.g. boilers, dryers, motors) that is pervasive in many different types of industries. Therefore, the training program must emphasize the practical and applied aspects of energy audit performance rather than only the theoretical aspects. Both classroom and field training must emphasize the use of survey instrumentation to collect data.

At the conclusion of the training session it is expected that the trainee will have the capability, using appropriate instrumentation, to perform in-plant measurements that will result in an accounting of energy flows for, at a minimum, the following systems:

- Boiler, furnace and oven combustion systems;
- Process steam systems including boiler, steam line, steam traps, etc.;
- Electric motors and motor-coupled mechanical systems; and
- Waste heat discharge systems (i.e. hot water, steam and hot exhaust gas).

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It is anticipated that graduates of the training program will participate in the actual audits of Task 2.

Task 2. Industrial Energy Audits

The contractor will be responsible for conducting a number of industrial energy audits in Egypt. The contractor will be responsible for all instrumentation, analytical hardware/software systems, and similar support necessary to perform all phases of the audit process. It should be noted that rights in all information and data obtained or processed in the audit or audit-related procedures are governed by the Rights in Data clause of Appendix D-1 of this contract.

The industrial energy audit will include the following sequential steps:

- o Plant selection from a list of candidate plants,
- o Scheduling of pre-audit evaluation,
- o Pre-audit data collection and consultation with plant management,
- o Preparation and presentation of pre-audit evaluation to OEP/ANL,
- o Scheduling of plant audits,
- o Plant audits,
- o Analysis and evaluation of audit data,
- o Development of recommendations,
- o Preparation of written reports,
- o Presentation of results, and
- o Post-audit support and consultation.

Each of the above tasks is described below in greater detail.

Plant Selection. OEP/ANL will be responsible for developing a list of candidate plants for energy audit. The contractor will be responsible for assisting OEP/ANL in this task. The list will contain all energy-related information that is currently available. The contractor will assist OEP/ANL

in screening the information and selecting the most favorable candidates for energy audit.

Plants expected to be chosen for industrial audit during the first twelve- month period will be primarily medium-sized industries (e.g. textiles and food processing). This may change, however, to includesome larger industries as the plant selection data are reviewed. Therefore, the audit program should be geared to analysis of, at a minimum, the following process systems and equipment:

- o Boiler, furnace and oven combustion systems,
- o Process steam systems including boiler, steam lines, steam traps, etc.,
- o Electric motors and motor-coupled mechanical systems, and
- o Waste heat discharge systems (i.e. hot water, steam and hot exhaust gas).

Schedule Pre-Audit Plant Interview. OEP/ANL will be responsible for arranging for a pre-audit visit to the plant and conference with plant management based on the contractor's requirements for pre-audit evaluation. The contractor will provide OEP/ANL with a full set of criteria for the pre-audit evaluation.

Pre-Audit Information Gathering and Consultation with Plant Management. The contractor will be accompanied by one or more member(s) of the OEP/ANL observer team and possibly one or two energy audit trainees (see Task 1). The contractor will be responsible for utilizing a pre-audit procedure to gather information that will allow a subsequent determination of the suitability of conducting a full-scale plant audit. The contractor will be responsible for pre-audit information gathering and pre-audit consultation with plant management. OEP/ANL will be responsible for obtaining the cooperation of plant management.

Presentation of Pre-Audit Evaluation to OEP/ANL As a result of the pre-audit plant visit and analysis of pre-audit information, the contractor will report to OEP/ANL as to the advisability of performing an industrial energy audit. The report will include the proposed scope of the overall audit, target areas where energy savings might be found, estimated time to complete the audit, disposition of management/operators and any other information supportive of a recommendation. Based on the contractors' recommendations, it will be an OEP/ANL responsibility to decide whether an energy audit should be performed at a particular plant. In the determination of the disposition of a plant for industrial audit, OEP/ANL may require that the contractor return to the plant to secure additional information.

Schedule Plant Audit. It will be an OEP/ANL responsibility (with contractor assistance) to schedule an industrial energy audit with plant management. It will be the contractor's responsibility to biref plant management on the audit strategy, make arrangements to connect instrumentation and obtain signature approval for any modifications or hookups to plant facilities as well as any instructions to plant operating personnel regarding plant operations during the audit.

Plant Audit. It will be the contractor's responsibility to perform the complete plant audit and advise plant management and OEP/ANL of audit progress on a regular basis. The contractor will also be responsible for not only general insurance of their audit personnel but any special coverage required for working in a variety of plant environments. The contractor may be responsible for field training of Egyptian personnel that have completed the classroom portion of the training course in energy audits (see Task 1) by including them in the audit activity. The contractor will be responsible for advanced training of Egyptian personnel that have successfully completed both the classroom and field portions of the training program.

It is the responsibility of the contractor to perform the audit in such a manner as to cause minimum disruption to the plant process. Where variable load conditions are significant in a plant operation, the contractor is responsible for collecting audit data that suitably reflects these conditions. The contractor is responsible for documenting the calibration and proper working order of all instrumentation used in the audit process. The contractor is expected to have an adequate supply of spare survey instrument parts to assure non-interrupted collection of data.

Analysis and Evaluation of Audit Data. The contractor will have full responsibility for processing and analyzing the audit data. The contractor is also responsible for any supportive analytical tools such as computer hardware/software systems. The contractor will be responsible for instructing the Egyptian trainees in the data processing and analysis activity. If computer-based software systems are used, the contractor will provide instruction on the use of the systems and advise trainees on the basic algorithms used to perform the analysis and the significance of results. It may be required that the analysis and evaluation of audit data be performed entirely in Egypt.

Development of Recommendations. The contractor will be responsible for developing specific recommendations for energy conservation or management based on the processing and analysis of audit data. The recommendations would include both operational and hardware modifications. Each energy conservation recommendation should be specific and include quantitative estimates of energy savings and an economic analysis based on capital and operating costs. If computer-based software systems are used, the contractor will advise trainees on the basic algorithms used to perform the analysis and the significance of

results. It may be required that the analysis of energy conservation measures be performed entirely in Egypt.

Audit Report. The contractor will be responsible for the preparation of a written audit report in English that provides specific energy conservation recommendations that can be readily implemented. An economic analysis must be performed for each recommendation. The audit report will include all raw data in an appendix, documentation as to calibration of instrumentation, indicate all assumptions made, algorithms used in the analyses, and all other pertinent data necessary to support the energy conservation recommendations. The contractor will be responsible for submitting a draft report to OEP/ANL in a timely manner prior to submission to plant management. OEP/ANL reserves the right of review and edit prior to submission of the report to plant management. Upon approval of the audit report by OEP/ANL, the contractor will be responsible for submission of an adequate number of copies of the report to plant management.

Oral Presentation. The contractor will be responsible for an oral presentation/discussion of the audit report before OEP officials, government officials, and plant management. During the presentation the contractor is expected to be in a position to adequately defend the analyses and recommendations contained in the audit report. OEP/ANL, in consultation with the contractor, will schedule the meeting with plant management. The contractor will be responsible for any audio-visual materials necessary for the oral presentation.

Post-Audit Support and Consultation. The audit process calls for specific recommendations for energy conservation measures that can actually be implemented. Stanley Consultants, Inc. will be responsible for followup work with plant management regarding operation and maintenance and general housekeeping energy conservation measures. The audit contractor may also be called upon to assist OEP/ANL in the preparation of competitive bid packages for each capital cost energy conservation measure recommended in the audit report. The audit contractor may also be asked to interact with the engineering firm or vendor designated to perform the work in order that a smooth and orderly transfer of information takes place that would assure a successful, cost-effective completion of the project. OEP/ANL will have the responsibility of coordinating discussion between the audit contractor and firms contracted to carry out the audit recommendation.

