# TECHNICAL LETTER REPORT

# SITE SURVEY OF ARKANSAS NUCLEAR ONE

# UNIT-2

# MAINTENANCE PROGRAM AND PRACTICES

# FIN 2984

January 21, 1986

# EXECUTIVE SUMMARY

As part of the U.S. Nuclear Regulatory Commission's (NRC) Maintenance and Surveillance Program's Survey and Evaluation of Maintenance Effectiveness Project, a site survey was conducted at the Arkansas Nuclear One (ANO) Unit-2 (ANO-2) Nuclear Power Plant. The purpose of the visit was to collect plant maintenance program descriptive information and observations about ANO's maintenance and surveillance program, using a formalized data gathering outline (protocol). The site survey was conducted during the week of November 4, 1985, with a team of three NRC and two Pacific Northwest Laboratory (PNL) staff. A member of the Japanese Nuclear Power Safety Administration (MITI) accompanied the survey team as an observer.

Protocol information was collected in five main areas: organization and administration; facilities and equipment; technical procedures; personnel; and work control. The completed protocol includes the detailed information collected at the site, while this report contains selected observations and summaries extracted from that protocol.

The ANO maintenance program was assessed as "good and improving" by the NRC Systematic Assessment of Licensee Performance (SALP) ratings. ANO has moved from a SALP rating of 3 (requires increased attention) to a 2 (maintain attention at normal levels) in its most recent assessment of maintenance performance. The more significant of the survey team observations can be summarized as:

(1) Maintenance Department Work Control - The organization of the Maintenance Department has not changed over the past five years. While reorganization of the ANO staff is to take place next summer, the Maintenance Department will not be affected. The major innovation in the Maintenance Department over the past five years was the addition of the Work Control Center (WCC) concept this past August to replace the old Planning/Scheduling (P/S) Department. In the past, most of the work planning and scheduling had been done by the first-line supervisors (requiring a major fraction of their time). The P/S department size was approximately quadrupled for the new WCC, with all of the planning and scheduling now being done in the WCC. The entire work control system utilizes the Station Information Management System (SIMS) computer for planning, control and history of plant maintenance.

The work control changes have liberated first-line craft supervisors from much of their former paperwork and planning/scheduling functions. An average increase of 35% in time spent in the plant supervising job performance has resulted. The improvement in maintenance performance is at least partially attributed by plant staff to this increase in supervision. However, the implementation of the WCC has created some dissatisfaction among operations personnel because of the partial loss of operations control of maintenance priorities (i.e., in the past, operations could order maintenance done on the non-day shifts without going through the

work control process, which is not the case now). In addition, the implementation increased the paperwork requirements of the craft staff, because they are now required to write more information into the work package (a more complete work description and a simple level of root cause analysis).

(2) Use of Procedures - The use of procedures and setting of formal goals are highly developed with regard to the maintenance functions (e.g., corrective, preventive, and predictive maintenance). Goal achievement is tied directly to performance appraisal and salary adjustments for management and supervisory staff. There are formal specifications in the Administrative Procedures for the development, use, update and control of technical procedures; for content and format requirements; and for the verification and validation of the procedures.

(3) Austerity Program - The Arkansas Power and Light (AP&L) Austerity Program, which was caused by the financial problems at Grand Gulf, has had little effect on ANO and on the ANO Maintenance Department according to the Senior Vice President, Energy Supply. The main impacts on ANO were that some vacancies were not filled, some travel was cut, overtime was scrutinized closely, and some capital projects were postponed. The Senior Vice President indicated that with the recent rate increase the Austerity Program had effectively been lifted at ANO.

(4) Material Availability - Maintenance is rarely delayed by material shortage. An inventory of approximately $35 million in spare parts is available to support both units. A computerized Material Management Information System (MMIS) will be completely implemented by June, 1986. ANO is part of an inter-utility cooperative parts loan system.

(5) Component Labeling - Although a component labeling program is in place and is reported nearly complete on Unit-1, Unit-2 is essentially unlabeled. Considering the recent change in offsite contractors, potential exists for "wrong unit" or "wrong train" errors.

(6) Personnel - ANO is reasonably staffed to keep ahead of the backlog of maintenance items. However, overtime has been high, averaging from 22% to 40% across the different maintenance work groups since January, 1984. There are approximately 190 craftsmen, supervisors, and managers in the Maintenance Department; and there are 36 staff in the Work Control Center for planning/scheduling purposes, for putting together work packages, and for keeping an equipment history file. The maintenance staffing is supplemented by approximately 30 contractor personnel in the Maintenance Support Group and by 54 site personnel who do building maintenance. Except for I&C technicians, maintenance staff turnover has been quite low since January, 1984. ANO has formal programs in place for job appraisals, for grievances, and for suggestions on safety and efficiency of operation.

(7) Training - A formal, systematic approach to training has been used by the training staff for the past two years. The training goal of approximately 20% of craftsmen time spent in training has been met or exceeded over the past two years.

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U.S. NUCLEAR REGULATORY COMMISSION
DIVISION OF HUMAN FACTORS TECHNOLOGY (DHFT)

# ANO-2 NUCLEAR POWER PLANT
# SITE SURVEY REPORT

## A. GENERAL INFORMATION:

ANO-2 Docket No.: 50-638 ANO-2 License No.: NPF-6

Licensee: Arkansas Power and Light Company
P. O. Box 551
First Commercial Building
Capital and Broadway
Little Rock, Arkansas 72201

Survey Conducted: November 4 through November 8, 1985

Team Members: N. B. Le, NRR, Team Leader
O. Gormley, IE
J. Boardman, RIV
W. Rankin, PNL
D. Jarrell, PNL
Y. Arakawa (observer)

## B. SURVEY METHODOLOGY:

The NRC has undertaken a program to investigate, and, if necessary, initiate measures to improve maintenance in the U.S. nuclear power industry. A multi-year Maintenance and Surveillance Program Plan (MSPP) (SECY 85-129) has been prepared to document this program. The MSPP has two purposes: (1) Provide direction for NRC efforts to ensure effective maintenance and surveillance and (2) Propose alternate regulatory approaches with respect to maintenance and surveillance activities, if necessary. The MSPP identifies the technical and regulatory issues to be addressed and directs the integration and planning of NRC's activities to accomplish these objectives.

Phase I of this effort is entitled "Survey and Evaluation of Maintenance Effectiveness." A major objective of this project is to obtain information and assess the current practices of nuclear power plant maintenance and surveillance programs. A protocol (formalized data gathering outline) was developed for use in the collection of maintenance and surveillance program descriptive data. Data were collected in five broad categories:

- organization and administration
- facilities and equipment
- technical procedures
- personnel
- work control

The attached appendixes contain a list of ANO staff who were interviewed, a list of the people who attended the entrance and exit meetings, a brief summary of descriptive data concerning ANO and a summary of quality program performance indicators. A completed protocol and the materials/references obtained from the site are part of the MSPP file which will be maintained for data background. These materials have been cleared by Arkansas Power and Light Company with respect to 10 CFR 2.790 (Public Inspections, Exemptions, Requests for Withholding).

## C. DESCRIPTIVE DATA

### 1. Organization and Administration

#### a. General Description

ANO has a highly developed set of procedures and has set an extensive number of goals for plant management staff for the functional areas listed in the Administrative Procedures (APs). For example, APs exist regarding the preventive maintenance (PM), corrective maintenance (CM), and predictive maintenance (PDM) functions; and formal goals are set for particular aspects of each of these maintenance areas.

This year the Work Control Center (WCC) was implemented to replace the old Planning/Scheduling (P/S) Department. The implementation of the WCC placed increased emphasis on the planning and scheduling function, increased the amount of planning done in the department in order to decrease the workload of the first-line craft supervisors, and added a computerized maintenance equipment history function and work control system.

The week before the site visit, a major reorganization was approved, which added three new manager positions. The main purpose of the reorganization is to shift some of the functions originally assigned to the ANO general manager to other managers so that the general manager (of Plant Operations) can focus his attention on the main functions that support electricity generation--operations, maintenance, and work control. The organization of the Maintenance Department, which coordinates maintenance activities for both units number 1 and 2, is unaffected.

Under the present organization, the Maintenance Manager reports to the General Manager (see Figure 1), and the Superintendent Mechanical Maintenance, Superintendent Electrical Maintenance, Superintendent I&C, Shift Maintenance Superintendent, Maintenance Support Group Superintendent, and the Senior Maintenance Coordinator report to the Maintenance Manager (see Figure 2). Under the revised ANO nuclear organization (see Figure 3), the Maintenance Manager will still report to the General Manager Plant Operations. The maintenance support group recently changed contractors (from Bechtel to Daniels) through an open bid process. Otherwise, except for increased staffing levels, the other six maintenance groups that report to the Maintenance Department manager have remained stable.

