UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

November 30, 2000

MEMORANDUM TO: Chairman Meserve
Commissioner Dicus
Commissioner Diaz
Commissioner McGaffigan
Commissioner Merrifield

FROM: Janice Dunn Lee, Director
Office of International Programs

SUBJECT: IAEA REPORT ON OSART MISSION AT NORTH ANNA POWER STATION, JANUARY 22 TO FEBRUARY 10, 2000

The IAEA has completed work on the final report of the IAEA Operational Safety Review Team (OSART) Mission to the North Anna Power Station, conducted from January 22 to February 10, 2000. A copy of that report titled "Final Draft" is at Attachment 1. This report is entitled "Final Draft" because it contains findings and recommendations, and thus is always considered not available to the public unless specifically permitted by the U. S. There is another report, without the findings and recommendations, that will be de-restricted by the IAEA in 90 days unless otherwise requested by the U. S.

In response to EDO Control No. G20000226, comments were prepared on the initial draft report of the mission by Region II, on behalf of NRC. Additional comments were provided by NMSS regarding a specific issue in the draft report. We have reviewed the "Final Draft" report and find that all of NRC's comments have been accepted or accommodated. Of specific interest, the report still includes the statement that NRC should consider incorporating ICRP60 limits in 10CFR20, but goes on to say that NRC has indeed already considered this issue and has decided against inclusion of the ICRP60 limits in 10CFR20. Many additional comments were provided by the licensee and have been accommodated by the IAEA.

The initial draft report from the IAEA plus comments from NRC R-II and from the licensee were transmitted via Note to Commissioner Assistants from OEDO on August 1 and August 10, 2000.

Subsequent events for the North Anna OSART are:

De-restriction of the report (which does not contain findings and recommendations) on February 6, 2001 (90 days after the date of the transmittal letter), unless a contrary response is received by the IAEA from the U.S.;

Preparation of a plan by Dominion Generation to resolve findings and recommendations in the OSART report and transmittal to IAEA before the follow-up OSART mission;

Contact: C. Serpan, OIP
(301) 415-2341

Preparation of plans by NRC to interact with Dominion Generation to review the resolution plan and follow implementation;

Follow-up visit to North Anna in March 2002 (to meet the requirement of follow-up not less than 18 months after the initial visit); and

Publication of the final, OSART Follow-up Mission report (TBD in CY2002).

By copy of this memorandum, SECY, OGC, EDO, NRR, NMSS, RES, and IRO are being advised of the schedule of events.

Attachment: Final Draft Report of the OSART Mission
to the USA North Anna Nuclear Power Plant

cc: SECY
OGC
EDO
NRR
NMSS
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R-II
SR RI North Anna

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* See previous concurrence

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Only when it is known that the report has been 'derestricted' should this cover sheet be removed.

Division of Nuclear Installation Safety
International Atomic Energy Agency
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INTERNATIONAL ATOMIC ENERGY AGENCY

FINAL DRAFT

REPORT OF THE

OSART

(OPERATIONAL SAFETY REVIEW TEAM)

MISSION

TO THE

U S A

NORTH ANNA NUCLEAR POWER PLANT

22 JANUARY to 10 FEBRUARY 2000

DIVISION OF NUCLEAR INSTALLATION SAFETY

OPERATIONAL SAFETY REVIEW MISSION
IAEA-NSNI/OSART/00/106

PREAMBLE

This report presents the results of the IAEA Operational Safety Review Team (OSART) review of North Anna nuclear power plant, USA. It includes recommendations for improvements affecting operational safety for consideration by the responsible American authorities and identifies good practices for consideration by other nuclear power plants. Each recommendation, suggestion, and good practice is identified by a unique number to facilitate communication and tracking.

Any use of or reference to this report that may be made by the competent American organizations is solely their responsibility.

FOREWORD

by the

Director General

The IAEA Operational Safety Review Team (OSART) programme assists Member States to enhance safe operation of nuclear power plants. Although good design, manufacture and construction are prerequisites, safety also depends on the ability of operating personnel and their conscientiousness in discharging their responsibilities. Through the OSART programme, the IAEA facilitates the exchange of knowledge and experience between team members who are drawn from different Member States, and plant personnel. It is intended that such advice and assistance should be used to enhance nuclear safety in all countries that operate nuclear power plants.

An OSART mission, carried out only at the request of the relevant Member State, is directed towards a review of items essential to operational safety. The mission can be tailored to the particular needs of a plant. A full scope review would cover eight operational areas: management, organization and administration; training and qualification; operations; maintenance; technical support; radiation protection; chemistry; and emergency planning and preparedness. Depending on individual needs, the OSART review can be directed to a few areas of special interest or cover the full range of review topics.

Essential features of the work of the OSART team members and their plant counterparts are the comparison of a plant's operational practices with best international practices and the joint search for ways in which operational safety can be enhanced. The IAEA Safety Series documents, including the Nuclear Safety Standards (NUSS) programme and the Basic Safety Standards for Radiation Protection, and the expertise of the OSART team members form the bases for the evaluation. The OSART methods involve not only the examination of documents and the interviewing of staff but also reviewing the quality of performance. It is recognized that different approaches are available to an operating organization for achieving its safety objectives. Proposals for further enhancement of operational safety may reflect good practices observed at other nuclear power plants.

An important aspect of the OSART review is the identification of areas that should be improved and the formulation of corresponding proposals. In developing its view, the OSART team discusses its findings with the operating organization and considers additional comments made by plant counterparts. Implementation of any recommendations or suggestions, after consideration by the operating organization and adaptation to particular conditions, is entirely discretionary.

An OSART mission is not a regulatory inspection to determine compliance with national safety requirements nor is it a substitute for an exhaustive assessment of a plant's overall safety status, a requirement normally placed on the respective power plant or utility by the regulatory body. Each review starts with the expectation that the plant meets the safety requirements of the country concerned. An OSART mission attempts neither to evaluate the overall safety of the plant nor to rank its safety performance against that of other plants reviewed. The review represents a `snapshot in time'; at any time after the completion of the mission care must be exercised when considering the conclusions drawn since programmes at nuclear power plants are constantly evolving and being enhanced. To infer judgements that were not intended would be a misinterpretation of this report.

The report that follows presents the conclusions of the OSART review, including good practices and proposals for enhanced operational safety, for consideration by the Member State and its competent authorities.

CONTENT

INTRODUCTION AND MAIN CONCLUSIONS

INTRODUCTION

At the request of the government of the United States of America, an IAEA Operational Safety Review Team (OSART) of international experts visited North Anna Nuclear Power Plant from 22 January to 10 February 2000. The plant is located on the southern shore of Lake Anna in Louisa county, Virginia, USA. The site comprises of two PWR reactors, Unit 1 was first connected to the grid in 1978 and Unit 2 in 1980.

The purpose of the mission was to review operating practices in the areas of Management Organization and Administration; Training and Qualification; Operations; Maintenance; Technical Support; Radiation Protection; Chemistry; and Emergency Planning and Preparedness. In addition, an exchange of technical experience and knowledge took place between the experts and their plant counterparts on how the common goal of excellence in operational safety could be further pursued.

The North Anna OSART mission was the fourth in USA, the last being performed at Grand Gulf in 1992. It is also and the 106th mission in the programme, which began in 1982. The team was composed of experts from France, UK, Slovak Rep, Germany, Sweden, Belgium, Japan, Slovenia, together with three IAEA staff members and observers from Russia, Mexico and Switzerland. The collective nuclear power experience of the team was approximately 285 years.

Before visiting the plant, the team studied information provided to the IAEA by the North Anna plant to familiarize themselves with the plant's main features and operating performance, staff organization and responsibilities and important programmes and procedures. During the mission, the team reviewed many of the plant's programmes and procedures in depth, examined indicators of the plant's performance, observed work in progress, and held in-depth discussions with plant personnel.

Throughout the review, the exchange of information between the OSART experts and plant personnel was very open, professional and productive. Emphasis was placed on assessing the effectiveness of operational safety rather than simply the content of programmes. The conclusions of the OSART team were based on the plant's performance compared with good international practices.

MAIN CONCLUSIONS

The OSART team concluded that the managers of North Anna NPP are committed to improving the operational safety and reliability of their plant. The team found good areas of performance, including the following:

The team was impressed by the strong management team at the plant, which continuously demonstrated a clear commitment to safety. The ownership and motivation of the plant staff was also noticeable. Over the last years the plant has achieved and is presently sustaining, a very successful and safe performance and staff are obviously proud of this achievement.

Management has also recognized the need to nurture a continuous improvement culture with extensive and innovative self-assessment processes, performance indicators and a focus on special human performance initiatives. This is also reflected in the emphasis placed on top-of-the-line training and facilities. The highest level of safety is considered as a necessary condition to pursue in the operation of the plant. This is manifested in their management processes and is well established throughout the organization.