APPENDIX "F"

Contract No. 44006403

HOURLY FEE SCHEDULE - OVERSEAS INPUT

1. April 1, 1984 thru March 31, 1985

SC CLASS	
SC-01	14.80
SC-02	17.80
SC-03	20.49
SC-04	24.56
SC-05	29.17
SC-06	34.43
SC-07	40.12
SC-08	45.48
SC-09	51.59
SC-10	58.35
SC-11	67.46
SC-12	79.69

2. April 1, 1985 thru March 31, 1986

SC CLASS	
SC-01	15.56
SC-02	18.70
SC-03	21.51
SC-04	25.78
SC-05	30.63
SC-06	36.14
SC-07	42.13
SC-08	47.75
SC-09	54.17
SC-10	61.26
SC-11	70.83
SC-12	83.68

3. April 1, 1986 through March 31, 1987

SC CLASS	
SC-01	16.47
SC-02	19.81
SC-03	22.79
SC-04	~~26.74~~ 27.34
SC-05	32.48
SC-06	38.32
SC-07	44.64
SC-08	50.62
SC-09	57.42
SC-10	64.93
SC-11	75.08
SC-12	88.69

HOURLY FEE SCHEDULE - HOME OFFICE INPUT

1. April 1, 1984 thru March 31, 1985

SC CLASS	
SC-01	13.66
SC-02	16.43
SC-03	18.91
SC-04	22.67
SC-05	26.93
SC-06	31.78
SC-07	37.03
SC-08	41.98
SC-09	47.62
SC-10	53.86
SC-11	62.27
SC-12	73.56
SC-13	90.03
SC-14	110.82

2. April 1, 1985 thru March 31, 1986

SC CLASS	
SC-01	14.36
SC-02	17.26
SC-03	19.86
SC-04	23.80
SC-05	27.27
SC-06	33.36
SC-07	38.89
SC-08	44.08
SC-09	50.00
SC-10	55.55
SC-11	65.38
SC-12	77.24
SC-13	94.84
SC-14	116.66

3. April 1, 1986 thru March 31, 1987

SC CLASS	
SC-01	15.20
SC-02	18.29
SC-03	21.04
SC-04	~~24.64~~ 25.23
SC-05	29.98
SC-06	~~34.37~~ 35.37
SC-07	41.21
SC-08	46.73 < 53.00
SC-09 >	
SC-10	59.94
SC-11	69.30
SC-12	81.87
SC-13	106.88
SC-14	130.06

See attached sheet entitled "Representative Positions" Form B-84-85.

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STANLEY CONSULTANTS

Representative Positions

Fiscal Year 1984-85

Classification	Position Title
SC-1	Aide or Clerk
	Typist or Clerk-Typist
	Word Processing Specialist
	Varitype Specialist
	Data Entry Specialist (Comput
	Computer Operator I
	Reprographics Operator I
SC-2	Aide or Clerk
	Secretary
	Word Processing Specialist
	Varitype Specialist
	Data Entry Specialist (Comput
	Computer Operator II
	Reprographics Operator II
SC-3	Aide or Clerk
	Secretary
	Word Processing Specialist
	Varitype Specialist
	Data Entry Specialist (Comput
	Computer Operator III
	Reprographics Operator III
	Assistant Technician
	Programming Aide
	Assistant Programmer
SC-4	Senior Secretary
	Computer Operator IV
	Reprographics Operator IV
	Technician
	Assistant Programmer
SC-5	Reprographics Operator V
	Senior Technician
	Programmer
	Party Chief
	Professional
SC-6	Reprographics Operator VI
	Programmer
	Programmer Analyst
	Party Chief
	Designer
	Inspector
	Professional
SC-7	Programmer
	Programmer Analyst
	Party Chief
	Land Surveyor (Registered)
	Senior Designer
	Senior Inspector
	Professional
SC-8	Senior Programmer
	Senior Programmer Analyst
	Professional
	Senior Professional
SC-9	Professional
	Senior Professional
	Principal Professional
	Consultant
	Project Manager
SC-10	Senior Professional
	Principal Professional
	Consultant
	Associate Professional Chief
	Planning, Design, or Construction Manager
	Project Manager
SC-11	Principal Professional
	Associate Chief
	Chief
	Consultant
	Planning, Design, or Construction Manager
	Project Manager
SC-12	Associate Chief
	Chief
	Consulting Professional
	Planning, Design, or Construction Manager
	Project Manager
SC-13	Project Manager
SC-14	Project Manager

APPENDIX G

Contract No. 44006403

CONSULTANT FEE SCHEDULES

For Work performed by Dr. M. A. Larson

During the period 4/1/84 thru 3/31/85	$300/day
During the period 4/1/85 thru 3/31/86	$330/day
During the period 4/1/86 thru 3/31/87	$360/day

For Work performed by Kinetics Consulting Group

During the period 4/1/84 thru 3/31/85	$65/hour
During the period 4/1/85 thru 3/31/86	$68/hour
During the period 4/1/86 thru 3/31/87	$72/hour

For Work performed by Pacer Consultants

During the period 4/1/84 thru 9/30/86

Professional Staff	$24.50/hour
Senior Engineer	$15.75/hour

Contract No. 44006403

APPENDIX "H"

ADDITIONAL TERMS AND CONDITIONS

July 1984

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1.	Administration of Cost Accounting Standards-Non Defense Contract	1
2.	Consistency of Cost Accounting Practices - Nondefense Contract	3

WORK ORDER 1: INITIAL INDUSTRIAL AUDITS AND ON-THE-JOB AUDIT TRAINING[a]

Prepared by

Center for International Energy Development
Argonne National Laboratory

WORK ORDER 1: INITIAL INDUSTRIAL AUDITS AND ON-THE-JOB AUDIT TRAINING

This work order will require the completion of two initial industrial audits involving Egyptian public sector industrial facilities and limited classroom training of Egyptian nationals in the audit process. The conduct of the two audits will also serve as on-the-job training to supplement to the classroom training.

The subtasks required to accomplish both training and industrial audits are specified in Section 1.1. The deliverables are listed in Section 1.2. Personnel requirements are in Section 2. Administrative requirements and provisions are described in Section 3. The budget is in Section 4. The time schedule specifying milestones for accomplishment of key subtasks and deliverables is in Appendix A. At the request of the Egyptian Organization for Energy Planning (OEP), Argonne National Laboratory has developed a very specific format for reporting all billing costs. This format is contained in Appendix B.

In order that the initial industrial audits and training be accomplished in the time schedule set forth in Appendix A, the two industrial audits will have to be accomplished simultaneously. Therefore Argonne National Laboratory is requiring that the contractor provide the equivalent of two audit teams to accomplish this work order.

1 SCOPE OF WORK

1.1 SUB-TASK DESCRIPTION

There are five major subtasks (Subtask 1a through 1e) in Work Order 1. These subtasks are described below with specifications of contractor responsibility. The notation "T1 and T2" denotes a simultaneous parallel activity of two distinct audit teams (composition provided by the contractor). The notation "T1 and/or T2" denotes that the activity can be carried out by members of either or both audit teams at the contractors discretion. The audits will be done on an entire plant (as distinguished from a company which has several plants) or on a meaningful process or subsystem within the plant.

SUBTASK 1A PLANT SELECTION FOR PRE AUDIT

The contractor will be responsible for the following activities in this subtask.

- Review OEP data for approximately 10 plant facilities.
- Perform a one-day walk-through inspection visit of each of the ten plant facilities accompanied by OEP personnel. (Five plant visits per audit team T1 and T2).
- Confer with ANL and OEP and select two distinct plant facilities (i.e., associated with different company organizations) for preaudit.

Prepare and present plant selection report for the two plants as described in Section 1.2 at the time specified in Appendix A.

ANL and OEP will be responsible for the following:

- Provide available facility data in OEP format.
- Schedule plant facility visits. (See Appendix A Time Schedule).
- Provide OEP staff member, car and driver for each plant facility visit.
- Confer with contractor on choice of plant for preaudit.
- Schedule two plant facilities for preaudit work to commence as indicated in Appendix A based on selection by contractor.

SUBTASK 1B INSTRUCTION ON PREAUDIT PROCEDURES AND ANALYSIS

The purpose of this subtask is to provide limited classroom instruction on the contractor's general preaudit procedures and analysis. The preaudit analysis is designed to determine the audit work to be performed including the systems and equipment to be evaluated and the method of evaluation (i.e., types of measurements taken). The preaudit analysis also establishes the effort level required to perform the audit. The class size will be small and involve a maximum of 8-10 trainees.

For purposes of this sub-task the instruction in preaudit analysis is considered to have three parts: 1) instruction in preaudit data collection and plant inspection 2) instruction in preaudit data analysis and determination of sites for audit measurement and 3) instruction in the development of recommendations for the conduct of the audit. The classroom instructional period should be approximately three days and will concentrate primarily on preaudit data collection and its significance toward subsequent analysis and recommendations for the conduct of the audit. Instruction on data analysis should be limited and focused at a basic level that allows the trainee to perform individual analysis with the use of a calculator. The use of one or more case studies to demonstrate preaudit procedures is encouraged.