#### b. Specific Observations

Maintenance problems and technical issues are being resolved through the use of various committees that have been initiated at the corporate level. These include the Plant Safety Committee, the ANO Safety Committee, the Predictive Maintenance Program Project, the Environmental Qualifications Committee, the Systematic Tracking of

Figure 1.

# ANO ORGANIZATION

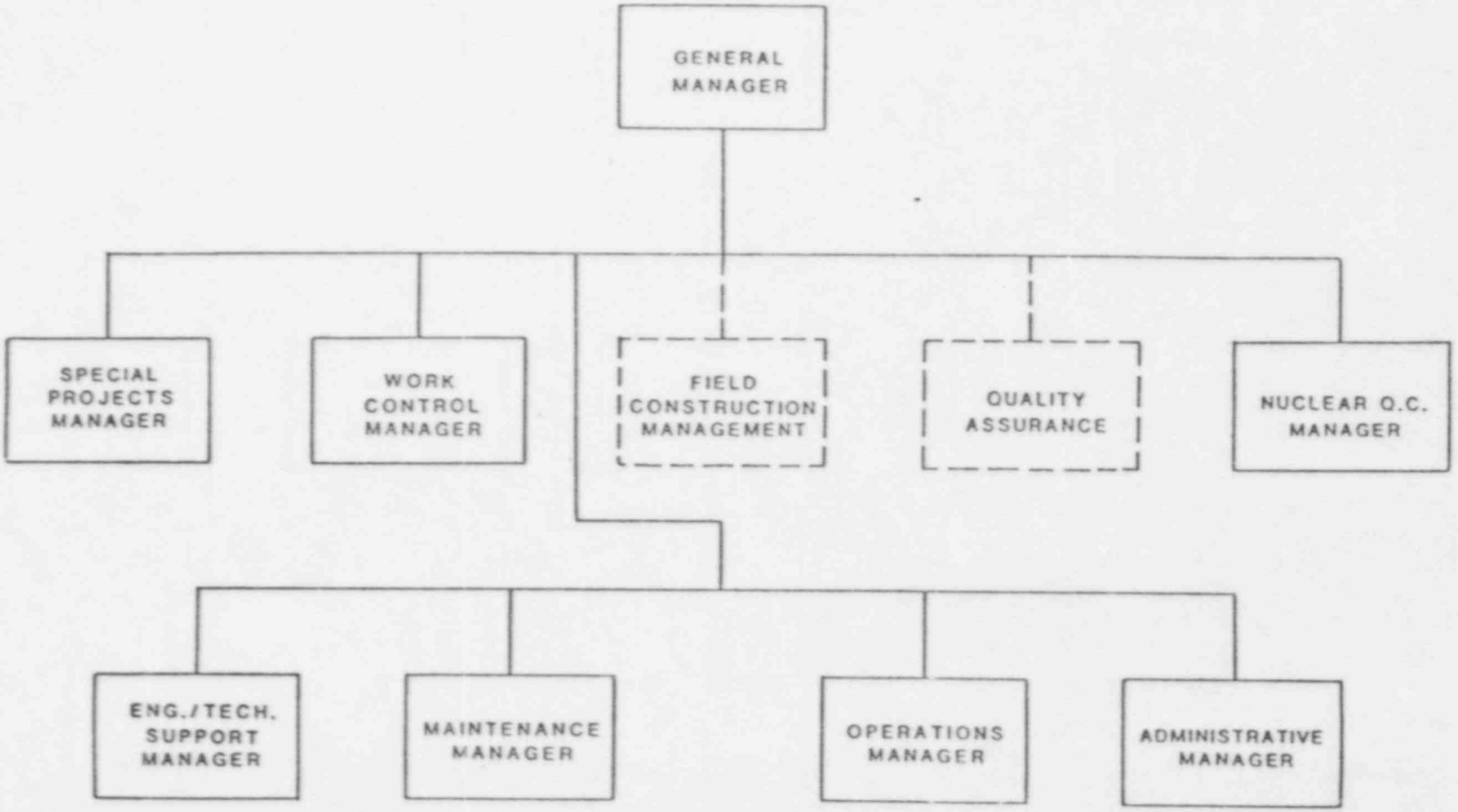


Figure 2.

# ANO MAINTENANCE ORGANIZATION

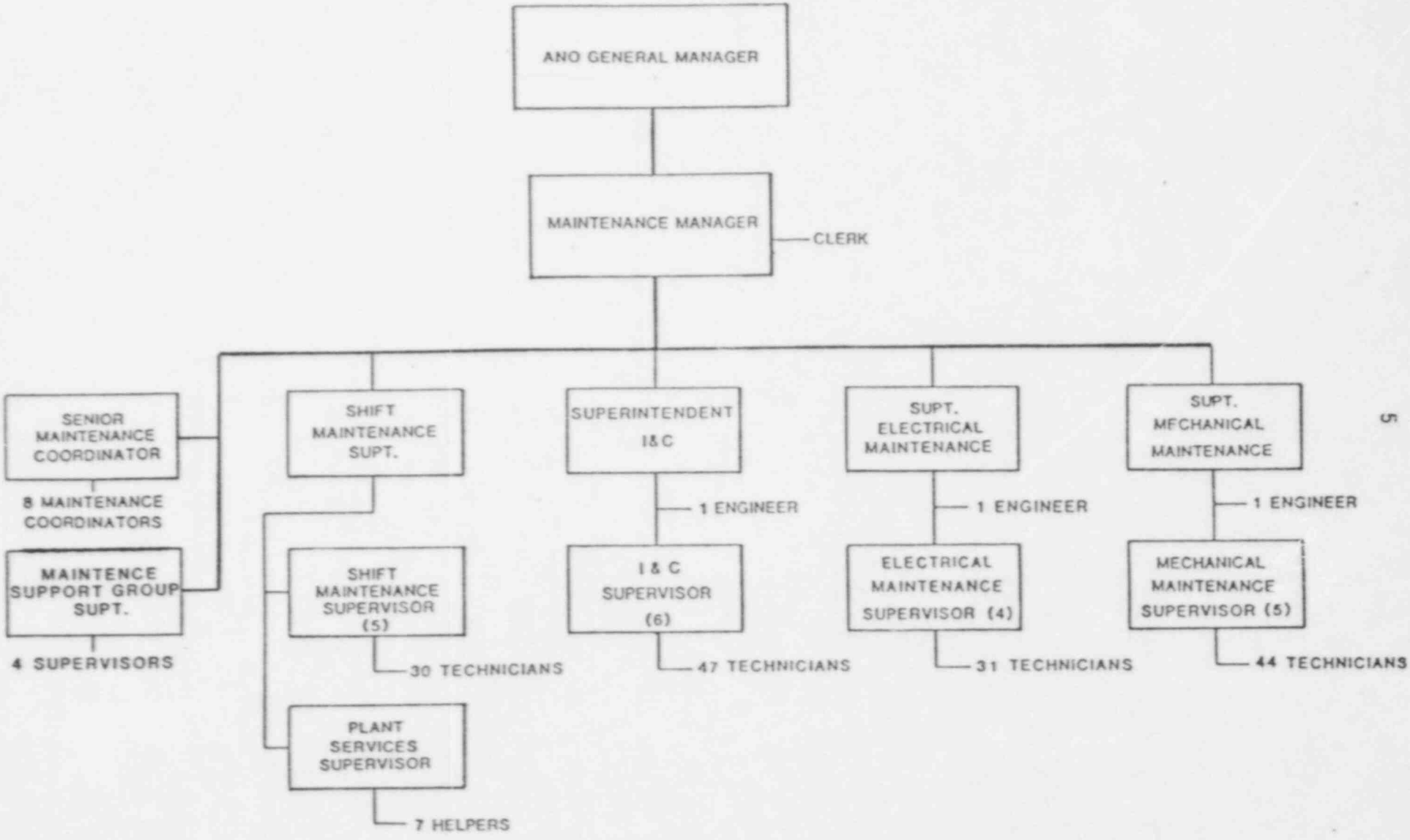


Figure 3.