The plant has developed a very impressive and integrated use of computerized data- bases with very user friendly access systems. This strategy, to make maximum plant information generally available and to include timely operating experience, is a significant enabler for effective work by all staff. A tremendous array of plant information is available and well used by most employees. The ability of staff to readily obtain current data focused on their own area of responsibility is impressive.

A number of proposals for improvements in operational safety were offered by the team. The most significant proposals include the following:

Although the plant has developed a comprehensive set of administrative procedures, the system has become very voluminous and complex and often not well understood by employees. The procedures themselves tend to be overburdened with peripheral information and sometimes contain errors and duplications making it difficult for personnel to be aware of and to understand their content.

The team recognized that the plant performance is good in many areas but there appear to be some lapses in attention to detail that warrant additional attention. These lapses manifest in small pockets of poor; housekeeping, material condition, some less than favorable maintenance and industrial safety conditions and practices coupled with a lack of reporting of these conditions.

As stated earlier, there is a pride amongst staff in having achieved good performance and it was noted that in many areas that pride is justified. However, there are also areas where the plant can improve in order to achieve good performance on an international scale. In these areas it is important that the plant recognizes this opportunity and exposes some key functions to good international practices and performance to raise standards and stimulate further improvement. The plant is facing aging and obsolescence factors and as one of the lower cost energy producers is marginally resourced to handle any increase in work burden hence all the more reason to find innovative ways to further improve safe performance.

North Anna management expressed a determination to address the areas identified for improvement and indicted a willingness to accept a follow-up visit in about eighteen months.

1. MANAGEMENT, ORGANIZATION AND ADMINISTRATION

1.1. CORPORATE ORGANIZATION AND MANAGEMENT

The North Anna Power station is owned by Virginia Power, part of Dominion Resources Incorporated (DRI). Two stations, North Anna and Surry constitute the nuclear business unit of Virginia Power. The North Anna plant has been in operation for about 20 years, a project group has already been established to prepare for license renewal and life extension of the plant from the current 40-year license to a 60-year license.

Roles and responsibilities are clearly defined between both corporate and plant personnel and moreover, the matrix organization, including corporate representatives on-site, has established a good working relationship between plant and corporate personnel. The common areas of; human and financial resources, communication and union relations, are mainly held at the corporate level with a weekly review meeting attended by the Station Vice President. This process allows the plant management team to maintain its focus on the core nuclear business without under corporate distractions .

The plant matrix organizations of Engineering, Training and Oversight etc. which represent the Corporate Office functions have a good working relationship with Station Management and both have the same overall purpose of providing the safe and competitive production of electricity.

The importance of safety associated with quality, professionalism and fitness for duty is widely and effectively communicated across the plant using meetings and posters to continuously remind the employees of the company's commitment to safety and professionalism. In addition the Corporate Nuclear Business Plan represents a "contract" between the plant personnel and the Owner Company. It is built around 25 safety performance measurable drivers including corresponding goals. Performance to these areas is checked every month at a corporate review board meeting in order to monitor or initiate corrective actions.

The station resource level is established based on a three year plan. New investments are prioritized to respond to safety requirements, production availability and commercial needs.

Within schedule constraints, resources can be utilized from corporate level or from the other nuclear power plant (Surry Nuclear Station). This is typically done in support of plant outages but could be used for other significant projects as needed.

Plant management is strong, effective and well respected by employees. The management processes used in the plant are generally robust, innovative and comprehensive.

The highest level of Safety is considered a necessary condition in the operation of the plant; the vision of a World class operator implies permanent self-assessment and training to stay with the leaders. In this regard, North Anna has achieved a very successful performance. In the teams opinion, however, there is presently little resource margin to absorb increased demands and although the highly motivated staff continue to look for ways to improve, the potential for complacency and demotivation from the prospect of long term challenges with aging facilities and equipment and tightening budget poses a risk to maintaining that performance. The team has made a suggestion in this area.

1.2. PLANT ORGANIZATION AND MANAGEMENT

The organization of the plant includes departments for Operation, Maintenance, Radiological Protection and Safety and Licensing. Other functions like Training, Engineering, Human Resources, Oversight etc. are staffed on-site but are matrixed to the station from the corporate level. The rhythm of the plant life is supported by various short and efficient meetings held on a daily basis to bring step by step the information from the operating crews up to the corporate management level.

On a weekly basis, a management review board (MRB) and the Station Nuclear Safety Operating Committee (SNSOC) examine medium and long term projects as well as issues relating to nuclear safety.

The goals and objectives of the plant are translated into performance drivers and gathered into a station window annunciator panel where each performance driver is detailed and displayed in department panels. The station annunciator window program is self-sufficient and contains a level of detail adequate to measure the overall performance of the individual departments and the station overall. Moreover it includes a reported and pragmatic process of periodical review every three months leading to a real measure of progress. The process is well documented and the information is widely distributed throughout the station.

A program of self-assessment is used as a tool by the management team in relation to the follow up of performance drivers and corrective actions. This process is extremely comprehensive and constitutes a real strength for the management of this station. The team regarded this as a good practice.

Corrective actions are tracked at the department, station and corporate level according to their importance to safety. They are discussed at plant issue meetings, safety committee meetings (SNSOC), and the corporate safety committee. In addition, they are highlighted by oversight audits and during plant oversight meetings.

The SNSOC members exhibit a professional manner and stay focused on real nuclear safety issues. The committee is consistent and efficient with the participation of people directly concerned by the agenda.

The plant has developed several programs in the area of human performance that have substantially contributed to individual and group improved performance. Each department has a human performance specialist who has developed and applied training on human factors for the whole department and has developed specific human performance impact programs.

1.3. QUALITY ASSURANCE PROGRAMME

The company Quality Assurance Program for the operational phase is described in the Operational Quality Assurance Program Topical Report (OQAPTR). This report is written in the format of the Safety Analyses Report Chapter 17, part 2, "Quality Assurance During the Operational Phase" and provides comparison with the 18 criteria of 10 CFR 50, Appendix B.

The QA program is conveyed to the work force using the VPAP's (Virginia Power Administrative Procedures). These procedures follow the outline of the 18 criterion of 10-CFR-50 Appendix B. Where administrative guidance is needed beyond the criterion of 10-CFR-50 Appendix B, administrative procedures are sequenced at the end of the administrative tables.

Plant employees have a clear understanding of their responsibility for the quality of the activities assigned them. Although all employees may not understand that procedures are part of the policy on quality most employees understand that any action, or work assigned to them is expected to be completed right the first time. The QA documentation system (VPAP, OPAP...) is widely used within the plant and at corporate and is quite comprehensive and self-sufficient. However, although the QA program is intended to focus employees' attention on regulatory requirements and management expectations, the connection of the documentation system with regulations is not always clearly understood by plant employees. They have difficulties finding their way among the administrative procedures and to knowing what procedures affect their job. The team has recommended improvement in this area, which is further, explained in Section 1.6 of this report.

The corporate organization provides an agenda of audits whereby reports are generated and analyzed at appropriate levels, however, the backlog of corrective actions corresponds to half a year of findings.

Station Nuclear Oversight as part of the plant organizational structure is responsible for independently planning and performing activities to verify the quality assurance programs for different plant areas and are developed and implemented in compliance with; Technical Specifications, applicable codes and standards, NRC guides and regulations, company policies and commitments. Nuclear Oversight personnel from both the station and corporate offices report through a line of management completely separate from operational and production management and influences. Nuclear Oversight provides services for the station by means of internal audits and takes actions to focus on the problem areas providing recommendations regarding solution of problem areas. There is a weekly debrief of prevailing reviews with the site VP which provides a healthy independent assessment of issue status.

The comprehensive self-assessment program, which also provides contribution to the Station annunciator windows program, closes the loop of control.

The root cause evaluation process (RCE) is clearly described and the examples reviewed demonstrate that this a working process and is used by the people.

The corrective action process (referred to as "Plant Issues") at the station is an electronic system linked to the company's e-mail system. There were approximately 800 plant issues generated for corrective actions during the fourth quarterly of 1999, 450 are still open and 150 are completed. It still remains difficult to provide a good overall view of the full work process as this electronic process is still relatively new to the station having been implemented in September 1999, but initial indications are that it will be a valuable contribution to future programs.

1.4. REGULATORY AND OTHER STATUTORY REQUIREMENTS

The Nuclear Regulatory Commission (NRC) is represented by a resident inspector. He has access to all the technical information of the plant and has the opportunity to attend technical meetings, where he can focus his attention to the safety issues presented. In addition the inspections held by the resident inspector and those from the regional office provide an efficient overview of the plant.

Plant Issues are recorded in a 6 weeks report sent to the company and to the local authorities; this report includes follow up of prior requirement issues. The backlog is limited to 4 to 5 items showing a good response from the plant to implement corrective actions.