At the conclusion of the instruction period the contractor will be required to test the trainees and evaluate the performance of the classroom instruction (see Section 1.2 Deliverables). The contractor is encouraged not to have the instruction entirely on consecutive days and schedule the instruction to provide study time and homework assignment time for the trainees. Such a schedule appears appropriate and manageable since the classroom trainees will also participate in the preaudit field training and be available to assist the contractor in the preaudit activity. However, the course must be completed by the time schedule established in Appendix A.

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The contractor is also responsible for the following:

- Provide ANL with an "instruction package" as specified in Section 2.1.
- Provide each trainee with a full set of instructional material.
- Provide ANL with a date schedule for the course one full week prior to the first day of the course.
- Provide a measure of trainee comprehension of the course by assignment of homework that is graded (as appropriate) and administration of an exam at the end of the course session. The exam will be graded by the contractor and the grades kept confidential as specified in Section 1.2.
- Provide a course evaluation whereby the instructors evaluate the course presented with recommendations for revisions as well as recommendations for additional courses.
- Provide instructional handout material for the trainees one week before start of the course.

ANL and OEP are responsible for the following:

- Notifying and registering the trainees based on the schedule provided by the contractors.
- Providing the contractor with a roster of class attendees.
- Distributing course material to the trainees upon receipt from contractor.
- Provide classroom visual aid equipment support.

SUBTASK 1C PRE AUDITS

In this subtask the contractor is responsible for the conduct of two preaudits using the procedures described in the contractors proposal response to the ANL Request for Proposal as well as the guidelines established in the Description of Work in the Basic Ordering Agreement. The two preaudits will be done simultaneously and will involve a parallel effort by two audit teams (T1 and T2). The contractor will also conduct on-the-job training of OEP trainees during the preaudit subtask.

For purposes of this sub-task the preaudit analysis is considered to have four parts: 1) data collection and plant inspection, 2) data analysis and determination of sites for data monitoring, 3) development of recommendations, and 4) report preparation and

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presentation. The contractor is responsible for the following activities relating to these parts of the work:

- Work with plant management and operating personnel to obtain the necessary technical data and general information required under the contractors preaudit procedure (T1 and T2) (Note: The contractor will not be able to simply drop off data collection forms with plant personnel but will have the responsibility to assist and guide plant personnel in the data collection activity. The contractor will confer with plant personnel in the estimation of certain data where recorded measurements have not or cannot be documented because of lack of monitoring instrumentation.) - (T1 and T2)

- Work with plant management to obtain an accurate and meaningful assessment of "hard-wired" and portable monitoring instrumentation that the plant facility requires to better document energy or energy-related process measurements for future analysis: (T1 and T2)

- Provide on-the-job training to OEP trainees during the preaudit data collection and evaluation (T1 and T2)

- Analyze preaudit data and provide ANL and OEP with a copy of all software used in the preaudit data evaluation inclusive of full documentation and user instructions (See Section 2.1) - (T1 and T2)

- Preparation of two preaudit reports. - (T1 and T2)

- Presentation of two preaudit reports to ANL and OEP management and trainees. For this activity only one presentation per plant preaudit report is required (i.e., separate presentations are not required for OEP staff and trainees). - (T1 and T2)

- Modification of prepared Pre Audit Reports as directed by ANL. - (T1 and T2)

- Presentation of Pre Audit Reports to respective plant management. - (T1 and T2)

- Modification of Pre Audit Reports as requested by Plant Management and approved by ANL and OEP. - (T1 and T2)

ANL and OEP will be responsible for:

- Scheduling plant facilities for preaudit based on a timely choice by contractor.

- Assigning trainees to each audit team, T1 and T2.

- Scheduling the presentation of preaudit report to OEP and Plant Management.

SUBTASK 1D INSTRUCTION ON AUDIT PROCEDURES AND ANALYSIS

This subtask involves classroom training (same trainees as in subtask 1b) for four to five days on the contractors procedures and analysis during an actual plant audit. The emphasis of the course should be on the general types of plant systems and equipment evaluated (i.e., boilers, furnaces, steam lines, electric motors, etc.), the types of measurements taken and the equipment used to perform the measurements. The contractor need not schedule the classroom session to run entirely on consecutive days but is encouraged to schedule the session to allow the trainees to digest the information between classroom sessions and participate in on-the-job audit training before returning to the classroom.

Although the emphasis of the classroom training is on field measurement of industrial equipment and systems, the course should provide an introduction to the analysis of data inclusive of computer-software-assisted analysis procedures. At the conclusion of the classroom session the contractor will administer an exam to determine trainee comprehension of the material covered.
The contractor shall:

- Provide ANL with an "instruction package" as described in Section 1.2.

- Provide each trainee with a full set of instructional material.

- Provide ANL with a date schedule for the course one full week prior to the first day of the course.

- Provide a measure of trainee comprehension of the course by assignment of homework (as appropriate) that is graded where the grades are recorded. The contractor will administer an exam toward the end of the classroom session. The contractor will grade the exam and keep the grades confidential pending disposition by OEP as specified in Section (1.2).

- Provide an evaluation whereby the instructor(s) evaluate the course that was presented with recommendations for revisions as well as recommendations for additional courses.

ANL and OEP are responsible for the following:

- Notifying and registering the trainees based on the schedule provided by the contractors.

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- Providing the contractor with a roster of class attendees
- Distributing course material to the trainees upon receipt from contractor.
- Providing classroom, projectors, overheads and other classroom support.

SUBTASK 1E AUDITS AND ON-THE-JOB AUDIT TRAINING

In this subtask the contractor is responsible for the conduct of two industrial audits based on the approved preaudit reports described under Subtask 1C. The contractor is responsible for using the audit procedures described in the proposal response to the ANL Request for Proposal and the BOA Description of Work. The two audits will be done simultaneously and therefore consist of a parallel effort by the equivalent of two audit teams (T1 and T2). The contractor will also conduct on-the-job training of OEP trainees during the audit subtask.

For purposes of this sub-task, the audit analysis is considered to have four parts: 1) instrument setup and plant personnel briefing, 2) data collection and analysis, 3) development of recommendations for energy conservation measures inclusive of economic analysis, and 4) report preparation and presentation. The contractor is responsible for the following activities relating to these part of the work:

- Work with plant management and operating personnel to set up the appropriate measurement instrumentation and schedule of data measurement based on the plant operating schedule. - (T1 and T2)
- Perform the necessary measurements recognizing the load performance of equipment and systems monitored. - (T1 and T2)
- Provide on-the-job training to OEP trainees during the instrument set up, audit data collection and evaluation. - (T1 and T2)
- Analyze audit data and provide OEP/ANL with a copy of all software used in the audit data evaluation inclusive of full documentation and user instructions. (See Section 1.1). - (T1 and T2)
- Prepare two audit reports to include recommendations for energy conservation with economic analysis as generally outlined in the ANL Description of Work and the contractors response to the ANL Request for Proposal.

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- Present two audit reports to ANL and OEP management and trainees. For this activity, only one presentation per plant audit report is required. (i.e., separate presentations are not required for OEP staff and trainees) - (T1 and T2)

- Modification of prepared Audit Reports as directed by ANL. - (T1 and T2)

- Presentation of Audit Reports to respective plant management (T1 and T2).

- Modification of prepared Audit Reports as requested by plant management and approved by ANL and OEP. - (T1 and T2)

- Evaluation of trainee performance during the audit.

ANL and OEP will be responsible for:

- Scheduling plant facilities for audit based on a timely final report by contractor of the preaudit activity.

- Assigning trainees to each audit team, T1 and T2.

- Scheduling the presentation of audit reports to ANL and OEP, and Plant Management based on a timely indication by contractor when they would be prepared for the presentations.

1.2 DELIVERABLES

In this section the contractors responsibility to deliver written reports, and other task-related information is specified. This work order requires the contractor to provide seventeen deliverable items. Each deliverable item is consecutively numbered (1 through 17) and is listed under the appropriate subtask (Subtask 1a through 1e) that is described in Section 1.1. The time schedule for deliverables is contained in Appendix A. Unless otherwise stated the contractor is responsible for delivery of an original plus five copies for all prepared material.