## Revised Nuclear Operations Organization

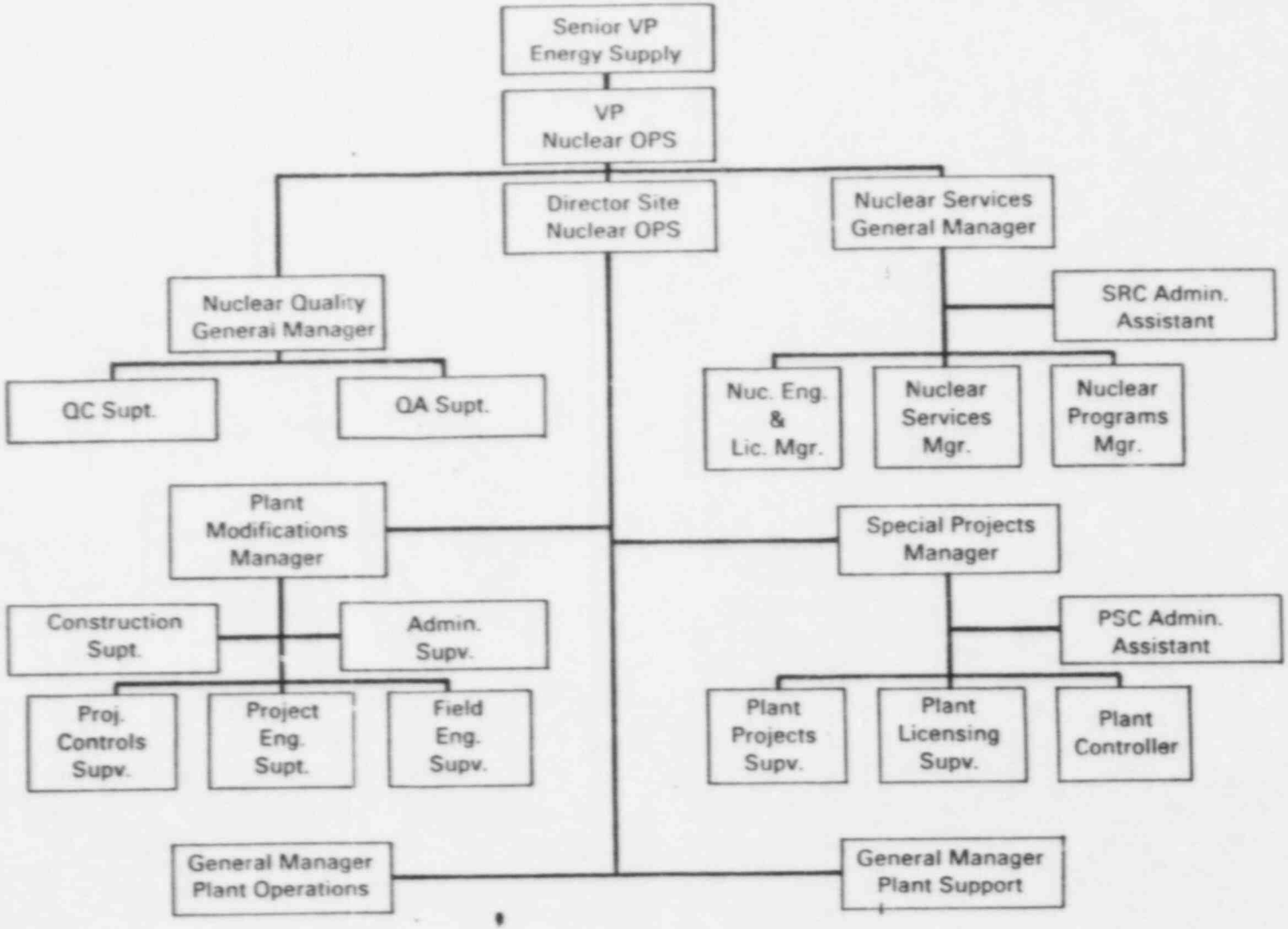
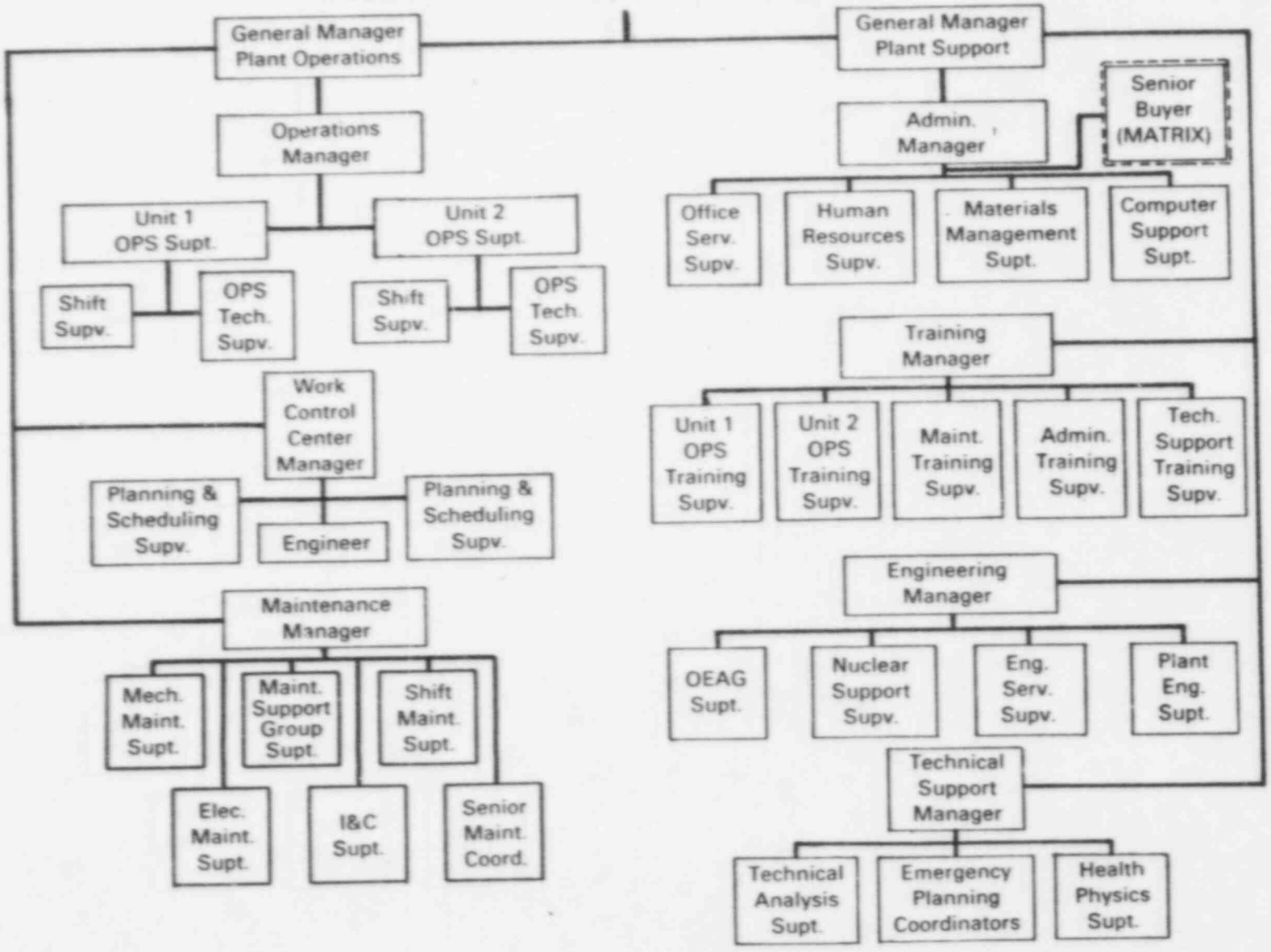


FIGURE 3 (contd)

## Revised Nuclear Operations Organization



Repetitive Equipment Problems (STREP), and the Davis Besse Event Group.

In addition, ANO management supports its staff's participation in nationwide maintenance-related groups, such as INPO Accreditation teams for maintenance training, the Nuclear Utilities Management and Human Resources Committee (NUMARC), the Nuclear Plant Reliability Data System (NPRDS), the Pooled Inventory Management System (PIMS), the B&W owner's groups on reactor trip breakers and reactor coolant pump seals, and the subcommittee on Maintenance of the Middle South Nuclear Oversight Committee.

The potential impact of the ANO Austerity Program was discussed with the Senior Vice President, Energy Supply and the Vice President, Nuclear Operations. The team was told that the nuclear organizations and functions of AP&L were largely exempted from the Austerity Program except that:

- o some vacancies were not filled at the plant
- o travel was reviewed and cut back where possible
- o overtime was reviewed and reduced to a minimum
- o capital projects were evaluated to determine whether they were fully necessary at this time

Many of the above were contingency planning measures. AP&L asked for and received a 10.2% rate increase earlier this year. This rate increase took care of ANO operating costs, but not all of the costs of Grand Gulf. Grand Gulf's costs were divided into three areas: charges to be paid immediately, charges that could be paid for after an approximate 10-year period, and losses that the stockholders will have to bear. With the exception of ANO, where the austerity program has effectively been lifted, measures for the remainder of AP&L will last through December, 1985. AP&L expects to benefit from some of the efficiencies that were introduced during the program. The survey team only heard one comment from ANO personnel about the impact of the Austerity Program. That comment concerned the cancellation of one trip for training purposes. Such action is in line with the stated program policies.