The everyday relations with the resident inspector are considered as satisfactory by both parties.

The daily communication between the regulator and the station staff allows both organizations to anticipate future problem areas affecting safety.

Technical specifications and regulatory requirements are well known, they are often referenced in daily and weekly meetings.

1.5. INDUSTRIAL SAFETY PROGRAMME

The safety message is conveyed at every level of the company, every meeting begins with industrial safety topic. Systematic pre-job briefings always begin with industrial safety comments. In the case of particular events, the daily meetings, from the workshop floor to the corporate level begin with the same safety information, the same information is also delivered verbally by the security officers at each entrance to the controlled area.

All staff appeared to be wearing the required individual protection devices. A few exceptions were observed but were typically corrected by direct intervention of the managers.

Despite all this, during the OSART mission team members noted some lapses in industrial safety practices particularly in maintenance and in addition 3 maintenance related industrial safety events occurred during the visit. The team has made a recommendation in this area.

1.6. DOCUMENT AND RECORDS MANAGEMENT

Procedures are used extensively at the plant to help ensure good quality of work and control of processes. They are very comprehensive but often contain a lot of information such as definitions and responsibilities, which can hide the operational part of the process. The administrative procedures, which constitute an extension of the Safety Analysis Report, appear to be overly complex and often contain the same information in multiple procedures. Moreover, the procedures contain some errors and discrepancies which can lead to confusion. Some workers, when interviewed, were not fully cognizant of some specific requirements in the administrative procedures and did not fully understand the links they have with safety. The team has recommended improvements in this area.

The modification of documents is orchestrated by a station procedure group. This group is supported by departmental people dedicated to the same purpose. They provide an efficient and reactive system adapted to the kind of modification to be made.

The record of documents is at a high standard of quality and in accordance with the procedures in use. The storage conditions for fire protection, control of humidity, and implementation of back-up storage at the corporate level are satisfactory.

DETAILED MANAGEMENT, ORGANIZATION AND ADMINISTRATION FINDINGS

1.1. CORPORATE ORGANIZATION AND MANAGEMENT

1.1(1) Issue: Over the last years, North Anna NPP has achieved and is sustaining a very successful performance, however, in the teams opinion, there is presently little resource margin to absorb increased demands. Although the highly motivated staff continue to look for ways to improve, the potential for complacency and de-motivation from the prospect of long term challenges with aging facilities and equipment and tightening budgets poses a risk to maintaining that performance.

Although the plant work backlog is high relative to international experience, it is well managed, is not increasing and the plant has a good knowledge of plant and equipment status with relatively low reporting thresholds. There is, however, evidence of aging and obsolescence becoming significant. This is preventing some work orders being closed due to the difficulty in obtaining parts and is forcing maintenance to do more repairing and refurbishing of components.

Safety and cost are considered in all plant decision making processes at all levels, but some staff expressed that, unless a request for a design change or equipment purchase can be linked directly to either safety or reliability, it will not be granted.

The emphasis the plant is making on self-assessment and improving human performance to bring about a sustaining safety culture is presently balancing the perception of increased cost drivers and short term budgeting. However, some poor office and working conditions, lack of space and other frustrations, although presently being tolerated, require careful management.

New work programs, such as the potential introduction of the SAP Work Control System, on top of an already very successful information system, the impact of the FSAR review and work related to the potential 20 year life extension will create demands on experienced resources. Overall, human resource levels have remained stable and relatively low compared to international practice over the last three years but plant demographics indicate retirements will play a significant role in diluting experience over the next 10 years.

Considering the above, it is important that there are strong links between corporate strategic planning and what is required to sustain the goals and objectives of the plant as depicted in the plant's business plan and displayed on the performance annunciator.

Placing increased burden on the plant and people at this time without the necessary compensatory measures could lead to deterioration of plant performance.

Suggestion: Corporate decision makers should consider reinforcing how they take into account the present vulnerability of the plant and its people to decisions which could affect safety, staff motivation, knowledge and working conditions. The necessary resourcing for longer term programs to sustain good performance while managing the effects of aging should also be considered.

1.1(a) Good Practice: There are several assessment tools used to monitor Station performance. These assessment tools have contributed to achieving improved levels performance and assist management in focusing in areas that require improvement:

- Nuclear Business Plan Performance Drivers are established to monitor and assess the performance of the entire Nuclear Business Unit. The performance drivers are divided into five sections that include Safety, Nuclear MWHR Production, Resource Management, External Relations and Regulation, and System/Component Reliability. Each performance driver contains windows that contain established goals. The status of each window is monitored on a monthly basis to determine whether Nuclear Business Unit performance is meeting the established goal. Each window is colored either Green (Exceeds Goal), White (Meets Goal), Yellow (Goal in Jeopardy), or Red (Goal Not Met). Windows that are colored Yellow and Red receive additional management attention.

- The Station Performance Annunciator Panel Program provides station management the capability to monitor and assess plant performance on a quarterly basis. The three main performance areas on the main annunciator panel include Equipment Performance, Non-Equipment Performance, and Cross Functional Performance. There are 32 performance panels under the main annunciator panel and there are 145 assessment areas used to document station performance. Each assessment area is reviewed against an established set of criteria. The assessment area is colored either Green (Significant Strength), White (Satisfactory), Yellow (Improvement Needed), or Red (Significant Weakness). Assessment areas that are colored Yellow and Red receive additional management attention and specific action plans are formulated to respond to improve performance. The results of the quarterly assessment are reviewed by the management review board and displayed to inform station employees of plant performance.

- Station level self-assessments are conducted by expert teams including people from other NPPs to determine the causes and contributors to identified personnel or programmatic weaknesses. The results of the assessments are reviewed by the management review board (MRB) to provide more objective conclusions that support effective decisions and corrective actions. Recommended corrective actions from station level self-assessments are tracked to ensure resolutions are completed in a timely manner. Completed corrective actions are periodically reviewed to ensure corrective actions are effective.

- Department self-assessment plans are established by each department to determine whether department programs, processes, procedures, and expectations are effective. On a quarterly basis, each department will review selected areas from the plan. The results of the department self-assessments are provided to the department head to initiate corrective actions for areas needing improvement. Recommended corrective actions are entered into a departmental tracking system to ensure resolutions are completed in a timely manner. The self-assessment is also provided to Station Nuclear Safety (SNS). SNS reviews the completed self-assessment and provides the department a grading sheet to indicate the quality and consistency of the self-assessment. The results of the grading are trended in the Station Performance Annunciator Panel Program.

1.1(b) Good Practice: Station and corporate personnel make effective use of a local area computer network to access current information on most station activities:

For example computerize logs located on the network are maintained by operations, maintenance, engineering, outage and planning, quality inspectors, and site services. The computerized logs effectively offer wide distribution of real time information that contributes to informed decision-making. This method of information exchange reduces control room distractions from personnel investigating the status of plant equipment. The network can be accessed by anyone onsite and by station management from home computers, allowing them to remain informed on current status of activities. Incorporation of operating experience information and the ability to be selective in data acquisition adds to making this a truly integrated and effective use of information technology.

The team noticed particularly:

- Availability of current procedures at the latest revision, Management (§ 1.6);
- Bimonthly electronic magazine :Ideas factory, Training (§ 2.1);
- Key information in control room, Operation (§3.2);
- Operating experience, Technical Support (§5.1);
- Chemistry functions (§7.3).

1.2. PLANT ORGANIZATION AND MANAGEMENT

1.2(1) Issue: The system of administrative procedures is complex, the links with safety are not well understood and the procedures themselves sometimes contain errors and duplications, making it difficult for personnel to be aware of and to understand their content.

Many supervisors informed the team that they are not sure which procedures affect their particular duties.

Several departments have produced informal guidance documents to help staff understand expectations without having to find them in the administrative procedures.

In the tagging office, the procedure OPAP 0010, tag-outs, was being used in its Revision 10 form however, the latest revision of this procedure was 11. The local staff had difficulties determining through the computer when the last revision was issued.

The procedures VPAP 2002, Work Request and Work Order Tasks, and VPAP 1402, Control of Equipment, tag-outs and tags refer to the same tag using different names and models. The tag is called in the first procedure Nuclear Work Request, and in the second Work Request Submitted Tag. In addition, different copies of the tags are attached to the procedure, the one on the VPAP 1402 is no longer used in the plant.

Despite the fact that some procedure approvals require up to 8 signatures, errors were found such as significant errors in a sentence referring to nuclear safety aspects of the Fix-It-Now team (VPAP 0801, Maintenance Program, page 37 of 41, first bullet).

The administrative procedure VPAP 1404, Reactor Control, issued in 1992, and VPAP 1410, Reactivity Management, issued in 1998 are inconsistent when describing plant management posts and responsibilities. For example, terms such as qualified control room trainee, station manager, senior operations manager are used in the document from 1992 despite the fact that these posts no longer exist. In addition, the plant operational phases are not treated consistently, e.g. reactor start up versus approach to criticality.