SUBTASK 1A PLANT SELECTION FOR PRE AUDIT AND AUDIT

DELIVERABLE NO. 1: PLANT SELECTION REPORT

The contractor is responsible for the submission to ANL of two typewritten plant selection reports. One report is required for each of the two plants selected for preaudit and audit. Each report will specify the choice of a plant or specific industrial process system within a plant for preaudit analysis. The report will contain the rationale for the

choice of the plant for preaudit supported by the contractors analysis of OEP plant data and the contractors evaluation during a one-day plant inspection visit.

SUBTASK 1B PRE AUDIT INSTRUCTION

DELIVERABLE NO. 2: PRE AUDIT COURSE INSTRUCTION PACKAGE

The contractor is responsible to deliver to ANL one copy of all course-related material that will be used in the preaudit instruction. All information will be in English recognizing that English is a second language for the trainees. The course-related material will include material that the instructor uses as well as material that will be used by the trainee. Course-related material used by the instructor includes a copy of all visual aid material such as slides and overheads (Paper copy of overheads is acceptable) used during classroom instruction. Course-related material used by the trainee includes all textbooks, workbooks or other printed material distributed for the trainees use.

The contractor is also responsible for including the following with the Pre Audit Instruction Package:

- A course topical outline by session day indicating the number of hours per day devoted to each topic and the recommended schedule of time between class sessions for study and homework assignments.
- A complete set of homework assignments that will be distributed to the trainees.
- A copy of an exam that will be given to the trainees toward the completion of the course with an answer sheet.
- One copy of all software used in the pre audit evaluation instruction inclusive of documentation and user instructions with licensing terms and costs for use of the software by ANL and OEP.

DELIVERABLE NO. 3: PRE AUDIT COURSE INSTRUCTIONAL MATERIAL FOR DISTRIBUTION TO TRAINEES

The contractor is responsible for supplying ANL with sufficient copies of prepared training information for each trainee (estimated to be no more than ten trainees) plus 3 copies for files. As part of this training material, the contractor is responsible for supplying the trainees with a glossary of definitions of "often used" technical terms as well as conversion tables allowing for conversion from English, Engineering, Metric and SIU units. The contractor is responsible for delivering a 2-3 day training course on preaudit procedures and analysis using this material described in Section 1.1.

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DELIVERABLE NO. 4: PRE AUDIT COURSE TEST RESULTS

The contractor is responsible for supplying ANL with the full set of graded tests resulting from the exam given toward the conclusion of the preaudit course. The contractor will also supply ANL with a separate grade tabulation sheet which lists each students grade by descending order of magnitude of the grade. As indicated in Section 1.1, the contractor will not distribute the test scores to the trainees and will leave this responsibility entirely to OEP.

DELIVERABLE NO. 5: PRE AUDIT COURSE EVALUATION REPORT

The contractor is responsible for submitting to ANL a formal typewritten course evaluation report. The test score results may be part of the report. The contractor will evaluate the course that was presented and provide recommendations for course improvement as well as recommendations for additional course work.

SUBTASK 1C PRE AUDIT

DELIVERABLE NO. 6: PRE AUDIT DATA ANALYSIS PACKAGE

The contractor is responsible for submitting to ANL one copy of all computer software used in the preaudit data evaluation inclusive of full documentation and user instructions. The contractor is responsible for specifying to ANL the licensing conditions and costs for use of the software by ANL and OEP. If the same software is used for both preaudit training and preaudit plant facility evaluation, only one submission is required to comply with deliverable requirements.

DELIVERABLE NO. 7: PRE AUDIT DRAFT REPORT AND PRESENTATION TO ANL AND OEP

The contractor is responsible for providing ANL with a typewritten draft report for each of the two plant facilities that undergo a preaudit evaluation. The report will include the proposed scope of the overall audit, target areas where energy savings may be found, estimated schedule for the completion of the audit, disposition of plant management and operators toward the audit, estimated cost of the audit, and any other information supportive of a recommendation. The contractor is also responsible for the presentation of these recommendations to ANL and OEP for each facility evaluated.

DELIVERABLE NO. 8: PRE AUDIT REPORT AND PRESENTATION TO PLANT MANAGEMENT

The contractor is responsible for modifying each draft preaudit report at the request of ANL prior to presentation to plant management. After modification, if called for, the contractor is responsible for the submission of a formal preaudit report and presentation to plant management.

DELIVERABLE NO. 9: PRE AUDIT FINAL REPORT

As a result of suggestions and comments from plant management, the contractor is responsible for revising the preaudit reports under Deliverable No. 8 above and submitting a final preaudit report for each plant facility to ANL.

DELIVERABLE NO. 10: AUDIT COURSE INSTRUCTION PACKAGE

The contractor is responsible to deliver to ANL one copy of all course-related material that will be used in the audit instruction. All course-related material will be in English recognizing that English is a second language for the trainees. The course-related material includes material that the instructor uses as well as information that will be used by the trainee. Course-related material used by the instructor includes a copy of all visual aid material such as slides or overheads (a paper copy of overheads is acceptable) used during classroom instruction. The contractor is also responsible for specifying all measurement or monitoring equipment that will be used during classroom instruction. The equipment list must be specific and include vendor name and model number. Course-related material used by the trainee includes all textbooks, workbooks or other printed material distributed for the trainees use.

The contractor is also responsible for including the following with the Audit Instruction Package:

- A course topical outline by session day indicating the number of hours per day devoted to each topic and the recommended schedule of time between class sessions for study and homework assignments, and field training.

- A copy of an exam that will be given to the trainee toward the completion of the course with answer sheet.

- One copy of all computer software used in the audit evaluation instruction inclusive of documentation and user instructions with licensing terms and costs for use of the software by ANL and OEP.

DELIVERABLE NO. 11: AUDIT COURSE INSTRUCTION MATERIAL FOR DISTRIBUTION TO TRAINEES

The contractor is responsible for supplying a sufficient number of copies of prepared training information for each trainee (estimated to be no more than ten trainees; the same trainees that participate in the preaudit instruction course) plus 3 copies for files. As part of this training material, the contractor is responsible for supplying the trainees with a glossary of definitions of "often used" technical terms as well as conversion tables allowing for conversion from English, Engineering, Metric and SIU units. The contractor is encouraged to develop the glossary of terms and unit conversion tables to accommodate both the preaudit and audit instruction courses.

DELIVERABLE NO. 12: AUDIT COURSE TEST RESULTS

The contractor is responsible for supplying ANL with the full set of graded tests resulting from the exam given toward the conclusion of the audit course. The contractor will also supply ANL with a separate grade tabulation sheet which lists each students grade by descending order of magnitude of the grade. As indicated in Section 1.1, the contractor will at no time reveal the test scores to the trainees and will leave this responsibility entirely to OEP.

DELIVERABLE NO. 13: AUDIT COURSE EVALUATION REPORT

The contractor is responsible for submitting to OEP/ANL a formal typewritten course evaluation report. The test score results may be part of the report. The contractor will evaluate the course that was presented and provide recommendations for course improvement as well as recommendations for additional course work.

SUBTASK 1E AUDITS/FIELD TRAINING

DELIVERABLE NO. 14: AUDIT DATA ANALYSIS PACKAGE SUBMISSION

The contractor is responsible for submitting to ANL one copy of all computer software that will be used in the audit data evaluation inclusive of full documentation and user instructions. The contractor is responsible for specifying to ANL the licensing conditions and costs for use of the software by ANL and OEP. If the same software is used for both audit training and audit plant facility evaluation, only one submission is required to comply with both deliverable requirements.

DELIVERABLE NO. 15: AUDIT DRAFT REPORT AND PRESENTATION TO ANL AND OEP

The contractor is responsible for providing ANL with a typewritten draft report for each of the two plant facilities that undergo an audit evaluation. The report will provide specific energy conservation recommendations that can be readily implemented. An economic analysis must be performed for each recommendation. The economic analysis shall use both existing prices of energy and equivalent world prices of energy to evaluate the recommendation. The audit report will include all new data in an appendix, documentation as to the calibration of instrumentation, all assumptions made, algorithms used in the analysis, and all other pertinent data necessary to support the energy conservation recommendations. The contractor is also responsible for preparing and delivering a presentation to ANL and OEP on the report.