There is some duplication of functions between ANO and AP&L Corporate regarding performance of some predictive maintenance. The plant staff indicated that this duplication, which centered on both groups performing vibration analysis and oil analysis, had caused some problems in the past in that the maintenance staff did not know whose analysis to believe when discrepancies arose. Therefore, decisions are being made at this time to determine which group will carry out these functions in the future.

Corrective maintenance (CM), predictive maintenance (PDM), preventive maintenance (PM), and emergency maintenance (EM) are defined in APs.

The Maintenance Department Manager has set the following goals regarding CMs, PDMs, and PMs:

- o CM--less than 3000 hours backlog (current backlog is about 4000 hrs.)
- o PDM--implement the pilot Predictive Maintenance Program
- o PM--70% completion rate of all PMs

The goal for surveillance tests (STs) is to do all mandatory STs (i.e., those required by regulation or ASME code). Approximately 10% of the STs are discretionary (i.e., not required by regulation or ASME code). In addition to these goals, the Nuclear Utilities Management and Human Resources Committee (NUMARC) performance indicators will be included in the formal goal-setting process in 1986.

With regard to performance indicators, ANO catalogs over 40 different indicators through its Quality Indicators Program. These indicators are summarized in Appendix D.

At the present time, ANO has not set specific goals for the ratio of PM to CM. The following chart represents an estimate by the cognizant superintendant of each craft regarding the percentage of time spent on different types of maintenance activities:

| | PERCENTAGE OF TIME SPENT | | |
|---|---|---|---|
| CRAFT | PMs | CMs | PDMs & STs |
| Electrical | 20 | 55 | 25 |
| Mechanical | 25 | 70 | 5 |
| I&C | 10 | 50 | 40 |

A verbally stated goal by the General Manager, the Maintenance Manager, and the maintenance superintendents was to spend about 50% of the maintenance craft time on PM. Thus, this goal has yet to be attained.

ANO currently has a Preventive Maintenance Improvement Program (PMIP) project underway. The purpose of the PMIP is to: (1) meet all regulatory requirements, (2) plan and effectively schedule PMs and (3) improve plant reliability.

Efforts to accomplish these goals include:

- o Evaluate and consolidate preventive maintenance from the existing PM list, vendor recommendations, and regulatory commitments.

- o Conduct an engineering review of discrepancies in PM procedures. Review and resolve any conflicts regarding nature or frequency of PMs.

- o Categorize each PM according to its requirement (mandatory, discretionary, predictive, or stored components).

- o Plan and enter into SIMS information to allow automatic recall of repetitive tasks and instructions.

To coordinate and oversee the PMIP, ANO has formed a team with representatives from:

- o ANO Special Projects
- o ANO Maintenance Coordinator
- o ANO Plant Engineering
- o ANO Plant Maintenance Manager
- o Energy Supply Maintenance Manager
- o Energy Supply Plant Performance Evaluation Manager
- o Contractors.

Another problem being handled by ANO corporate projects is repeat corrective maintenance. A special program, the Systematic Tracking of Repetitive Equipment Problems (STREP), is now underway to determine the cause of repeat CM. Once the cause has been determined, a program will be implemented to correct the problem.

Surveillance tests are only carried out on safety-related equipment. All surveillance testing is reviewed and approved by the ANO Plant Safety Review Committee. Discretionary surveillance (surveillance tests not required by regulation, ASME code, or the Technical Specifications) is done principally as special tests or reliability checks of plant equipment. Discretionary surveillance comprises only about 5% to 10% (as estimated by plant staff) of all testing, which is down from approximately 25% during the pre-TMI period.

Predictive maintenance, while comparatively new as a program at ANO, has been practiced for several years under an engineering test format. Nonsafety-related vibration analysis and oil analysis is currently carried out, and flow-head pump performance and infra-red heat detection analysis is planned for implementation in the near future.

A formal trend analysis program is not yet in place. The advent of SIMS, with its ability to track and compute parametric changes as a function of time, will make trending automatic with the accumulation of machinery history data. However, only the historical information beginning August 1, 1985, will be in the system. ANO did an analysis and found that it would cost them over $1,000,000 per year per maintenance group to add earlier data to SIMS. In addition, earlier historical data was not structured to readily permit trending. It would not, therefore, be of the same quality as presently collected data. As a result, a decision was made by ANO maintenance management

not to attempt to add pre-August 1, 1985, historical data to SIMS. This does not remedy the current difficulty in tracking parts failures, but it does promise much improved traceability in the future.

Contractor personnel are used in the Maintenance Support Group and in Field Construction Management. Bechtel had been the contractor since 1974, but the contract was recently rebid and awarded to Daniels. Bechtel used union craftsmen, while Daniels uses non-union craftsmen. Thus, while some former Bechtel supervisory personnel took a job with Daniels, most of the union craftsmen are not moving from Bechtel to Daniels. To do so would mean that they would forfeit their union benefits. The changeover may have caused some loss in productivity, but it was estimated by the Maintenance Manager that the changeover will have no effect after the first two months. Contractor personnel must follow the administrative procedures just as if they were ANO staff. The contractor provides its own superintendent, supervisors, and QC staff, who report to the ANO Maintenance Manager.

The electrical and mechanical groups divide work between work units for Unit-1 and Unit-2. However, craft personnel can work on either unit, if needed. Other than this type of job rotation, dual training and job rotation are not presently used at the site.

The Station Information Management System (SIMS) and the Master Schedule are computerized information systems used to track Maintenance Department Activities during normal operations. Project 2, a computerized scheduling system, is used to schedule and track Maintenance Department activities during outages.

Written policies are in place to identify and correct problems attributed to maintenance worker errors or negligence. There are also procedures regarding sanctions governing the use of procedures by maintenance craft workers. If the worker is negligent or does not use the procedures, the union contract specifies the following sanctions: a verbal warning, a written warning, days off without pay, and termination.

Finally, the team found that ANO receives strong support from the corporate Industrial Engineering Group. This group has been called on several times in the past two years to assist in staffing studies, to define preventive maintenance needs, and to help with the vendor technical information update project.

2. Facilities and Equipment

a. General Description

The ANO-2 plant, including warehouse, craft shops and office facilities, is clean and well ordered. Workshops are of sufficient size, based on team observations and staff input, and are equipped to

handle the workload adequately. Tool storage is somewhat cramped, but neat and well managed. Warehouse storage is exceptionally well organized and clean, and components are well labeled. A majority (estimated by plant staff at approximately 95%) of the test equipment calibration is done by ANO. The remaining (very specialized) calibration is done by offsite contractors.

b. Specific Observations

The ANO spare parts inventory is sufficient to provide excellent support for all corrective as well as preventive maintenance. An inventory of approximately $35M in spare parts is available to support the needs of both plants.

Maintenance is rarely delayed by material shortage, and then only by long-lead-time items of an unusual nature. ANO is a member of the Pooled Inventory Management system. Automated inventory control through Material Management Information System (MMIS) is in the testing phase and will be fully implemented by June, 1986.

Machinery history data for current work has been transferred from a time-consuming microfiche system to a SIMS computer tracking program function. SIMS machinery history is available only since August, 1985, and some microfiche searches will be an awkward necessity for several years to come. There is no plan to enter pre-SIMS machinery history data into SIMS or any requirement to perform a microfiche search for history upon component failure. If data is recovered from microfiche on a specific component, it is entered into SIMS at that time.

Data is input to INPO's Nuclear Plant Reliability Data System (NPRDS), but for the most part ANO intends to do its own trending through the SIMS tracking capability. The trend analysis function has not yet been implemented.

According to ANO staff, lay-down areas around equipment are adequate during operation, but are only marginally adequate during outages.

ANO has implemented a component labeling program for both units. Although the labeling was reported by plant staff to be nearly complete on Unit-1, Unit-2 is essentially unlabeled. This presents a potential problem regarding misidentification of components by operations and maintenance staff, especially considering the recent change in ANO's maintenance contractor.

The survey team found the warehouse to be extremely neat, clean, and well layed-out. Safety related (Q), non-safety related (non-Q) and environmentally qualified (EQ) designated areas are labeled and, for the most part, segregated. The site survey team was impressed by the plant-wide knowledge of EQ requirements.