Administrative procedure VPAP-1404 for reactor start-up demands that reactor start-up shall be assessed and approved by station management in accordance with VPAP-2804 dealing with start-up assessment. VPAP-2804 does not exist.

In VPAP 1901 the responsibility of the maintenance superintendent appears in section 6.6 although it is not indicated in section 5 which specifies the responsibilities concerned by this procedure.

Staff were not always aware of some important contents of procedures, and the requirements were not always followed.

The structure of the plant procedures is described in the QA document and is described in administrative procedure, but the and staff had difficulties to explain the logic of this structure.

The procedure VPAP 1401, Conduct of Operations specifies that during normal operation access to the control room limited entry area requires the Unit Senior

Reactor Operator authorization. During emergencies and abnormal operations, a limit of 15 people should be established. In discussions with operations staff, including control room operators and supervisor, this limit was not always known.

The administrative procedure OPAP 0008, Control of Keys and Locked Valves and Switches requires key inventory three times per week. This has not been carried out recently and the staff were not aware of this requirement. The team was informed that before the re-engineering conducted at the plant some years ago, this inventory was carried out and recorded appropriately because administrative support was on shift. When staff was reduced, the administrative support was taken out of shift and the key inventory was overlooked and no one took responsibility for the task.

The team found the procedures robust but not always user-friendly. In several the substance of the procedure starts around page 10. When interviewing plant staff, they indicated that the administrative procedures were difficult to use and that important information was sometimes diluted by irrelevant texts.

Instances of lack of knowledge by staff of the system of administrative procedures and their links with safety and the fact that they contain errors and duplication can lead to mistakes.

Recommendation: The plant should review the coherence of the system of administrative procedures, assess and improve its user friendliness and make staff aware of the procedures that regularly affect their job.

1.2(a) Good Practices: The plant has developed several programs in the area of human performance that have substantially contributed to individual and group improved performance. Each department has a human performance specialist who has developed and applied training on human factors for the whole department and has developed specific human performance impact programs. Training by human performance specialists is given to managers and supervisors during their formal training and refresher programs. Examples of human performance difficulties from the plant and their solution are described. The plant has developed a Human Performance Agreement program. Managers and supervisors periodically observe key activities, such as shift turnover, job briefing and equipment tagouts and report areas for improvement in human performance. As an example, the operations department has instituted the following program:

Procedure and tagging activities are tracked monthly for human performance errors. The number of procedure steps completed and danger tags placed are totaled to determine the number of opportunities for error. Errors, categorized by severity, are then sorted by time of day, day of the week, and type of error. The information is trended to provide management with areas where additional attention is needed. This has led to changes in self-checking, component labeling practices, and use of simultaneous and independent verification. The number of activities performed is also used to determine if operator workload is equitably distributed. Concurrent activities in maintenance, surveillance, and tagging schedules are limited to reduce the potential for error.

1.5. INDUSTRIAL SAFETY PROGRAM

1.5(1) Issue: There is insufficient questioning attitude when dealing with industrial safety matters, particularly in maintenance, leading to plant conditions and personnel behaviors that are not always conducive to achieving good industrial safety performance.

- Three industrial safety events which were maintenance related occurred in the plant during the OSART visit: A fork lift was run into a door, an auxiliary building crane cable pulled out and arced close to the hand of an employee, a 50 lb bearing housing fell from the turbine hall crane down to the deck, a height of about 50 feet, during a maintenance operation on the crane. All of these could have been prevented by a questioning attitude or application of the STAR principles before doing the work.

- The work area surrounding the service water pipe repair project involved a large amount of tools and equipment in close proximity to unguarded operational safety-related equipment (pumps and valves, etc.). Some of the project tools and equipment were left lying about and had obviously not been used for some time, but had not been moved to a more suitable location. Even though the working area was by necessity extremely cramped, there were still many people in the location, some but not all of whom were essential to the job. Access, however did not appear to be restricted even though the area was somewhat hazardous. The team was told that a full assessment of industrial safety had been performed for the area, but that as the job progressed, the margins had been gradually encroached by lapses in control of material.

- At the boundary to working areas, there are few signs indicating the hazards due to the activity or resulting from the conditions.

- Neither in the industrial sections of the plant nor in the offices are there any indications of exit paths in case of fire or emergency. See Section 3.7.

- Although workers in general were seen wearing the required protective apparel, a worker was observed without hearing protection near boron recovery system, another was observed manhandling drums without gloves and no action was volunteered by the supervisor. Several people were seen in the area of the service water pipe repair project observing the welding operation and protecting their eyes from the glare with their hands rather than protective glasses or shields.

- Workers were noted throwing parts to one another when assembling a scaffold around a motor and a worker was seen drilling holes in a metal plate that was being hand held on a table by another. The work for receiving fresh fuel assemblies needs difficult manual intervention when the cask is raised to a vertical position and the plastic envelope is removed.

- It was noted that there was no safety chain at the top of a ladder in the area of the primary sampling system and there were no protective bumpers on horizontal valve stems in the service water building and on the secondary drains system in the turbine hall.

- Maintenance personnel had difficulty in obtaining the chemical hazard in Material Safety Data Sheet (MSDS) information from the computer when asked to identify such hazards for a chemical from the shop storage.

Lack of a questioning attitude in industrial safety matters can lead to a deterioration in standards and performance, personnel injuries, and a reduction in staff motivation.

Recommendation: The plant should reinforce the importance of industrial safety and the need for a questioning attitude and attention to detail in the area. Consideration should be given to enhancing job safety analysis on specific tasks and feeding the resulting information into the pre-job briefs and for walk around inspections.

2. TRAINING AND QUALIFICATIONS

2.1. ORGANIZATION AND FUNCTIONS

North Anna adopts a robust attitude to training, with very strong support from senior management. This is seen at all levels on site right up to the site Vice President and continues at the corporate VP level. Comprehensive procedures laid down and controlled by the use of the Training Program Review Committee and Training Review Boards ensure that all initial and continuing training programs remain current to the actual tasks being performed on site. As a result of these, a strong partnership exists between the line organization and training. They jointly agree on training program content and meet regularly to review progress. There are numerous examples of close working relationships between site staff and training. The team considered this to be a good practice.

The software database, "VISION", used by training staff at North Anna, consists primarily of a listing of all tasks (primarily safety related,) carried out by North Anna staff. These tasks are broken down into task elements and then cross-referenced to the appropriate training objective used to provide training against that task element. The training objectives are then linked to the material and then to assessment questions. By selecting tasks or task elements, the user of the system can immediately prepare lesson plans (classroom or OJT) and randomly generated assessments to support a training program. The team considered this to be a good practice.

The Program Development Teams, Training Review Boards, and the Training Program Review Committees provide an effective process for reviewing the effectiveness of training.

The assessment process is robust and rigorously maintained according to administrative procedures. Comprehensive training programs are planned a year in advance, and are vigorously adhered to and adequately support job responsibilities. Training records are well maintained, complete and adequately stored in a fireproof vault. Attendance on scheduled training is closely controlled and overall completion of approved training is above 99%.

The training center is well organized and staffed in support of North Anna's training requirements without the need for contractors. Some support for training in supervisory skills (leadership, coaching, command and control, etc.) comes from the Virginia Power corporate office via their Performance Development Center.

The instructors observed possessed good plant and technical knowledge. They are as well qualified as their station equivalents and in several cases, better qualified. Their continuing training program is very good and is based on a three-part approach to enhance instructor knowledge and performance. The three parts consist of quarterly instructor skills training improvement sessions, an annual instructor excellence workshop and a bimonthly on line magazine, which the team considered to be a good practice.

The instructors that were observed during the OSART mission all demonstrated good technical knowledge and good instructional skills. The robust training observation process with its feedback to instructors ensures that these high standards are maintained and all instructors' plant qualifications were seen to be current. There is strong pressure for all instructors to keep their qualifications up to date as several of them are used on station to support outages in responsible positions.

2.2. TRAINING FACILITIES, EQUIPMENT AND MATERIAL

The training facility at North Anna is well equipped. It has ten classrooms, which are all equipped with computers, computer projection equipment, video players, white boards, etc. The station has all its important documents and drawings stored on a networked computer system. This is linked into all the classrooms such that any of this information can be swiftly accessed and then projected onto large whiteboards for display to the students. The computer projection system allows for power point style presentations which incorporate digital photographs of actual station equipment which help to keep the training sessions relevant and up to date. The center also contains study rooms for self study and a well-equipped reference library, although the use of this library is becoming less important as all station procedures and drawings, etc., are on the station computer system and this is available to all students.

All laboratories and workshops visited contained replica plant equipment, and training staff together with station personnel make every effort to ensure that it is well used. In several training areas, scenarios have been developed that deliberately include several different disciplines training together.