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DELIVERABLE NO. 16: AUDIT REPORT AND PRESENTATION TO PLANT MANAGEMENT

The contractor is responsible for modifying each draft audit report and presentation at the request of ANL prior to presentation to plant management. After modification, if called for, the contractor is responsible for the submission of a formal audit report and presentation to plant management.

DELIVERABLE NO. 17: AUDIT FINAL REPORT

As a result of suggestions and comments from plant management, and with the approval of ANL and OEP, the contractor is responsible for revising the audit reports prepared under Deliverable No. 15 above and submitting a final audit report with 10 copies to OEP/ANL.

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2 PERSONNEL

2.1 ASSIGNMENT OF PERSONNEL

The contractor will assign the staff indicated on Tables 2-1 and 2-2 to work on the project for the effort level and time periods shown. For all personnel who will work in Egypt, the contractor will provide to ANL a complete and up-to-date resume or work history.

The personnel indicated on Tables 2-1 and 2-2 as working in Egypt are deemed to be key individuals. The contractor will not replace these individuals nor change their assignments or work schedules on the task without the consent of ANL.

2.2 DESIGNATION OF IN-COUNTRY CHIEF-OF-PARTY

The contractor shall designate one individual of the group working in Egypt, to serve as In-Country Chief-of-Party. This individual will have responsibility for all activities carried out in Egypt under this work order. The In-Country Chief-of-Party will provide ANL with a verbal progress report once per week or more frequently if conditions warrant it. ANL will designate the individual to receive this progress report. The individual may be located either in Egypt or at Argonne's Illinois site.

TABLE 2-1 PERSONNEL ASSIGNED TO TASK

Name	Billing Category	Responsibility	Effort Level by Subtask, person-hours					Total Effort person-hours
			Subtask 1A	Subtask 1B	Subtask 1C	Subtask 1D	Subtask 1E	
In-County Personnel								
1.								
2.								
3.								
4.								
5.								
6.								
7.								
8.								
9.								
10.								
Home Office Personnel								
(Individual names not required. Billing category only) 1.								
2.								
3.								
4.								
5.								
6.								
7.								
8.								
9.								
10.								

TABLE 2-2 IN-COUNTRY PERSONNEL SCHEDULE

Name[c]	Billing Category	Project Activity During Week[a,b]												
		1	2	3	4	5	6	7	8	9	10	11	12	13
1.														
2.														
3.														
4.														
5.														
6.														
7.														
8.														
9.														
10.														

[a]Indicate "I" for work done in Egypt, "O" for work done on the task but out of Egypt, "X" for not working on the task.

[b]Week denotes the in-county portion of the task commencing with the work of Subtask 1A.

[c]In-County personnel only.

3 ADMINISTRATIVE REQUIREMENTS AND PROVISIONS

3.1 CONTRACTOR RESPONSIBILITIES TO ANL

The contractor will take all direction in the conduct of this task from ANL. No reports, either formal or informal, shall be delivered to anyone outside of ANL without the expressed approval of ANL. Any modifications to the subtasks, time schedule, budget, or general thrust of the activity will be discussed with ANL and approved before being implemented.

At no time shall the contractor make commitments to any organization (U.S. or Egyptian) to undertake activities outside the work order. All commitments for additional work or modifications to current work will be made by ANL.

3.2 REPORTING COSTS

At the request of the Egyptian Organization for Energy Planning (OEP), Argonne National Laboratory (ANL) has developed a very specific set of procedures for reporting costs. The contractor must comply with these procedures when reporting their costs to ANL. The procedures and copies of forms to be used to compile cost data are co in Appendix B. The contractor is also responsible for identifying to ANL and in that will be in a position to answer any questions regarding cost reports.

3.3 WORKING HOUR ADJUSTMENTS

As specified in the Basic Ordering Agreement, the basic work week for this task is 40 hours/week and 8 hrs/day. However based on a proper showing of cause by the contractor, authorization can be given to exceed this effort level. ANL will designate staff members that have the authority to allow the contractor to work in excess of the 40 hour week and 8 hour day.

3.4 FOREIGN TRAVEL, TRIP REPORTS, AND CUSTOMS CLEARANCE

As specified in Appendix C of the Basic Ordering Agreement, all travel outside the continental U.S. requires written Laboratory and DOE approval. In addition, AID requires all visits to Egypt to have the approval of the AID Mission in Cairo. To meet all of these requirements, the contractor must complete DOE Form 445 and submit it to the Laboratory 14 days prior to any trip to Egypt. ANL will secure the necessary DOE and AID approvals and will notify the contractor of these approvals. All contractor travel is expected to comply with the travel policy of Appendix C in the Basic Ordering Agreement.

Within 30 days of completion of each trip, the contractor shall submit a trip report to ANL. The report shall follow the guidelines of Appendix C of this work order.

The contractor is required to specify to ANL all equipment (monitoring instrumentation, spare parts, etc.) that will be brought to Egypt to accomplish this task. The specification includes, quantity, manufacturer name and serial number and a short description of the item. This information must be provided two weeks in advance of the equipment arrival in Egypt. This information is necessary in order for ANL and OEP to provide the required customs clearance in Cairo.

3.5 ANL AND OEP SUPPORT TO CONTRACTORS

Argonne National Laboratory (ANL) has joint offices with the Egyptian Organization for Energy Planning (OEP) that are centrally located in Cairo, Egypt. This allows ANL and OEP to provide certain support for the contractors in the accomplishment of this task. The items of support are as follows:

- Two vehicles with Egyptian national driver (one for each audit team).
- Office accommodations (i.e., desk, chairs, ordinary office supplies) for all contractor in-country personnel.
- Telex and telephone service from ANL offices (for business purposes related to this task only).
- Photocopy facilities inclusive of paper.
- Secretarial services (ANL has a full time Egyptian national secretary that has an excellent command of verbal and written English).
- Use of overhead projector, 35 mm carousel slide projector, large projection screen and flip chart.
- Use of a personal computer, (COMPAQ Plus, IBM-PC-Compatible) computer with 512K bytes of memory, integrated 10 m Byte hard disk drive and monachrome monitor. Also use of COMPAQ compatible dot matrix graphics printer, and external color monitor.
- Assistance in obtaining hotel accommodations in Cairo at preferential rates.

The contractor is expected to make use of the above items as needed. Support required in addition to the above items must be supplied by the contractor.

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4 BUDGET

The budget for this task is described on Table 4-1. This breakdown is the same as will be used to report actual billings (see Appendix B).

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TABLE 4-1 BUDGET

1. Effort

	Billing Category	Person-Hours	Rate	Cost
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
	SUBTOTAL			

2. Travel

No trips
- Foreign
- Domestic

Airfare
- Foreign
- Domestic

Per Diem (Hotel/
Living Expenses)

Other Travel Costs

SUBTOTAL

3. Materials and Services

1. (Itemize major materials/services costs.)
2.
3.
4.
5.
6.
7.
8.
9.
10.

SUBTOTAL

TABLE 4-1 (Cont'd)

4. Subcontracts[a]	
Subcontract A	
Subcontract B	
SUBTOTAL	
5. Other Costs	
Overhead	
General and Administrative	
Profit	
SUBTOTAL	
TOTAL WORK ORDER	

[a]Note: Subcontractor costs must be itemized in detail (i.e., using the same description of items 1-5 as the contractor's costs. Add additional tables as required.