3. Technical Procedures

a. General Description

There is a significant management commitment to the preparation and use of procedures to guide and control safety-related work. This results in documentation of the performance of work. The policy regarding the use of procedures is clear, and the craft workers understand that failure to use them will result in disciplinary action. They also understand that they are to stop work and correct any defects in a procedure they are using. They are also encouraged to make, and in some cases rewarded for making, improvements in how work is carried out.

b. Specific Observations

ANO procedures require the provision of vendor technical information (VTI) as part of their hardware procurement/contracting system. Updates in VTI are not required in the contract or by procedure, but the Maintenance Manager said that they try to get all of the updates possible. ANO currently has a Vendor Technical Manual Project underway. The purpose of the project is to establish and maintain a continuing program to ensure that VTI for ANO equipment is correct, complete, current, and controlled throughout plant life. Vendor technical manuals are used by the planner to plan maintenance jobs, by craftsmen to carry out maintenance work, by engineers to develop plant changes, by maintenance procedure writers for writing technical maintenance procedures, and by contractors who perform some of the maintenance work. Because of this important and extensive use of, and reliance on, these manuals, the Vendor Technical Manual Project has an important bearing on the Maintenance Department. This project is scheduled for completion in late 1986.

The primary responsibility for preparing the procedures is given to the most experienced personnel, that is, the maintenance coordinators, the maintenance superintendents, the first-line supervisors, and senior craft people.

ANO APs specify which maintenance procedures must be written and the format and content of the procedures. In addition, ANO recently completed a Writer's Guide specifically for writing and updating maintenance procedures. The Writer's Guide was based on the INPO guidelines and on guidance found in other documentation. Approximately 50% of all the maintenance supervisory and craft staff have been trained on the use of the Writer's Guide. During the biennial review of the procedures, the existing maintenance procedures will be rewritten, as necessary, for conformance to the Writer's Guide.

When maintenance procedures are written, VTI is typically rewritten and included in the plant-developed procedure. Approximately 80% to 85% of all maintenance procedures are written by ANO personnel, and

15% to 20% of all maintenance procedures are vendor technical manuals.

There is an AP that specifies when and where QC hold points should be included in maintenance procedures. QC has issued a memorandum on their policy for QC hold points. In addition, QC reviews Job Orders and technical procedures to identify the need for QC hold points. ANO is currently working on a more formal policy/program, based on INPO good practice guidelines, regarding the use of QC hold points.

ANO APs contain a written requirement for the verification of the technical adequacy and written correctness of the procedures. The check for technical adequacy is a comparison of the VTI with the procedure. The written correctness is checked via the Writer's Guide and associated checklist. Changes to procedures are also verified. An informal method is used to provide feedback on needed changes during the verification process.

Procedure validation for usability is done by "walking through" the procedure at the equipment location during the writing of the procedure, validating the procedure on training mock-ups if they are available, and noting needed changes during the first two uses of the procedure. During the first two procedure uses, the procedure is accompanied by a formal change sheet. If no changes are required, the sheet is removed from the procedure after the second use. Changes to a procedure are also validated.

Maintenance personnel are required to have procedures with them during accomplishment of work, if the procedures are specified in the Job Order. Approximately 95% of the jobs require the use of a procedure. The policy on procedure use was clearly known by all ANO maintenance personnel from craftmen through the Maintenance Department Manager.

The maintenance procedures are required by administrative policy to be reviewed every two years. The maintenance coordinators are chiefly responsible for the review. In addition, any user of the procedures can initiate a change to or an update of a procedure.

4. Personnel

a. General Description

There are approximately 190 persons in the Maintenance Department and 36 in the WCC. In addition, the maintenance staffing is supplemented by approximately 30 contractors in the maintenance support group (MSG). During outages, from 20-30 utility-added staff help carry out maintenance work, and the staffing level of the MSG can be expanded as necessary. Except for one or two specific work groups, turnover has been quite low since January, 1984.

Overtime has been relatively high over the past two years--ranging from 22% to 40% for specific maintenance work groups. Overtime is

paid to nonexempt staff, and exempt staff from Superintendent on down can get overtime pay during extended work weeks. Twenty-four hour maintenance coverage is provided by the shift maintenance group. Craft salaries at ANO are a little higher than craft salaries in the area, so hiring good craft workers has not been a problem. Overtime pay is at 1.5X base pay, except for work on holidays (2.5X base). Pay for supervisory and management staff is above the average for the Russellville, Arkansas, area, and was said to be about average nationally. Superintendents and supervisory staff can get paid overtime at a straight time rate for every hour past 44 hours during extended work weeks.

A formal, systematic approach to training has been used by the training department for the last two years. The goal is to provide all craft workers with initial basic training followed by ongoing skills enhancement training. INPO accreditation is expected in December, 1985, for all three maintenance specialty areas.

b. Specific Observations

Maintenance coverage is provided as follows:

- o Twenty-four hour maintenance coverage is provided by five Shift Maintenance Groups. Each group consists of seven men (2 electricians, 2 mechanics, 2 I&C technicians, and 1 supervisor). The group is headed by a Superintendent.

- o Day maintenance personnel work on the day shift only, except during outages when two 10-hour shifts are used. Twenty-two to thirty-two additional staff are used during outages.

- o Contractor staffing in the maintenance support group (MSG) normally runs about 50 men, but this may increase to approximately 130 contractors during outages.

- o Building and grounds maintenance is performed by 54 contractor personnel (who report through foremen to the Maintenance Manager).

Turnover rates in 1984 and through October, 1985, were:

| | TURNOVER RATES (%) | |
|---|---|---|
| CRAFT | 1984 | JAN-OCT 1985 |
| Mechanical | 0 | 0 |
| Electrical | 2 | 2 |
| Inst & Cont | 20 | 0 |
| Admin/Supv | 15 | 10 |

The major reason for turnover has been internal plant promotions. At this time, the Maintenance Department is actually overstaffed because of lower than expected attrition rates. A high percentage of local personnel recruitment (in 1984/85 approximately 50% of the craft staff were recruited locally and 50% were recruited outside the area) is claimed to be a factor in the low turnover rate.

The recruitment plan at ANO includes "block hires," which allows staff to be trained before they are needed to fill in for turnover. That is, enough staff are hired at the beginning of the year to fill in for all anticipated turnover during the year. This overcomes problems that the survey team observed at other plants where staff are not hired early enough to be trained before they begin to carry out maintenance work.

The plant uses a formal, documented appraisal system, which ties management and supervisory personnel appraisals directly to pay raises.

Management has given attention to staffing levels so that the maintenance backlog has not increased over the past several years. However, in 1984, mechanical had 27% overtime, electrical 23%, and I&C 26%. So far this year, mechanical has had 40% overtime, electrical 32%, and I&C 22%. This is higher than the vice president's goal of approximately 20% overtime.

There are formal opportunities at ANO for promotion into first-level supervisory positions and for promotion into higher supervisory and managerial positions using the "Go For It" program, the Career Path Interview, and the Succession Planning Program. However, the opportunities for advancement into the journeyman position from the helper are limited by the lack of openings in the journeyman ranks. The Action Idea Program is used to reward staff monetarily for efficiency and safety-related suggestions. This is the first program of this kind that the survey team has seen on the site visits.

The Training Department has a large staff of 12 trainers/supervisors dedicated to training of maintenance craftsmen. The Training Department has used a systematic approach to training over the past two years, and INPO accreditation is anticipated this December for all three maintenance specialty areas.

Initial training for electricians takes 28 weeks, mechanics 19 weeks, and I&C technicians 27 weeks. The goal for continued skills upgrade training is 10% classroom training during outages and 20% classroom training during normal operations. The training staff are trying to do all of the necessary training at ANO rather than depending on vendor training.

The maintenance instructors have the use of a 22-classroom training center. There are three workshops equipped with demonstration devices that are shared by I&C technicians and electricians. A fourth

similarily equipped workshop serves mechanics. The training staff has the use of a large number of simulators and training devices, including simulators for Units 1 and 2, a Control Element Assembly (CEA) coupling/uncoupling mock-up, a plastic mock-up of RCP seals, an HVAC trainer, laboratory voltmeter equipment, a hydraulic motor actuator, a pump and valve test loop, and other equipment such as controllers, valves, pumps, and compressors.

Personnel joining the training staff typically take a pay cut (because of differences in overtime) to move from craft or first-level supervisory positions to the Maintenance Trainer-1 position. This may create a problem in the future attracting good people from the crafts into the Training Department.

5. Work Control

a. General Description

Work control during performance of maintenance tasks is well defined both procedurally and conceptually. Consistency in responses to our procedural questions demonstrated good flow and simplicity in a newly computerized area. SIMS, despite its recent introduction, produced little functional confusion. However, there was some frustration with regard to the time required to become proficient at computer terminal use. SIMS has produced a lessening of operator control over the priority of the maintenance being performed on shift. While there has been a decrease in the paperwork requirements by first-line supervisors, an increase in paperwork was noticed by craft workmen. In general, the new computer centered job order system was seen as an improvement by plant personnel.