The training center houses a full scope simulator, which accurately models North Anna Unit 1 control room. Together with a simulated auxiliary shutdown room, and a small self check-switching simulator, these adequately support normal, abnormal and emergency events training. The simulator is routinely used for emergency drill training. Training staff at North Anna put a lot of effort into maintaining the fidelity of the simulator and there is an efficient process for controlling work and software modifications on the simulator.

The simulator software is also used to run a classroom simulator in the training center. This is a soft desk type simulator with photograph style presentations of the desk controls and indicators that can be operated with a computer mouse. This is used in a variety of training scenarios and is particularly effective in briefing sessions and non-licensed operator training.

The simulator is fully equipped with a comprehensive sound recording system and three cameras used to video training sessions. The simulator can also store up to one hour of operations and play them back in the simulator hall and together these make a very effective feedback system, which enables students and instructors to effectively debrief training sessions. The feedback aids are very effective and students can normally self evaluate their training sessions with the minimum of input from the instructor. All LORP examination sessions end with a debrief, several of which are carried out by the Shift Supervisor Operations who has received training in simulator debriefing. He is assisted by an Operations instructor.

Training materials at North Anna are well maintained and organized according to their Administrative Documents manual. Any changes to training materials are fed into the system by their Training Impact Reporting (TIR) System, which is managed by their Program Change Coordinator (PCC). All changes (e.g., OEF, modifications, task changes, document changes, etc.) are fed to the Program Change Coordinator, who raises a TIR and allocates responsibility for the change to a specific instructor. The TIR is entered into a database and tracked monthly to ensure it is completed. If the issue needs to be relayed urgently to staff, then the PCC can issue a training information bulletin that can immediately be sent electronically to all staff.

The only area where the control of training materials could be improved is in the area of power point presentations. Approved power point presentations are stored on a specific drive on the networked computer system and this is available to all instructors in all training rooms. However, they also have all the other networked drives available to them in the training rooms and so they could inadvertently select a power point presentation from another drive that was under development and hence unapproved for use. The station would be advised to limit access to the networked computer system in the training rooms to approved drives only.

All new training packages are either self-taught computer based packages or power point computer presentations and the quality of the visual aids in both is excellent. Digital photographs are used extensively in the power point presentations. These have proven so successful that the training staff, in conjunction with the maintenance department, has produced a series of electronic maintenance briefs, which essentially tie together maintenance procedures with digital photographs of the actual equipment the procedure relates to. These briefs are available to everyone via the networked computer system. As maintenance staff performs maintenance activities, they are photographing them so that training staff can produce more of these briefs. However, some of the photographs in these briefs do not demonstrate best maintenance practices and the team has made a suggestion in this area.

2.3. CONTROL ROOM OPERATORS AND SHIFT SUPERVISORS

The initial training program for licensed control room staff is based on a systematic analysis of control room tasks. The initial licensed operator training program covers all critical tasks performed by the operators, both in the control room and on the plant, and the training observed during the mission was viewed as world standard.

The continuing training program (LORP: Licensed Operator Requalification Program) is 420 hours long, spread over two years and provides refresher training on all plant systems and emergency procedures. Use of the TIR process ensures that plant modifications are fed into the LORP in a timely manner.

The shift team training, as observed, was carried out in a professional manner. However, in one debrief that was observed, team issues and issues such as control room conduct, were not discussed or reinforced. The debrief focused entirely on technical issues and the timeliness of the operations that were taken. Debriefs carried out after simulator training should always be used to reinforce management's expectations and a suggestion has been made in this area.

2.4. FIELD OPERATORS

The field operators training program, is based on a full systematic approach to training with tasks and training objectives maintained on the Vision database. Use of the Operations Training Review Board ensures that the operations department provides a good input into the development of the non-licensed operator's training program. There are seven steps in the training program ranging from basic watch standing principles and administrative tasks to working on control and protection systems. Each step is assessed and must be completed before moving onto the next and each step contains specific duties and specific tasks. The practical training uses job performance measures to train in all of these tasks.

The continuing training program, for the non-licensed operators, is based on the Vision database as well as input from the operators themselves who are able to select subjects to go into the training program for the following year. The NLO's receive 112 hours of continuing training. As tasks are modified or new tasks added to the worklist, then training is informed and if necessary, a training impact report will be issued. Training also uses a new/modified task assessment form, which effectively controls those people who have been trained on the new task and then adds them to the task qualification list.

2.5. MAINTENANCE PERSONNEL

There is a very close relationship between the Maintenance instructors and their site counterparts. Instructors attend many site meetings and hence can then factor site events/issues directly into training. All tasks and task elements are cross-referenced to the relevant training objective in the Vision database. However, there is no observation skills training program for the check technicians and a suggestion has been made in this area.

The laboratories are equipped to a high standard with equipment that accurately replicates equipment used on site. The practical content of the training is based directly on actual tasks that need to be performed on site. In many cases, the final part of the training is the performance of a Job Performance Measure (JPM), which is a demonstration of an actual task or procedure. These could be demonstrated to either a trainer or a qualified plant evaluator. The process is such that whoever provided the training in a task would not be the evaluator for that task.

The continuing training program is usually finalized in the last quarter of the year in preparation for the next year. It includes elements selected by instructors, managers, supervisors, and a needs assessment completed by the staff themselves. In 2000, the continuing training programs are 76 hours for a Nuclear Instrument Technician, 48 hours for a Mechanic and 48 hours for an Electrician.

2.6. TECHNICAL SUPPORT PERSONNEL

The Technical Support programs are all very comprehensive, covering all work areas and aspects such as quality, self-assessment, nuclear safety, safety culture, ALARA and human performance enhancement. The instructors for technical support personnel are all specialists in their disciplines. They maintain a close contact with their counterparts on station and spend at least three days a quarter working on station with them, and often work on specific site projects.

The subjects covered in continuing training are derived from training instructors, managers, supervisors, and from the staff themselves via a needs assessment. In 2000, chemistry technicians will spend 80 hours in continuing training, health physics technicians 76 hours, health physics specialists 32 hours, and engineering support personnel 16 hours. The programs are spread across the year and attendance strictly controlled. There are very good practical facilities available for both health physics and chemistry and a good balance is achieved between the use of these facilities, JPMs and classroom-based training.

2.7. MANAGEMENT PERSONNEL

There is a strong initial training program for managers and supervisors consisting of two phases, the first concerned with leadership lasts for 32 hours and must be completed within 6 months of appointment to a supervisory role. Phase II is eight days long and builds on the previous material, covering such things as planning, organizing, leading, staffing, qualities of an effective supervisor, management versus leadership, situational leadership, motivation, communication, time management, etc. Line managers at all levels provide input into training sessions. At several of the training sessions provided at the company headquarters, the company vice presidents take part and lead some of the training events.

The continuing training program at North Anna is very strong and made up of several elements. There is a front line leadership course designed to enhance supervisory skills. Eight hours per year are spent on safety issues. Line managers with duties in an emergency will train as part of the emergency exercises. Training will be assigned to them as part of their annual appraisal process and there is a suite of open enrollment courses that they are encouraged to consider. Also, North Anna has embarked on a human performance enhancement process, which involved INPO conducting two courses on site for the managers. INPO then trained some North Anna staff as instructors and they are now being used to train all site staff. A CBT package has also been developed in human performance enhancement.

2.8. GENERAL EMPLOYEE TRAINING

There is a good initial training program given to all new North Anna workers which is Computer Based Training (CBT) with packages covering the following areas: plant access training, basic radiation worker training, respiratory protection training, fire watch training, confined space entry training, sub-atmospheric containment access training, and initial fitness for duty supervisor training. RCA access training, RCA dressout training and fire training are completed as practical training sessions in well-equipped facilities. Contractors receive exactly the same training as the plant personnel, adapted to where in the plant they are being granted access.

The CBT packages adequately reinforce high quality standards, adherence to procedures and rigorously reinforce the plant's safety culture. The initial group of ten CBT packages is well supported by a range of other CBT packages, classroom and self-teach packages for other specialist staff.

Initial Training is reinforced annually with a similar, but shorter, CBT package. This package has a built-in examination, which must be successfully completed every year. If an individual does not complete this within fifteen months of the previous test, then site access will be denied to them

DETAILED TRAINING AND QUALIFICATION FINDINGS

2.1. ORGANIZATION AND FUNCTIONS

2.1(a) Good Practice: The Training Review Boards create a partnership between plant and training staff which contributes to line management ownership of training resulting in continuous improvement of the learning environment.

The Training Review Boards oversee training at the working level and consist of Superintendent (applicable discipline), Superintendent Nuclear Training, Supervisor Nuclear Training (applicable discipline), Supervisor (discipline), and other relevant people may be co-opted, as necessary. The review boards meet quarterly.