APPENDIX A

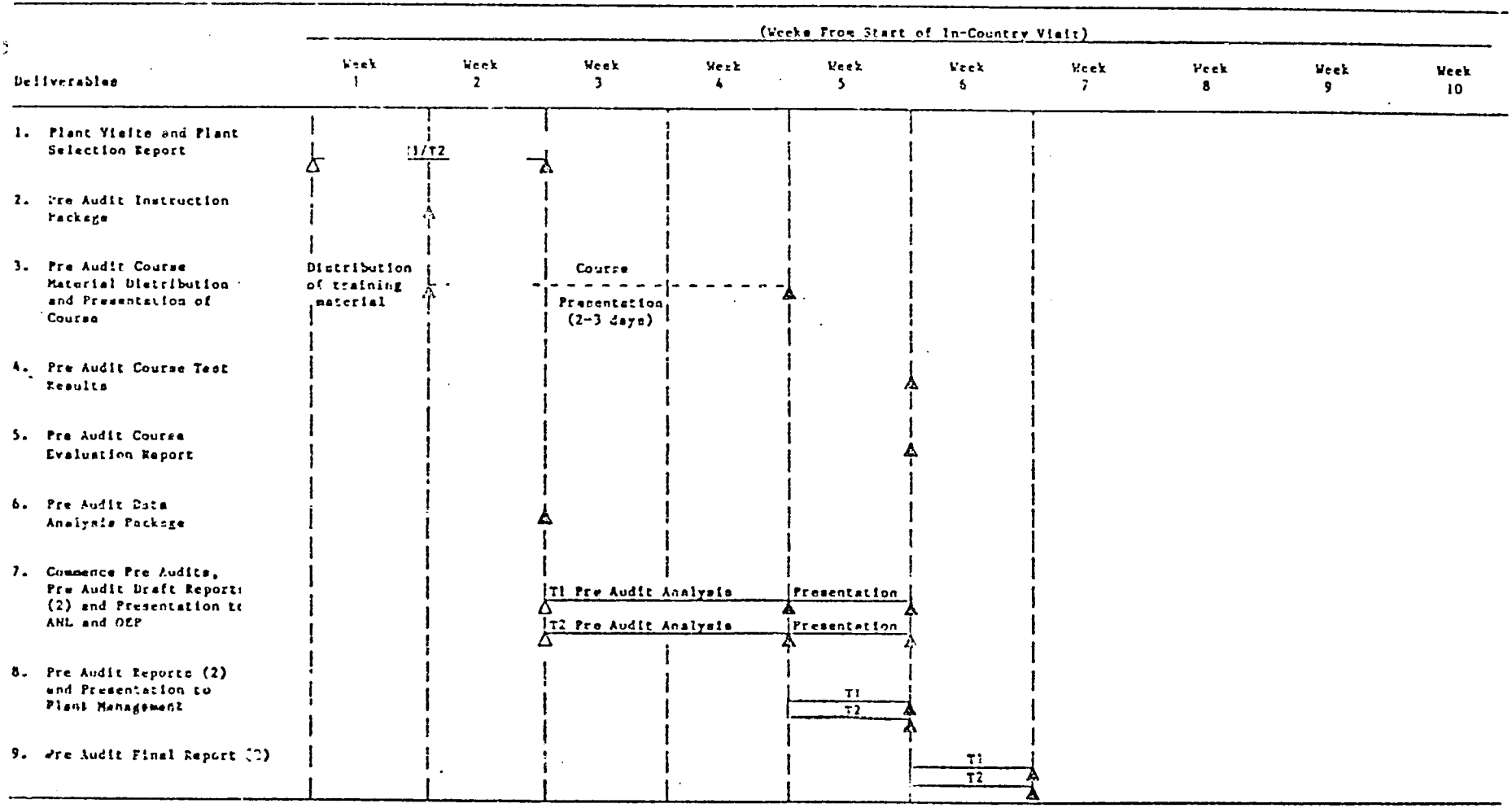
Time Schedule for Deliverables and Completion of Subtasks.

Table A-1 contains a time schedule for the completion of subtasks described in Section 1.1 and deliverables described in Section 1.2. Since all subtasks culminate with a deliverable, the time schedule has been keyed to the deliverables itemized (1 through 7) in Section 1.2.

The time schedule begins with the first week that the contractor begins the Subtask1A activity in-country. The time schedule is structured in this manner because no deliverable is required of the contractor until one week after the in-country activity starts. However, the contractor is expected to begin work on Subtask 1A as soon as the task order has been struck with ANL. It is expected that the contractor will immediately begin work on deliverables such as preaudit and audit course preparation prior to in-country activities.

The time schedule displayed in Table A-1 indicated for most of the subtasks and the associated deliverables a time for completion of the activity and delivery of the required information. This time is indicated by the symbol ▲ . For some of the subtask deliverables a beginning date is specified because of plant scheduling requirements. The start dates for these deliverables are indicated by the symbol Δ .

TABLE A-1 SCHEDULE FOR TASKS AND DELIVERABLES



[a]The notation T1 and T2 indicates a parallel effort is required by the equivalent of two audit teams.

TABLE A-1 (Cont'd)

Deliverables	(Weeks From Start of In-Country Visit)									
	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
10. Audit Course Instruction Package										
11. Audit Course Material Distribution and Presentation		Distribution of training material		Course (4-5 days)						
12. Audit Course Test Results										
13. Audit Course Evaluation Report										
14. Audit Data Analysis Package										
15. Commence Audit, Audit Draft Report and Presentation to ANL and OEP			T1	Setup	Audit and Analysis			Presentation		
			T2	Setup	Audit and Analysis			Presentation		
16. Audit Reports and Presentation to Plant Management									T1 T2	
17. Audit Final Report										T1 T2

[a]The notation of T1 and T2 indicates a parallel effort is required by the equivalent of two audit teams.

APPENDIX B

GUIDELINES FOR REPORTING COSTS

Instructions for Reporting Expenses

1. Effort

Each individual for whom effort is charged must have a daily effort report form (Table 1.1).

All effort billed must be summarized on Table 1.

2. Travel

Each trip that is charged must have a travel expense report (Table 2.1).

All travel billings must be summarized on Table 2.

Receipts are to be included in an attachment.

3. Materials and Services

All items purchased must be itemized (Table 3).

Receipts are to be included in an attachment.

4. Subcontractors

Subcontractors must report effort, travel, materials and services, and overhead expenses in the same format as the contractor. An attachment for each subcontractor should be appended.

The contractor must summarize subcontract costs (Table 4).

5. Overhead, General and Administrative, Profit

The contractor must tabulate these costs (Table 5).

6. Summary

The contractor must summarize all costs included in the voucher (Table A).

TABLE 1.1 INDIVIDUAL EFFORT REPORTING FORM

Voucher No._____

Period Covered_____

Name_____ Organization_____ Job Category_____

Date	Time Start	Time End	Working Time (Hours)	Site Where Work Performed	Description of Activities

Signature_____

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TABLE 1 EFFORT SUMMARY

Period Covered _____

Voucher No._____

Name	Organization	Category	Hours Billed	Rate	Billing
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
		Total	_____		_____

Voucher No._____

Table 2.1 Individual Travel Expense Report

Traveler _____

Destination _____

Purpose of Trip _____

Trip Start _____ _____
Date Time

Trip End _____ _____
Date Time

Itemized Expenses (Provide Receipts)

Description	Amount (US$)
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

Note: For expenses paid in foreign currency, indicate foreign currency amount, exchange rate, and US$ amount.

Note: Itemize hotel expenses separately.
Itemize per diem expenses separately.
Itemize miscellaneous expenses (e.g. taxi, mileage) separately.

TABLE 2. TRAVEL SUMMARY

Voucher No._____

Period Covered_____

Traveler	Destination	Trip Start	Trip End	Trip Purpose	Expense Summary			
					Airfare	Hotel	Per Diem	Other
1.								
2.								
3.								
4.								
5.								
6.								
7.								
8.								
9.								
10.								
				TOTAL				

CATEGORIES TO BE USED FOR MATERIALS AND SERVICES

1. General Supplies

   1.1 Miscellaneous Supplies ($100 per item)

   1.2 Miscellaneous Supplies ($100 per item)

2. General Services

   2.1 Graphics and reproduction

   2.2 Computing

   2.3 Clerical

   2.4 Other purchased services

3. Equipment

   3.1 Office equipment (< $500 per item)

   3.2 General equipment (< $500 per item)

   3.3 Major Equipment (> $500 per item)

4. Communications and Freight

   4.1 Telephone, telex

   4.2 Freight shipment

5. Other

   (Itemize)

Note: All charges except Miscellaneous Supplies (< $100 per item) must be itemized and substantiated by receipts, vouchers, etc.

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TABLE 3. MATERIALS AND SERVICES

Voucher No._____

Ref. No.	Category	Item Description	Item Cost	Markup	Billed Cost
		Total			

TABLE 4. SUBCONTRACTOR COST SUMMARY

Voucher No. _____

Period Covered _____

Subcontractor	Subcontractor Cost Total[a]	Markup	Billed Cost
Total	_____	_____	_____

[a]Note: Subcontractor costs must be documented in attachments in the same format as contractor costs (i.e. Effort, Travel, Materials and Services, Overhead and Profit).