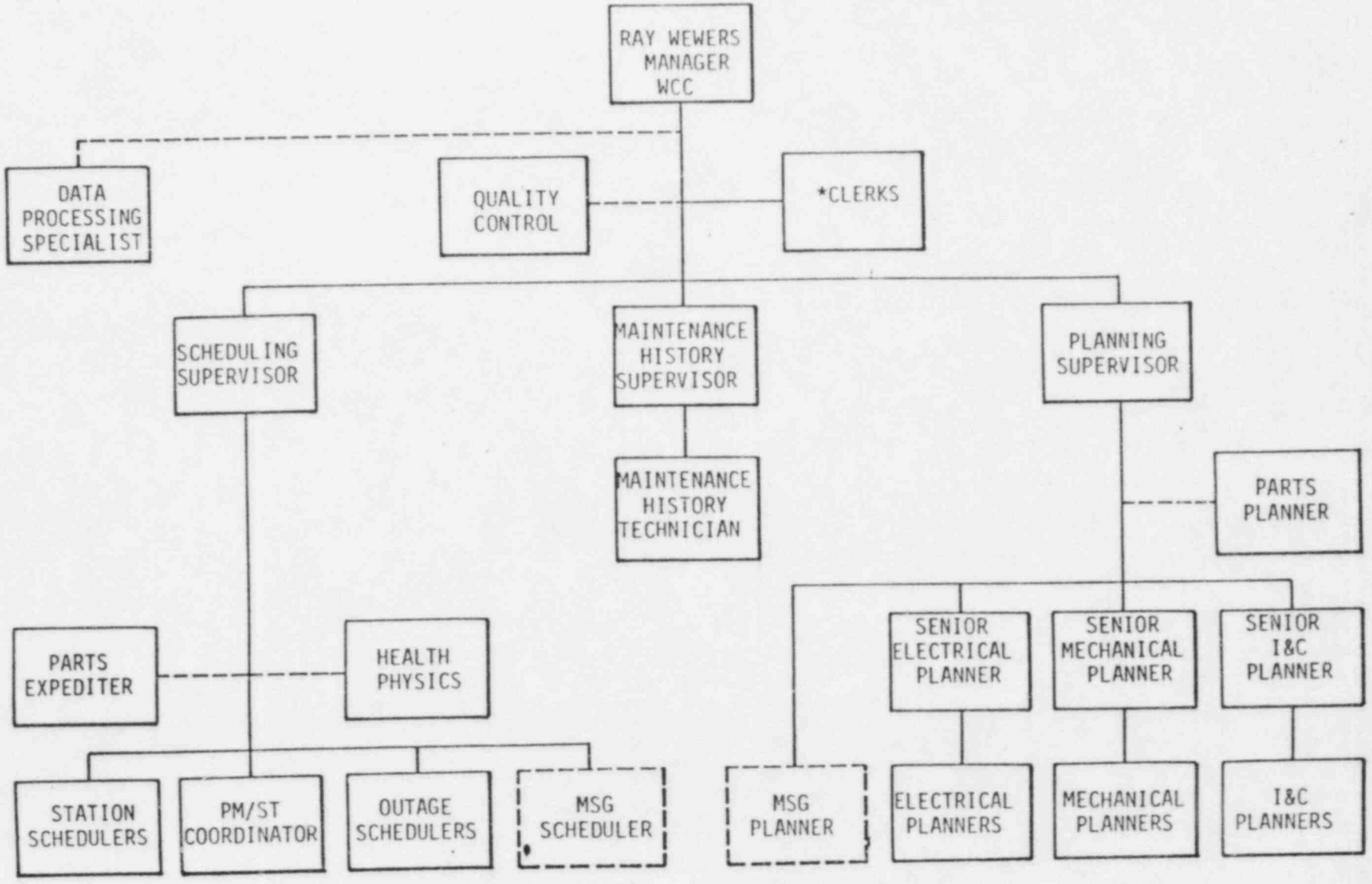
b. Specific Observations

A new Work Control Center concept was implemented on August 1, 1985. The WCC takes the place of the old Planning/Scheduling Department. It has increased the amount of planning and scheduling done by the department (previously done by first-line maintenance supervision) and added a computerized Job Order system and a machinery history function. The organization of the WCC is shown in Figure 4. The flow of work through the WCC is shown in Figure 5.

The response of first-line supervision to the new Work Control Center was enthusiastic. According to the first-line supervisors, their plant work supervision time has increased from approximately 15% to 50%, depending on the group. However, some ANO operations staff feel the SIMS system is cumbersome, in that it removes some direct maintenance work control from the operators. That is, in the past, operators were able to require that maintenance work be done on the non-day shifts without needing to have a Job Order filled out beforehand. Under the new system, all Job Orders must go through the WCC so that the planning and scheduling can be done there. Thus, the operations staff have lost some direct control of maintenance work.

Figure 4.

# WORK CONTROL CENTER ORGANIZATION



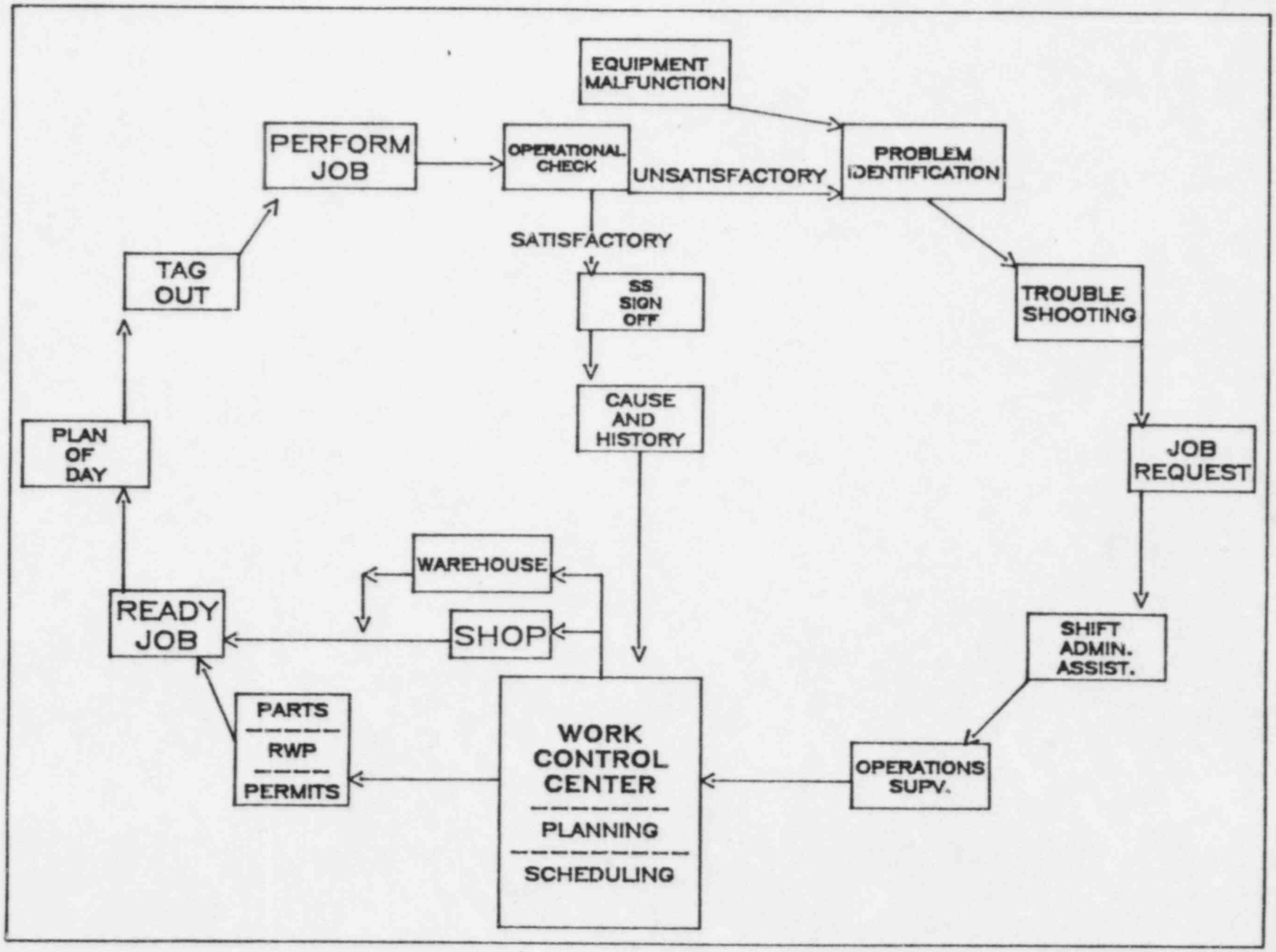



Figure 5. Work Control Center Work Flow

The operations staff also stated that on mid-shift and weekends there is no one to call regarding instructions on use of the SIMS system. This has tended to discourage some on-shift personnel from learning how to use SIMS at times other than Monday through Friday during the day shift. Finally, the new WCC system has increased the paperwork requirements for craft staff in that they are now required to write a more complete description of the work that they performed and to specify the root cause of the problem if they can. On balance, however, it was the survey team's opinion that the new work control system represents an extremely positive step for the Maintenance Department, despite some of the issues discussed above.