These review boards cover all site disciplines (eg. Operations, maintenance etc.) and meet regularly to discuss all aspects of training, training performance, changes to training programs, approval of programs etc. They lead to a very close relationship between site and training staff, examples of which are seen in the following areas:

- Subject-Matter Experts (SMEs) from site are routinely used to present training in all areas. Classes presented by the SME are attended by a qualified instructor. The qualified instructor intercedes and provides support as necessary to assure SME instructional effectiveness and consistent presentation of the subject matter;

- Training mockups and simulators, extensively used throughout the station, are provided using line department resources. For example, a mockup of the charging pump seal array was designed and manufactured by Station machinists that enables Mechanics to practice seal disassembly/ assembly prior to maintenance;

- Instructors regularly attend meetings on site, get involved in site projects and provide support to the outage.

2.1(b) Good Practice: The systematic approach to training is applied using a comprehensive training database, which is used effectively to enable timely, accurate, and cost-effective program design and maintenance of accredited training programs.

Performance-based training focuses instruction on a documented set of job performance outcomes and standards. Using a systematic instructional design process, all of North Anna's accredited training programs' job/task analysis information is integrated into an electronic data system to reflect the entire performance-based process. The software, known as "VISION," allows instructors to view a program's complete layout (analysis, design, and development), and quickly search, review, and retrieve training information and various documents from a desktop computer.

Job performance measures (JPMs) and randomly generated tests are produced from the VISION database. These documents are used to qualify trainees on program tasks. Within VISION, tasks are arranged under function (i.e., duty) areas. Below each task are its performance steps and the skills and knowledge (KSAs) associated with it. These KSAs are converted into cognitive objectives, and test items are created to evaluate them.

All test items for instructional material are electronically collected to form a question pool from which the VISION software can produce randomly generated tests. A table of specifications (a blueprint of an exam or exam bank) is produced to ensure all objectives are covered. This table provides a link between the objectives and the test items, as well as identifies the type of test items (e.g., multiple choice, essay, etc.) available in an exam bank or on a specific exam. If more than one version of a test is required, the software automatically scrambles distractors and/or selects different questions.

The primary advantage of the VISION software is the efficiency and consistency it provides. The test and document generation features allow instructors to perform routine development duties more quickly and easier than previous methods. Another advantage is that the same links that tie the data together provide a search trail for change management.

2.1(c) Good Practice: A bimonthly electronic magazine, The Idea Factory, is used to update instructors and helps to maintain and improve instructional knowledge and skills. It provides ideas and activities for application either in the classroom or in the development of training materials. Instructors and staff from both sites (North Anna and Surry) and corporate contribute ideas and activities. Examples of things covered by the magazine include the following :

- Aids to making Power Point presentations;
- Simple safety presentations that can be cut and pasted into other longer presentations;
- Details on presentation techniques;
- Examples and meanings of confusing words;
- How to search the Internet for training material;
- Training games;
- Training examples and Operating Experience Feedback (OEF) from other industries.

2.3. CONTROL ROOM OPERATORS AND SHIFT SUPERVISORS

2.3(1) Issue: There is no process in place to ensure the consistency of simulator debriefing. Two simulator debriefing sessions observed at North Anna varied in both content and style. One was very well performed covering both technical and human factors issues and made good use of the video throughout the debrief. However, the other focused entirely on technical issues and the timeliness of operation made no use of the video and did not cover any human factors issues or reinforce management's expectations of Control Room conduct. Simulator debriefing is an important part of the overall training process and if not completed properly, could result in an overall decline in the standard of training received by the operators which in time could lead to a degradation in operator performance.

Suggestion: The plant should consider establishing a process that ensures a consistent standard of simulator debriefings, that include both technical, human factor issues and management's expectations of control room conduct.

2.5. MAINTENANCE PERSONNEL

2.5(1) Issue: There is much evidence on site of a lack of attention to detail in the maintenance areas, and this is also reflected in maintenance training. In some of the electronic maintenance briefs produced by training, there are some electronic photographs that do not demonstrate good maintenance procedures for example:

- Coils of Tygon hose on a cover about to be lifted.
- A valve handle shown with a hose wrapped around.
- Inconsistent use of gloves shown in photographs.

When maintenance personnel train on practical scenarios in the training facility, they are given an excellent set of tools from the training center to use rather than using their own.

The excellent mock-ups and space available in the training areas does not adequately challenge the maintenance technicians to pay attention to detail in the areas of material condition and housekeeping.

The check technicians who are used on site to peer check other peoples work and carry out plant observations have no training in observation skills.

See maintenance issues 4.5(1), 4.6(1) and 4.6(2).

If the training environment does not adequately reflect the actual plant conditions such that attention to detail can be focused on, then incomplete or negative training may be given which could lead to a decline in maintenance standards on the plant.

Suggestion: The training department should consider providing the Check Technicians with training in observation skills, (with perhaps some examples in the training material being chosen from North Anna Plant), and they should also consider giving them exposure to standards of excellence.

The Training Department should also consider reviewing their electronic training material to ensure that it demonstrates best practice in maintenance.

The Training Department should also consider reviewing its maintenance training scenarios and facilities to ensure that a focus on attention to detail is achieved during the training. An accurate representation of the plant should be aimed for, whilst still providing training in the correct processes and procedures.

3. OPERATIONS

3.1. ORGANIZATION AND FUNCTIONS

The operations department of North Anna Power Station is headed by the Operations Superintendent who is responsible for the operation of the two units. The department is staffed with well-qualified and experienced personnel.

The operations department is composed of three groups, Shift Operations, Operational Support and the Maintenance Advisory group. The support and maintenance groups include areas such as fuel handling, water treatment, labeling coordination, tagging and the "Fix-It-Now" team (minor repairs). Several meetings covering most of the plant activities allow management to remain well informed of plant performance. The shift has a combination of very experienced and newly licensed staff, the majority being long time experienced. In discussions with the control room operators and supervisors, they demonstrated good knowledge of and commitment to safety policies.

Administrative procedures at corporate, plant and department level define responsibilities and interfaces among several groups of the plant. Nevertheless, the team identified several inconsistencies among plant administrative procedures, as well as some errors. In addition, plant staff were not always aware and knowledgeable of the requirements contained in these administrative procedures, and in some instances requirements were not accomplished. In the MOA section of this report, the team recommended improvements in this area. Policies and management verbal communication are consistent and emphasize the importance of safety first. Safety culture is referred to at several hierarchical levels of the plant.

Goals and objectives are well established at the plant level. At department level more specific goals are established. These assist management with an effective oversight of plant operations. They are clearly communicated to staff, orally and by posters around the workplace. They are measurable, and presented in a user-friendly way, permitting easy visualization of trends and reference to established goals. Colored windows, green for significant strength, white for satisfactory, yellow for improvement needed, and red for significant weaknesses facilitates staff self-assessment. Operators were found aware of these goals and objectives, but in some cases they indicate it is a tool for managers, and they do not have much chance to influence how the windows are organized and calculated. A comprehensive program is in place to follow-up actions resulting from recommendations from the different internal and external reviews.

An administrative procedure directs a general plant self-assessment program, which appeared to be of good quality. Processes seem to be well implemented. Included in the review teams are staff from the other nuclear power plant of the utility and representatives of other utilities within the country. Basically, a minimum of a quarterly self-assessment is required to be performed, with subjects determined by the site.

The plant's program to update licensed supervisors and operators returning to shift after a long time off shift quite needs to be strengthened. Operators and supervisors are rotated between units one and two quite frequently, relying on the periodic operators training program and normal shift turnover to update them with the differences between the units. The team recognizes that the training programs, including simulator and shift turnover are comprehensive, and aspects of plant design and procedure modifications are included. Nevertheless, the team suggested strengthening the plant program for licensed staff preparation on returning from lengthy periods off shift or when changing units.

3.2. OPERATIONS FACILITIES AND OPERATOR AIDS

The control room is common for both units. The control room panels are well laid out and the system and equipment status is adequately and effectively indicated. The plant has a policy for minimum-lit annunciators.

The Control Room is equipped with various reliable communication systems inside and outside the plant for normal and emergency situations.

The plant maintains the installation of some unused equipment. Generally it is well maintained, but in one instance the team identified unused equipment exhibiting standards of material condition and housekeeping below the station standards. There is some potential for such condition to develop complacency amongst staff with an acceptance of lower standards and the team made a suggestion in the technical support area of this report.

Control of operator aids is well described in an operations administrative procedure. Although the plant has implemented a good system and control of posted information for operator aids and equipment labeling, the team still found areas in need of improvement and made a suggestion in this area.

Operations maintains key operating information readily available to the operators through the use of a local area network computer system (LAN). The LAN contains not only standard plant information such as procedures, but also current plant conditions and operational experience. This was considered a good practice in the management, organization and administration part of this report.