TABLE 5. OVERHEAD, GENERAL AND ADMINISTRATIVE, PROFIT

Period Covered _____

Voucher No. _____

Expense Item	Base Upon Which Charged*	Rate	Billed Cost
	Total		

Attachment

1. Travel Receipts

2. Materials and Services Receipts

3. Subcontractor Cost Detail

   Including Tables 1, 1.1, 2, 2.1, 3, 4 (if appropriate), 5

   One attachment for each subcontractor

Table A. SUMMARY OF COSTS

Contractor _____

Voucher No. _____

Period Covered _____

Effort Billing _____

Travel Billing _____

Materials and Services Billing _____

Subcontractor Billing _____

Overhead/General and Administrative/
Profit _____

TOTAL BILLING THIS VOUCHER _____

APPENDIX C

GUIDELINES FOR TRIP REPORT

GUIDELINES FOR TRIP REPORTS

1. General Requirements. Trip reports are required for all foreign travel, including foreign travel when the traveller's salary is paid by DOE but the travel costs are borne by non-DOE sources, within 30 days of return to duty station.

2. Purpose. Trip reports are intended to be a principal mechanism for the timely and orderly dissemination of information about international energy R & D, thereby ensuring that DOE as a whole receives the greatest possible benefit from foreign travel by individuals. Specifically, trip reports are a means for identifying, describing and evaluating foreign energy R & D activities, and for providing information for the evaluation and planning of international cooperation in energy R & D. In addition, trip reports provide a basis for evaluating and monitoring the tangible benefit of foreign travel to DOE's programs and commitments, and thereby, are an integral element in DOE's overall foreign travel planning and control system.

3. Content and Format. In addition to local requirements, trip reports shall be prepared to satisfy the broad objectives stated in item 2 above. Particular information items identified below are minimum requirements, intended also to provide a consistency of content to reports. Beyond meeting minimum information requirements, the reporter has the responsibility to prepare a comprehensive report. Sound judgment should be used in excluding insignificant or trivial information.

   Trip reports shall consist of three primary sections:

   a. A summary, preferably one page highlighting pertinent information in the trip report, on the basis of which a reader can determine interest in reading the report in full. This summary shall include the following information:

      (1) The name of the traveller, position, DOE or DOE contractor organization represented, and the date of trip report.

      (2) The destination(s), by installation and organization, city and country, and dates of the trip and key personnel contacted.

      (3) A succinct statement of the purpose of the

      (4) An abstract of information contained in the full report.

   b. A comprehensive and detailed trip report, which includes the following information, as applicable:

      (1) A detailed statement of the purpose of the work or activities, and the relationship to U.S. and DOE programs, commitments and interests.

(2) A summary of the work or activities, emphasizing conclusions, decisions, significant findings, problem areas, and recommendations made.

(3) A brief description of the travelers' role, including participation in significant discussions and events.

(4) Recommendations concerning future or follow-up activities.

(5) The identification, description and evaluation of any significant technical or scientific developments or energy programs in other countries, in addition to such information items as level of effort, funding, time schedules, short and long range objectives, pertinent administrative information, key personnel, research sites, and the importance of the particular R & D area to the overall national energy policy of the country visited.

(6) A summary evaluation of the trip from the standpoints, as appropriate, of U.S. DOE, and scientific or technical interest.

c. An appendix, which includes the following information items:

(1) A full itinerary.

(2) A list of persons contacted, with titles and organization represented, grouped by context of contact.

(3) A bibliographical listing of literature acquired.

4. Classification. Reports shall be classified on the basis of their contents. If they do not contain classified information, but include political or administratively sensitive items, they shall be marked "Official Use Only." If the report contains information learned from a foreign source which may be classified in another country or reflects political attitudes of foreign representatives which might be harmful to individual interests if publicly released, it shall be classified as at least "Confidential, Security Information." Where possible, the classified portions of reports should be separated from the main body of the report and filed separately. This will assure that classified documents are not unnecessarily bulky. If no classified or sensitive information is included, the report shall be unclassified.

5. Submission and Distribution of Trip Reports. Authorities delegated responsibility for approving individual requests for foreign travel also have the responsibility for assuring that trip reports are submitted on time, and for distributing six copies to DOE Headquarters as follows:

	Copies
a. Cognizant Program Assistant Secretary	1
b. Cognizant Program Division	1
c. Office of International Security Affairs	2
d. Office of International Affairs	2

Reports of an especially sensitive or classified nature shall be controlled on a need to know basis by the approving authority.

APPENDIX

3.8.1-16

CONDENSED DESCRIPTION OF ANL AUDIT PROCEDURES
SPECIFIED IN WORK ORDER 1

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Work Performed: Task 2 - Industrial Energy Audit/Training - Work Order

BOA Contracts Established for Industrial Audit/Training: In October 1985 Argonne National Laboratory developed Basic Ordering Agreements (BOAs) with three firms for the conduct of industrial energy audits and audit training in Egypt. The three firms are:

- o Foster Wheeler Energy Corporation
- o Hagler, Bailly and Company
- o Stanley Consultants

The first BOA Work Order was submitted as a Request for Proposal (RFP) in October 1984. The Work Order that was issued is identical to the draft work order included in Appendix C of the July-August 1984 progress report.

All three BOA contractors submitted a proposal for the work order. An ANL proposal evaluation team was created to evaluate the proposals and provide a recommendation to the Argonne Procurement Division. After a careful evaluation, a recommendation was made to award the initial work of industrial audit and audit training to the Foster Wheeler Energy Corporation.

Contract Let for Work Order 1 (Pre-Audit Phase). A contract was let February 8, 1985 to Foster Wheeler Energy Corporation (FWEC) to perform Work Order 1 - Industrial Energy Audits (see July-August 1984 Progress Report for a copy of Work Order 1). Under the conditions of the contract, FWEC was authorized to proceed with work only through the pre-audit stage (i.e. inclusive of the plant screening). Based on the pre-audit reports, FWEC would then present to OEP/ANL a separate cost proposal (i.e. effort and personnel with associated cost and schedule) to complete the audits. The pre-audit training course would be part of the pre-audit effort, as well as the audit training course material and analytical tools (for review and distribution to OEP in advance of the proposed course).

Plant Screening - Work Order 1 (Pre-Audit Phase). At the request of ANL, OEP developed a list of ten plants from which two could be selected for the Work Order 1 industrial audits. OEP performed this task and developed a visit schedule in coordination with the in-country arrival of the FWEC plant screening team. M. Monarch (ANL) and the FWEC plant screening team participated in the plant screening phase during the period December 9-20, 1984. During this period a joint plant screening audit team was developed with FWEC and OEP audit engineers. The team visited the plants selected as candidates for the first set of industrial audits and audit training. The two companies chosen were the Cairo Dyeing and Finishing Company, a firm engaged in the manufacture of dyed and finished fabric, and the National Metal Industries Company, a firm that produces finished rebar from scrap, pig iron and billets. Two plants operated by the Cairo Dyeing and Finishing Company were chosen for audit. The two plants are located adjacent to each other in the Cairo area. The National Metal Industries plant chosen for audit is also located in the Cairo area. The significant energy demand for the three plants is mazout (i.e. equivalent to No. 6 fuel oil) and electricity. The combined base year consumption for the three plants is approximately 48 million metric tons per year of mazout and 33 million kWh per year of electricity.

Pre-Audit Evaluation — Work Order 1 (Pre-Audit Phase)

The preaudit plant evaluations and preaudit training took place during January 1985. The objective of the preaudit phase is to develop a detailed plan for each audit and provide preaudit classroom and on-the-job training to the OEP audit engineers.

For the preaudit activity, a joint OEP/plant personnel audit team was developed to be trained by FWEC and participate in the preaudit evaluations with the FWEC preaudit team.

The inclusion of plant personnel in the audit team was a key element of the subsequent success of the entire audit activity. In this way the plant engineering personnel were made an active party to the audit activity and plant management was continuously advised through their people of the progress of the preaudit analysis.

The preaudit team evaluated each plant and determined the specific Energy Conservation Opportunities (ECOs) that should be evaluated. For each ECO selected, a determination was made of the specific in-plant measurements that would have to be performed and the analysis procedures and expertise that would be required for both technical and economic analysis during the audit phase.