The work originator is not identified on the Job Order. This can make it difficult to ask the work originator questions about the job concept. If necessary, however, the work originator can be identified by tracing the Job Order back to the original Job Request, which does specify the Job Request originator.

The current QC organization has a staff of five QC engineers and six QC inspectors. Two inspectors are dedicated to welding inspection, and the remaining four inspectors cover other maintenance and surveillance activities. This represents a ratio of 1 QC inspector to approximately 30 craft personnel for both units at ANO.

About 10% of ANO maintenance procedures have QC hold points. According to ANO staff, less than 10% of non-outage maintenance work is covered by QC, and approximately 30% of all maintenance work is covered by QC during an outage. Compared to other plants, this is low QC coverage.

Electrical drawings are not easily accessible to technicians and craft during the performance of maintenance work. This problem could be resolved by the planner during assembly of Job Order packages.

ANO's new Job Order concept requires root cause analysis. However, there is no procedural definition of root cause criteria available to the craftsmen who are to do the analysis. There are no procedural requirements for trending or determination of generic implications of root cause analysis. Licensee response to NUREG-1154 (Davis Besse) will address root cause analysis. Plant management has identified this as an action item.

ANO does not have a method for tying together CM, PM, and STs. ANO has recognized the need for such a program, but at present has not determined the method that they will use in addressing this issue. SIMS has the ability to integrate these maintenance functions.

D. CONCLUSIONS:

Conclusions regarding the five main protocol areas are presented below.

Organization and Administration. The basic organization of the Maintenance Department has not changed over the past five years, except for the Work Control Center, which is discussed below. While reorganization of the ANO staff is to take place next summer, the Maintenance Department will not be affected. The major innovation in the Maintenance Department was the addition of the Work Control Center (WCC) concept in August, 1985, to replace the old Planning/Scheduling Department. The scheduling/planning group size was approximately quadrupled for the new WCC; all of the planning and scheduling is now done in the WCC (much of this effort had been done by the first-line supervisors in the past); a maintenance history function has been added; and the work control scheme now centers around a computer interface.

ANO uses a lot of administrative procedures and maintenance procedures in carrying out the maintenance work. In addition, much goal-setting takes place with regard to the maintenance functions (e.g., corrective, preventive, and predictive maintenance), and goal achievement is tied directly to performance appraisal and salary adjustments for management and supervisory staff.

The AP&L Austerity Program, which was caused by the financial problems at Grand Gulf, has had little effect on ANO and on the ANO Maintenance Department, according to the Senior Vice President, Energy Supply. The main impact on ANO has been that some vacancies were not filled, some travel was cut, overtime was scrutinized more for need, and some capital projects were postponed. Given the recent rate increase, the Senior Vice President indicated that the Austerity Program had effectively been lifted at ANO.

Six separate computer systems are used onsite to organize, control and track various functions including the maintenance program. An onsite computer support group supplements the computer development effort at the corporate level.

Facilities and Equipment. The ANO-2 plant is clean and well ordered, including the warehouse, craft shops and office facilities. Based on team observations and plant staff input, workshops were judged to be sufficiently sized and equipped to handle the workload. Tool storage is somewhat cramped, but neat and well managed. The warehouse is well organized and clean, and all components are well labeled.

Maintenance is rarely delayed by material shortage. An inventory of approximately $35 million in spare parts is available to support both units. Computerized material management will be completely effected by June, 1986. ANO is part of an inter-utility cooperative parts loan system.

Although a component labeling program is in place and is reported nearly complete on Unit-1, Unit-2 is essentially unlabeled. Hand written labels on some equipment and valves was observed. Embossed brass tag labels are being used on Unit-1. Considering the recent change in offsite contractors, a potential exists for "wrong unit" or "wrong train" errors.

Technical Procedures. ANO has an extensive technical procedures program. There are formal specifications in the Administrative Procedures for the development, use, update, and control of technical procedures; for content and format requirements of the procedures; and for the verification and validation of the procedures. ANO recently implemented a Writer's Guide for writing maintenance procedures, has trained approximately half of the maintenance staff in the use of the Writer's Guide, has required that all new procedures be developed using the Writer's Guide, and has required that all procedures will be rewritten to meet the guidelines in the Writer's Guide during the biennial review of the procedures.

Personnel. With regard to personnel issues, ANO is adequately staffed in terms of keeping ahead of the backlog of maintenance items. However, overtime has been high, averaging from 22% to 40% across the different maintenance work groups since January, 1984. There are approximately 190 staff, including craftsmen, supervisors, and managers, in the Maintenance Department. There are an additional 36 staff in the Work Control Center for planning/scheduling purposes, for putting together work packages, and for maintaining an equipment history file. Maintenance personnel are supplemented by approximately 30 contractors in the Maintenance Support Group and by 54 contractors who do building maintenance. Except for I&C technicians, maintenance personnel turnover has been quite low since January, 1984. ANO has formal programs in place for job appraisals, for grievances, and for suggestions on safety and efficiency of operation. A formal, systematic approach to training has been used by the training staff for the past two years. The training goal of approximately 20% craftsmen time spent in training has been met or exceeded for the past two years.

Work Control. Control of maintenance tasks at ANO is well defined both conceptually and procedurally. Consistent responses from all vertical levels demonstrated good understanding of the newly instituted System Information Management System (SIMS) for maintenance task control. SIMS, despite its recent implementation in August, 1985, has produced little confusion and a minimum of frustration thanks to a well-planned user education program.

However, some operator dissatisfaction with SIMS, because of the reduction of operator control of non-day-shift maintenance crews, was noted. An increase in craft paperwork is seen as a drawback by the crafts, although their increased paperwork deals with more thorough specification of the maintenance they performed and with some form of root cause analysis. In the eyes of management and the survey team, these drawbacks have been completely overshadowed by the additional time available for craft supervision by first-line supervisors. This has allowed a dramatic increase in task supervision (average increase of approximately 35% in

increase in task supervision (average increase of approximately 35% in time spent on the floor supervising job performance) with a resultant increase, in the opinion of plant staff, in maintenance quality.

The survey team observed strong management support in all aspects of maintenance activities at ANO. If this trend is continued, it is the team's judgment that ANO should have a strong maintenance and surveillance program.

## APPENDIXES

A. Plant Staff Interviewed During the Site Visit.

B. Entrance and Exit Meeting Attendance.

C. ANO-2 Plant Data

D. ANO Maintenance Program Performance Indicators

# Appendix A - PLANT STAFF INTERVIEWED DURING THE SITE VISIT

| | |
|---|---|
| Sr. Vice President Energy Supply | John Griffin |
| Vice President Nuclear Operations | Gene Campbell |
| Nuclear Services General Manager | Tom Cogburn |
| Special Projects Coordinator | Marie Bishop |
| Maintenance Manager | Lynn Sanders |
| Mechanical Maintenance Manager | Kenny Coates |
| I & C Supervisor | Paul Jones |
| Shift Maintenance Supervisor | Jack Waxenfelter |
| Electrical Maintenance Superintendent | Ray Tucker |
| Mechanical Maintenance Superintendent | Vance Pettus |
| I & C Maintenance Superintendent | Larry Dugger |
| Mechanical Supervisor | Sherman Yancy |
| Electrical Supervisor | Roland Rousselle |
| Electrical Supervisor | Randy Ashcraft |
| I & C Supervisor | George Wrightam |
| Maintenance Engineer | Bob Lovett |
| Plant Analysis Superintendent | Sandy McGreror |
| Training Superintendent | Jimmy Vandergrift |
| Employment Industrial Relations Coor. | Jim Martin |
| Lead I & C Trainer | Burl Neal, Jr. |
| Lead Mechanical Trainer | Don Moore |
| Lead Electrical Trainer | Jim Wilson |
| Manager Quality Control | Lloyd Schempp |
| Q C Engineering Supervisor | Mike Durst |
| Q A Engineering Supervisor | Dennis Provencher |
| Health Physics Superintendent | Matt Bolanis |
| Engineering & Tech Support Manager | M. L. Pendergrass |
| Plant Engineering Superintendent | Chris Shively |
| Operations Assessment Superintendent | Bobby Terwilliger |
| Work Control Center Manager | Ray Wewers |
| Planning Supervisor | Gary Helmick |
| Scheduler | Bill McChord |
| Maintenance History Supervisor | Jason Remer |
| Maintenance Training Supervisor | Dennis Barton |
| Fire & Safety Prevention Coordinator | Gregory Storey |
| Electrical Journeyman | James Taylor |
| Electrical Journeyman | Steve Stork |
| I & C Journeyman | Tom Wilkins |
| I & C Helper | Shannon Briggs |
| Mechanical Journeyman | Garry Slate |
| Mechanical Journeyman | Leo Whinery |
| Operations Shift Supervisor | Clay Reed |
| Operations Waste Control Operator | Randol McAlister |
| Operations Auxillary Operator | Richard Swanson |
| Assistant Plant Operator | Larry McLerran |
| Senior Reactor Operator | Larry McCarty |