Although the procedures in the Auxiliary Shutdown Panels (ASP) were found updated, the files were not stored and filed in a manner expected by plant standards. In addition, their location could present a fire hazard to the installation. The team recommended improvements in this area.

In general, plant cleanliness and housekeeping is of good quality. Nevertheless, areas for improvement were identified, see suggestion in the Conduct of Operations part of this report, and recommendation in Maintenance.

3.3. OPERATING RULES AND PROCEDURES

The plant has good and well-organized Technical Specifications. When staff need an interpretation, a Technical Specifications interpretation request is processed and documented. The copies the team reviewed were well maintained. The plant strongly values the Technical Specification requirements and procedures adequately refer to the topics they are intended to accomplish. Nevertheless, 12 Technical Specifications violations were identified for the two units over the last two years. Five of them were due to missed surveillances. The plant Design Review Program, an activity which has been ongoing for the last years and is coordinated by the engineering department, has revealed that some safety equipment surveillances were missing in the overall periodic test program. Such irregularities have been promptly corrected and communicated to the regulatory body.

Entries and exits of Operational Limits and Conditions were found well documented at Control Room and easily available in the computer. The Shift Technical Advisor, who also issues a report about this subject, provides additional oversight.

The engineering department co-ordinates the plant periodic tests required by the technical specifications. For those that affect the operations department, a detailed independent review is performed and control of the program and results is maintained.

Normal operating procedures are detailed, well written and well maintained. All technical procedures are computerized, and hard copies are kept in Control Room. For normal operations and shutdown conditions, risk assessment is used prior to a maneuver and isolation of plant safety equipment. Procedures and software guide and facilitate these calculations and decisions. The emergency operating procedures are symptom oriented procedures, clearly written and easily accessible both in the main control room and Emergency Shutdown Panel. During discussions, it was noted that the procedures are well understood by the control room staff.

3.4. OPERATING HISTORY

The plant history indicates that smooth, reliable and safe operation has been achieved.

The plant reporting criteria follows clear plant procedures, which are in accordance with international practices. Even for minor events, Plant Issues (PI) reports are generated, analyzed and tracked. This establishes a low threshold for plant reporting and analyzing, allowing development of a rich source of internal experience feedback. PI reports were noted to be well developed, containing information on corrective actions, staff responsible for corrective actions and a tracking number for follow-up.

The team observed that training for operations staff, shift and pre-jobs briefings adequately includes past experience.

3.5. CONDUCT OF OPERATIONS

The plant has a strong procedure compliance policy. When observing conduct of operations, the operators staff were noted to systematically follow written procedures.

Control room operators were found attentive and responsive to plant conditions. Interference with their routine plant supervisory work is minimized and carefully supervised by the unit supervisor. Work to be performed in the control room is carefully planned to avoid simultaneous activities and possible distractions to the shift staff. System parameters are recorded through handheld computerized logs in a similar manner to the data obtained by the operators in the field. The team sometimes found the Control Room busy. The plant has no written policy for drinking and eating in the "Operator At the Controls" area, and smoking is permitted for on-duty panel operators. The team recommended the plant should minimize the personnel traffic inside of the control room. In addition, the plant should establish clear policies for drinking, eating and smoking in the control room "Operator At The Controls" area.

Operations shift turnover is directed by specific and detailed procedures, which include checklists and refer to information contained in computer programs and shift log books, which have to be acknowledged by the incoming shift. When observing shift turnover, the procedure was carefully followed and information was well transmitted and verified. Effective pre-shift and pre-evolution briefings have improved plant turnover and worker performance. The team found them effective, detailing tasks, responsibilities, identifying risks and countermeasures. Authority of the unit and shift supervisor was clear. This was recognized as a good practice.

The plant and specifically the operations department have developed several programs in the area of human performance that substantially contributed to individual and group improved performance. The team recognized this as a good practice in management, organization and administration section of this report.

The plant surveillance program appears to be comprehensive. Engineering maintains the oversight of the program, but operations approves its implementation and is informed by the other departments at the end of each surveillance.

The operations key control system does not guarantee adequate support to system reliability. A plant administrative procedure requires key inventory three times per week, but this has not being done, the team recommended improvements.

The field operator rounds were found generally of good quality, adequately supported by procedures and a portable computer. However, during the plant tours the team noted that field operators did not always recognize and report equipment deficiencies, housekeeping and industrial safety deficiencies. The team suggested improvements in this area.

A plant administrative procedure contains guidance to appropriately manage reactor reactivity. It highlights general principles to control changes in reactivity. In addition, at corporate level the Reactivity Management Review Team meets quarterly to discuss issues relating to reactivity at both of their nuclear sites and experience from other utilities. Requirements for post-trip investigation and implementation of corrective actions prior to restart are properly covered by plant technical procedures. However, the team identified that some procedures overlap these requirements and an error referring to a non-existing administrative procedure was also found. See the recommendation "plant administrative procedures" in the Management, Organization and Administrative section of this report.

3.6. WORK AUTHORIZATIONS

The plant work control process, from the identification and report of a deficiency, Nuclear Work request, Work Order, Tag-out, Authorization, Post maintenance testing and Work completion is regulated by plant administrative procedures. Work orders are computer generated from work requests submitted by plant personnel through a series of co-ordination meetings that appropriately discuss, e.g. safety, priority and risks. The plant has a somewhat high backlog in work requests compared to good international standards. Some of these work requests are from 1997.

The operators identify and maintain a list of "operator-work-arounds" where operations has to compensate for deficiencies in the plant. These operator-work-arounds are reviewed by operations management.

The plant administrative procedures describe the requirements for independent and simultaneous verification. In addition, all work clearance tagouts are independently verified when placed and removed. The team observed that this was well implemented.

The process for plant temporary modifications is well described in administrative procedures. The implementation appears adequate, but the team identified several examples of cables and hoses that were not authorized or not well installed. The plant does not recognize all these installations as temporary modifications, and the team made a recommendation for improvement in the technical support section of this report.

3.7. FIRE PROTECTION PROGRAMME

The plant relies on the external support of neighborhood fire brigades and drills have demonstrated this arrangement to be adequate and reliable. Operations and security staff on shift comprise the internal brigade. They receive adequate training and perform necessary drills.

The plant fire protection systems are adequate and well maintained. Motor and Diesel driven pumps feed a common firewater ring header. Monthly periodic inspections on fire extinguishers and hoses are carried out in accordance with plant procedures. Some records were reviewed, and found to be of good quality. During field tours, the fire protection equipment was found to be in good conditions. The hoses are very well protected by plastic covers or in special cabinets. Fire doors were found closed and during plant tours field operators were noted to verify their status and operability. The plant does not always reduce the presence of combustible material and fire hazards. For example although, fire load permits were issued for the service water line replacement working areas improvement were still needed. The team recommended improvements in this area.

3.8. ACCIDENT MANAGEMENT

Accident management at the plant from operations perspective, is clearly organized and well described in adequate procedures and contains all the essential components required to provide a good response. Minimum shift group composition is adequate for necessary actions during the emergencies including fire. Simulator training and drills confirm this. The on-call technical personnel and managers support the on-duty Shift Supervisor. The emergency plan implementing procedures include a detailed description of the notification requirements and are adequately supported by necessary communication process. In addition technical information such as that from the Post Accident Monitoring System, support operators' decisions during emergencies. Results of Probabilistic Safety Assessment have been used to set up training scenarios and development of Severe Accident Management Guidelines (SAMG). Licensed operators and Technical Support Center staff receive initial training and retraining each three years on the use of SAMG procedures.

DETAILED OPERATIONS FINDINGS

3.1. ORGANIZATION AND FUNCTIONS

3.1(1) Issue: The plant's program to update licensed supervisors and operators returning to shift after a long time off shift needs to be strengthened. Operators and supervisors are frequently rotated between units one and two, relying on the periodic operators training program and normal shift turnover to update them on the differences between the units.

The operations shift schedule includes a period of 7 days off and another off duty period of seven days, 4 of which are used for training and simulator activities. A licensed person off shift may keep his/her license active by attending a minimum of 5 days per quarter on operations shift. Return from any extended periods off shift, including vacations, does not require any special update training for instance on plant modifications and new procedures, before assuming shift responsibilities.

An event from July 1999 indicated that a wrong operation of the unit 2 deborating IX caused an inadvertent increase of reactor power. One of the contributing factors was identified as supervisors and operators participating in the operation that caused the event were returning from a seven days off shift and were not briefed on the sensitivity of such operations, although they had previous experience in operating the system.

The team recognizes that the training program, including simulator and shift turnover are comprehensive and aspects of plant design and procedure modifications are included. The plant has a list of plant and procedure modifications called Operations Required Reading, but it is not obligatory for the staff to read it prior to or during the turnover. The plant, including the training section, has no comprehensive official list of the differences between units one and two, hardware and software, although they seem to be small in number.