At the conclusion of the preaudit analysis, two draft reports were prepared — one for the two textile company plants and one for the steel company plant. The preaudit report presented an analysis of plant annual energy consumption in various modes (e.g. per unit of production, per month, total and by fuel type). The report then proceeded to establish specific ECOs that should be investigated. The ECOs were grouped into opportunities that required little capital investment, such as pipe insulation, and those that required a moderate-to-significant capital investment, such as the use of heat pipes to recover heat from hot air leaving the dryer stacks to preheat cold, incoming combustion air and cogeneration. Once the ECOs were established, the preaudit report specified the types and location of measurements that would be needed for a technical evaluation of each ECO during the audit. Each preaudit report also included basic engineering data such as meteorological data, fuel specifications, electric rate structure, and other data that would be necessary to perform an in-depth technical and economic evaluation for each ECO.

The preaudit draft reports were reviewed and modified by OEP and ANL and presented to the respective companies for further comments and recommendations. The company management and staff reviewed the preaudit analysis and made some meaningful recommendations that resulted in a fine-tuning of the preaudit analysis. The company management of both the textile and steel companies basically concurred with the analyses and resultant audit plan and indicated their full cooperation with OEP and FWEC for the conduct of the audit.

Preaudit Training — Work Order 1 (Preaudit Phase). A preaudit training course was given during the preaudit activity. The energy conservation preaudit training course involved three days of formal classroom training and approximately three weeks of on-the-job training. The formal classroom training sessions were spread over the three-week preaudit activity,

allowing for reading and homework assignments between sessions. A total of 12 OEP staff engineers attended the course, and a final exam was given. All 12 OEP engineering personnel that actively participated in the course received a certificate of completion. Four textbooks and two workbooks were used during the formal training. This text material became the property of OEP. The formal classroom training was also supplemented by instruction in the use of software analysis programs that were used in the actual preaudit analysis. The software also became the property of OEP. At the conclusion of the course, the trainees were asked to evaluate the instructors and the course. This information, along with recommendations of the instructors, was part of a course evaluation report that was presented to Dr. Hussein Abdallah, Director of OEP. An itemized list of the preaudit training material that became the property of OEP at the conclusion of the training is presented in Attachment B.

Audit Proposal — Work Order 1 (Preaudit Phase). At the request of ANL, FWEC presented a separate cost proposal to proceed with the audit for the three plants, coupled with classroom and on-the-job audit training. The specific type and number of engineers, effort level, monitoring equipment, and subsequent cost necessary to evaluate the specific energy conservation opportunities for both the textile and steel plants and provide training was presented to OEP and ANL. The cost proposal was based on the audit plan that was laid out in the preaudit draft reports. After several meetings with OEP and ANL, a favorable decision was reached on the audit effort associated with Work Order 1.

Audit Training — Work Order 1 (Audit Phase): The audit training course involved five days of formal classroom training and approximately seven weeks of on-the-job training associated with the audit activity. The formal classroom training sessions were spread over the seven-week audit activity, allowing for reading and homework assignments between classroom sessions. A total of 17 OEP staff engineers attended the course; also some plant engineers from the plants that were audited were invited and attended some of the formal classroom sessions. Homework was assigned and graded, and a final exam was given. The course instruction material consisted of two workbooks prepared by FWEC especially for OEP. In addition to the text material, six commercial software programs licensed for use by OEP were used in the course presentation and actual audit analysis. See Attachments C and D for a listing of the audit training material. The software also became the property of OEP. The training course also emphasized the use of portable monitoring instruments.

At the conclusion of the course the trainees were asked to evaluate the instructors and the course. This information, along with recommendations of the instructors, was part of a course evaluation report that was presented to Dr. Hussein Abdallah, Director of OEP.

Audit - Work Order 1 - (Audit Phase): The audit evaluation of the three industrial plants began February 16, 1985 and was completed seven weeks later (per Work Order 1 schedule) on April 4, 1985. The audit evaluations were a coordinated effort among OEP audit engineers and the respective plant engineers and FWEC audit engineers.

At the conclusion of the audit analysis, two draft audit reports were prepared — one report for the two textile company plants and one for the

steel company plant. Each audit report presented an economic and technical analysis of a number of ECOs: The economic analysis was based on worldwide cost estimates for installed capital cost and fuel savings; the technical analysis was based on energy and material balances for plant processes supplemented by field measurements of plant operating parameters affecting energy consumption.

The draft reports were reviewed by OEP, plant management and ANL. After incorporating the appropriate comments from the concerned parties, the audit reports were finalized. The audit reports indicated that if all the ECOs for both plants that had a payback of three years or less were implemented, approximately 7.5 million Egyptian pounds (L.E.) per year would be saved in annual fuel savings by the investment of approximately 5.4 million L.E. Based on this aggregate date, the investment of 5.4 million L.E. would be paid by the energy savings in approximately nine months (i.e. the nine month period is an arithmetic average of all the ECOs in the one-to-three-year payback group). After this average nine month period, an annual 7.5 million L.E. would be saved by energy savings over the life of the energy conservation equipment (anywhere from 10 to 20 years).

Audit Portable Monitoring Instrument Package - Work Order 1 (Audit Phase). The audit phase contract with FWEC included the purchase of a package of portable monitoring instruments used for field measurements during an audit. The instrument package was purchased new at FWEC's actual cost. The instruments were used to support the audit activity and instruction was given in their use during formal classroom and field training sessions. At the close of business of the audit activity (April 4, 1985), each instrument was inspected by Carl Kastner (FWEC) in the presence of M. Monarch (ANL) and Engineer Ibrahim Hegazy (OEP) and turned over to OEP. All the instruments were considered to be in good order by visual inspection (see Attachment E for a description of the instrument package).

FOSTER WHEELER ENERGY CORPORATION

110 SOUTH ORANGE AVENUE · LIVINGSTON, NEW JERSEY 07039 · PHONE 201-533-1100

January 27, 1985
Letter #2.1-20
File 2.1, 1.2

Technical Representative
Argonne National Laboratories
Argonne, IL 60439

Attn: M. Monarch

FWEC Contract 11-35625
Argonne National Laboratories
Energy Audits & Audit Training in Egypt
Deliverable #1 final

Gentlemen:

The original transmittal of the plant screening report (ref ltr #2.1-7) was made in draft form, at OEP's request, such that comments by OEP could be incorporated prior to final issue.

This letter serves to transmit our final plant screening report which includes comments as received from OEP during our meeting of Dec 12, 1984 (ref ltr #2.1-10). Deliverable number one is satisfied by this report.

As a convenience to your records, we include herewith, as an attachment, the updated summary of deliverables for the project.

In the event that further discussion or clarification is required, please contact the undersigned.

Very truly yours,

FOSTER WHEELER ENERGY CORPORATION

C.E. Kastner, Jr.

CEK/ne

cc: H. Feintuch
T. Wolsko (ANL)
R. Houghton (ANL)

1/24/84 #19
1/27/84 #20

EGYPTIAN ENERGY AUDIT PROGRAM

SUMMARY OF DELIVERABLE ITEM SCHEDULE

SUB TASK	DELIVERABLE	TITLE	TIME (END OF WEEK
A	1	~~Plant Selection Report (2)~~ 12/20/84, 1/27/85 (w/comments)	2
1B	2	~~Pre Audit Course Instruction Pkg~~ 12/5/84	1
1B	3	~~Pre Audit Course Mtl for Trainees~~ 12/5/84	1
1B	4	~~Pre Audit Course Test Results~~ 1/22/85	5
1B	5	Pre Audit Course Evaluation Report	5
1C	6	~~Pre Audit Data Analysis Package~~ 12/5/84	2
1C	7	~~Pre Audit Draft Report (2) & Presentation (ANL OEP)~~ 1/4/85	4/5
1C	8	~~Pre Audit Report (2) & Presentation (PLT Mgmt)~~ 1/24/84	5
1C	9	Pre Audit Final Report	6
1D	10	~~Audit Course Instruction Pkg~~ 1/12/85	3
1D	11	~~Audit Course Mtl for Trainees~~ 1/16/85	4
1D	12	Audit Course Test Results	8
1D	13	Audit Course Evaluation Report	8
1E	14	~~Audit Data Analysis Package~~ 1/12/85	5
1E	15	Audit Draft Report/Presentation (ANL OEP)	9/10
1E	16	Audit Report/Presentation (PLT Mgmt)	10/11
1E	17	Audit Final Report	12

End of Week	1	2	3	4	5	6	7	8	9
Deliverable(s)	(2,3)	(1,6)	(10)	(11,7)	(4 5,8)	(9)	( )	(12,13)	(15)

10	11	12
(15,16)	(16)	(17)

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