# Appendix B - ENTRANCE AND EXIT MEETING ATTENDANCE

Entrance Meeting Attendance (11-4-85 / 10:00 AM)

| | |
|---|---|
| Owen P. Gormley | NRC |
| N. B. (Tommy) Le | NRC |
| Yoshitaka Arakawa | MITI (Japan) |
| W. D. Johnson | NRC (SRI) |
| John Boardman | NRC RIV |
| Don Jarrell | Battelle PNL |
| Bill Rankin | Battelle PNL |
| Gene Campbell | AP&L |
| E. L. Sanders | AP&L |
| Ray Wewers | AP&L |
| Tom Cogburn | AP&L |
| Robert J. Huggins | AP&L |
| M. L. Pendergrass | AP&L |
| Basil A. Baker | AP&L |
| Marie Bishop | AP&L |
| Vance Pettus | AP&L |
| Larry Dugger | AP&L |
| Ken Coates | AP&L |
| Jack Waxenfelter | AP&L |
| Ray Tucker | AP&L |
| Margaret Snow | AP&L |
| Paul Jones | AP&L |
| Dale E. James | AP&L |
| G. Dennis Provencher | AP&L |
| Lloyd W. Schempp | AP&L |
| Jimmy D. Vandergrift | AP&L |
| Larry W. Humpherey | AP&L |
| Early C. Ewing | AP&L |

Exit Meeting Attendance (11-8-85 / 9:00 AM)

| | |
|---|---|
| Owen P. Gormley | NRC |
| N. B. (Tommy) Le | NRC |
| Yoshitaka Arakawa | MITI (Japan) |
| John Boardman | NRC RIV |
| W. D. Johnson | NRC (SRI) |
| Greg Cwalina | NRC |
| Robert S. Lee | NRC (Proj. Mgr. Unit-2) |
| Bill Rankin | Battelle PNL |
| Don Jarrell | Battelle PNL |
| Gene Campbell | AP&L |
| Tom Cogburn | AP&L |
| Raymond P. Wewers | AP&L |
| Donald B. Lomax | AP&L |
| Margaret Snow | AP&L |
| G. Dennis Provencher | AP&L |
| Larry Dugger | AP&L |
| J. C. Garrett | AP&L |
| Brian Hamptom | AP&L |
| Dale E. James | AP&L |
| Lloyd W. Schempp | AP&L |
| Jack Waxenfelter | AP&L |
| Raymond Tucker | AP&L |
| George Hoit | AP&L |
| Robert J. Huggins | AP&L |
| Paul Jones | AP&L |
| Vance Pettus | AP&L |
| Lynn Sanders | AP&L |
| Marie Bishop | AP&L |
| M. L. Pendergrass | AP&L |
| Basil A. Baker | AP&L |
| Jimmy D. Vandergrift | AP&L |

# Appendix C - ANO-2 PLANT DATA

Specific data about ANO-2 includes:

| | |
|---|---|
| Type | PWR |
| Licensed Thermal Power (MWt) | 2815 |
| Condenser Cooling Method | Tower |
| Condenser Cooling Water | Pond |
| Reactor Supplier | Combustion Engineering |
| Turbine-Gen. Mfr. | General Electric |
| Engineer | Bechtel |
| Constructor | Bechtel |
| Construction Permit | 12-6-72 |
| Operating License | 7-18-78 |
| Critical First Time | 12-5-78 |
| Commercial Operation | 3-26-80 |
| Most Recent SALP Ratings | |
| (SALP Rept 50-312/85-18 for December 1, 1983 - May 21, 1985) | |
| Maintenance | 2 |
| Surveillance | 2 |
| Quality Program | 2 |

SALP Performance Categories - Definition

Category 1: Reduced NRC attention may be appropriate. Licensee management attention and involvement are aggressive and oriented toward nuclear safety; licensee resources are ample and effectively used so that a high level of performance with respect to operational safety or construction is being achieved.

Category 2: NRC attention should be maintained at normal levels. Licensee management attention and involvement are evident and concerned with nuclear safety; licensee resources are adequate and reasonably effective such that satisfactory performance with respect to operational safety or construction is being achieved.

Category 3: Both NRC and licensee attention should be increased. Licensee management attention or involvement is acceptable and considers nuclear safety, but weaknesses are evident; licensee resources appear to be strained or not effectively used so that minimally satisfactory performance with respect to operational safety or construction is being achieved.

# Appendix D - ANO QUALITY PROGRAM PERFORMANCE INDICATORS

The Quality Indicators Program at ANO catalogs over 40 different quality indicators. The following listing gives these indicators and a brief description of each :

1. MDC Capacity Factor
   CF(MDC) = Net Generation/((Hours/Month)*(MDC))
   where MDC = Maximum Dependable Capacity (NUREG-0020)
2. Monthly Average Avilibility Factor
   AF = Hours Gen. on line/Hours in month
3. Total Net MWHr Generated
   Total MWHr = Final Day's Reading - Begining Reading
4. Average Net Efficiency
   ANE = Total Net MWHr/Total Thermal Power Developed
5. Average Circulating Water Temperature
6. Net Heat Rate
   NHR = Net Electrical Output/Total Thermal Power
7. Daily Average Gross Generation
8. Core Burnup vs. Time
   Effective Full Power Days vs. Time
9. Refueling Date vs. Capacity Factor
   Cycle Design EFPD - Expended EFPD =>
   Date when EFPD remaining = 0
10. Station Whole Body Radiation Exposure and Goal
    TLD and SRD corrected Dose
11. Station Skin Contamination Events/Month and Goal
    Number of individual skin decontaminations required
12. Station Solid Radwaste Generation and Goal
    Monthly running cubic foot total
13. Primary Chemistry Hours Out-of-Spec
    Hours at least one parameter OOS/Month
14. Shop Maintenance Manhour Distribution
    Manhours spent by mechanical,electrical and I&C on Preventive, Corrective and Surveillance tasks.
15. Shop PM's--Scheduled vs. Completed
16. Corrective Maintenance Backlog
    Total number of jobs which lack only available manpower and their associated manhours.
17. Non-Functioning Control Room Annunciators
    Annunciators which:
    a) fail to alarm on alarm condition
    b) alarm W/O alarm condition
18. Station Audit Finding Report Status
    Site QA discrepancies
19. Station Non-Conformance Report Status
    Site QC discrepancies

20. Number of Reports of Abnormal Condition Written (per month)
21. Number of Licensee Event Reports Written (LER's per month)
22. Number of NRC Violations (per month - by severity)
23. Number of NRC Open Items (per month)
24. Number of Safety Significant Human Errors (per month)
    An LER caused by personnel error
25. Number of Safety System Impairments (per month)
    Number of times a Tech Spec "time clock" was entered
26. Number of Unplanned Automatic Reactor Trips
27. Safeguards Equipment Unavailability Leading to a Limiting Condition for Operation (LCO) Time Clock (per month)
28. Percent of Time Clock Required to Clear an LCO
29. Number of times Action Statement 3.0.3 was Entered
    Plant in a condition outside most limiting condition permitted by an LCO
30. Number of Unplanned Safety System Challanges
    Actual actuation of HPSI, LPSI, Containment Spray or Core Flood/Safety Injection
31. Number of AC Power Actuations
    Actual loss of power to a safeguards electrical buss
32. Number of Lost-Time Accidents per Month
    Also number of manhours worked at the station since last Lost-Time Accident
33. Lost-Time Accident Incident Rate
    No. of Lost-Time Accidents/year/manhrs worked/2.E5 (accident rate per 100 man-years)
34. Number of No-Lost-Time Accidents/Month
35. Number of Vehicle Accidents/Month
36. Station Operating & Maintenance Budget and Expendatures
37. Station Capital Budget & Expendatures
38. Percent Overtime Worked (plant wide)
    Overtime hours/straight time hours
39. Absentee Rate