International experience shows that returning to shift functions after a long time out of shift or changing units without proper preparation can lead to a lack of awareness of detailed plant status and consequently inappropriate operator actions, mainly during abnormal situations.

Suggestion: Consideration should be given to strengthening the plant program to update licensed supervisors and operators returning to shift after a long time off shift or when changing units. The plant should consider making the Operations Required Reading obligatory for the staff to read prior to or during the turnover, and develop an official list of the differences between Units 1 and 2.

3.2. OPERATIONS FACILITIES AND OPERATOR AIDS

3.2(1) Issue: Although the plant has implemented a good system of control of posted information for operator aids and equipment labeling, the team still found areas in need of improvement. These include lack of identification, double equipment identification (two different kinds of labels), dirty labels and few cases of non-authorized handwritten information. Examples are as follows:

Examples of areas with non authorized information were; At the external nitrogen storage tank, temperature limit tables and electrical power distribution drawings on control room panels, condensate polishing unit panel unit 2 turbine hall.

Examples of poor equipment identification/labeling were identified on;

Low pressure heater drains pump, fire water valves near the condensate pumps, valve close to heating from IHVUH12B, 1-GM-P8 and P5, 1-WT-209 and adjacent pumps, service water building fire water pump and some auxiliaries, valve building for the service water system

The plant has a system to temporarily identify equipment found without approved labelling where a pink tag is applied to the equipment. This tag is however not dated and managers, supervisors and operators when touring the field can not rapidly identify and track actions to resolve reported labeling deficiencies.

Use of unauthorized operator aids and poor labeling can lead to human errors, personnel injury and incorrect system operation.

Suggestion: Consideration should be given to identify current deficiencies in posted operator aids and plant equipment labeling and speed up its enhancement towards the high standards expected by plant management.

3.2(2) Issue: Although the procedures in the Auxiliary Shutdown Panel (ASP) were found updated, they are not stored and filed in a manner specified by plant standards. Procedures are placed untidily inside the bottom of the referred electrical panel. Although a significant sample of the procedures were checked and confirmed to be updated, obsolete letters from 1979/1980 and obsolete revision status sheets are placed together with the updated procedures. In addition, their location may present a fire hazard to the installation. A telephone set was found inside each ASP; later it was confirmed that they were out of use, and should not be in the panel. In addition, spare or abandoned non-identified cables were placed inside of one of the ASPs. This indicates lack of attention to an important panel, which would be used under the stress of a plant emergency situation and with limited resources.

The operability of the ASP could be compromised due to poorly stored and filed procedures, which could lead to inadequate operational actions.

Recommendation: The plant should improve the storage and filing of the Auxiliary Shutdown Panel procedures. In addition, the plant should relocate the set of procedures to outside the panel and remove any unnecessary material from the panel.

3.5. CONDUCT OF OPERATIONS

3.5(1) Issue: The key control system does not guarantee adequate support to system reliability. The administrative procedure OPAP 0008, Control of Keys and Locked Valves and Switches requires a key inventory to be taken three times per week. This has not been carried out and the staff were not aware of this requirement. The team was informed that before the re-engineering was conducted at the plant some years ago, this inventory was carried out and recorded appropriately because administrative support was on shift. When staffing was reduced, the administrative support was taken off shift, the key inventory was overlooked and no one took responsibility for that task. Without a reliable control of plant safety related keys, system reliabilities may be reduced.

Recommendation: The plant should implement a key control system to effectively support system reliability.

3.5(2) Issue: The team sometimes found the control room busy. In one instance 20 people were in the room, including a group of visitors. In addition, the plant has no written policy for drinking and eating in the "Operator At The Controls" area, and smoking is permitted for on duty panel operators. The plant explained cigarette butts found on the cable trays between the Control Room doubled floor as being left over from construction; cigarette ashes were also found in the Control Room.

A possible contributor to the personnel traffic in the Control Room is VPAP-1401, Conduct of Operations, which does not establish controlled to access to the Control Room. In addition, several exemptions exist to access the Control Room Limited Controlled Area. Procedures state that, during emergencies and abnormal operations, the limit of 15 people should be established. In discussions with operations staff, including control room operators and supervisor, it was noted that this limit was not always known. In addition, some staff stated that during outages the number of people entering the control room is even larger.

A busy control room could lead to distractions to the control room operators and supervisor, that may lead to inappropriate operational actions. Lack of a clear and adequate policy on drinking, eating and smoking in the control room may lead to a downgraded control room environment and incidental damage to panel circuits.

Recommendations: The plant should minimize personnel traffic inside the Control Room and should establish clear policies for drinking, eating and smoking in the control room "Operator At The Controls" area.

3.5(3) Issue: Although field operator rounds were generally of good quality and with comprehensive procedures for these activities, the team noted that field operators do not always recognize and report deficiencies in equipment, housekeeping and industrial safety.

For example:

In both units the steam driven auxiliary feed water pump room sump contains a steam trap, steam valve, steam pipes and pipe supports that have surface corrosion with insulation missing and valve labels which could not be read from floor level. These conditions along with several other examples of corrosion such as the primary grade tank electrical panel and the clarifier building heating steam system were not reported.

A few grounding cables were found not connected and there were examples of oil leaks and other equipment deficiencies that were also not reported.

During plant walkdowns several unreported examples of housekeeping deficiencies were noted.

In addition, the plant has a number of nuclear work requests and clearance isolation tags that have been in place for long period of time (up to 3 years). Clearance isolation tags and temporary labeling tags do not have the application date indicated. This makes it difficult for managers and supervisors and field operators, when touring the field to rapidly identify and track actions taken to remedy reported deficiencies.

Deficiencies not reported by field operators on equipment, housekeeping and industrial safety may cause plant equipment unavailability and personnel safety to be reduced.

Suggestion: Consideration should be given to assure that field operator plant rounds identify and report deficiencies in equipment, housekeeping and industrial safety. When touring the plant, managers and supervisors should enforce high expectations of plant conditions. In addition, the plant should consider to provide field operators with training in observation skills.

3.5(a) Good Practice: Operations Shift and Unit Supervisors conduct and participate in briefings that significantly improve the plant staff awareness of potential nuclear and industrial safety issues and formulate countermeasures for foreseeable events in planned activities. In addition, representatives of the areas possibly affected by the activity are invited to participate and confirm his/her responsibility, preparedness and understanding of the activity. The operations representatives focus on the possible influence of the activity on the plant operational status and the responsibility and authorities are clearly delineated within the discussion group participants. This was observed to be an important factor for improved plant work preparation and performance and shift turnover.

Pre-evolution: Detailed pre-job briefings include shift turnover briefings that help ensure operations personnel are cognizant of operational activities. Additionally, pre-job briefs are used prior to important surveillance tests and unusual plant operations. Procedure details such as initial conditions, precautions and limitations, and procedure steps are reviewed. Pre-job and complex procedure briefings were noted to be completed and highly participative. Typical briefings include all participants, cover industrial safety, the applicable procedure or section to be accomplished, potential risks, and compensatory measures. The team also observed that experience gained in previous equivalent activities were systematically explored during these briefings, and included specified contingency actions for foreseeable complications.

Pre-shift: Thorough operations shift turnovers and detailed turnover briefings contribute to increased operator awareness of current plant conditions and planned activities and improves teamwork with other plant groups. Following the individual watchstation turnovers, the shift supervisor leads a turnover briefing. This briefing is attended by all on-coming operations watchstanders, chemistry and radiation protection supervisors. Shift supervisors briefing includes industrial safety, key information obtained during their individual turnover and activities planned for the shift that will involve coordination with other work groups. This discussion process enables all participants to better understand the priorities of the day for the station and to establish the coordination needed to more efficiently meet those priorities.

3.7. FIRE PROTECTION PROGRAM

3.7(1) Issue: The plant does not always reduce the presence of combustible material and fire hazards. Examples are as follows:

Around the service water pipe repair project working area, the team identified several fire hazards. Fire load permits were issued but improvements were still needed for example; many gas bottles were found in the Radiological Controlled Area (RCA) including oxygen, acetylene and compressed air etc. mainly close to the service water work, black rubber mats appeared to be freely used in this area and in several buildings of the plant to protect the floor coating during maintenance work.

There were some examples of poor storage of flammable materials for example; in the auxiliary shutdown panels, several procedures were placed at the bottom of the panels which may present a fire hazard, in the RCA basement a waste bin for "oil rags only" was overloaded with too many rags such that the bin cover could not be closed, in the auxiliary building there was a 200 litre oil drum behind the boric acid transfer pumps, full of oil stored for use during the charging pump maintenance, the permanent radiation protection storage room in the basement of the RCA was packed with wood and plastic without a fire load allowance.

Several oil leaks were noted around the generator hydrogen seal oil system, the diesel generators , the charging pumps and the diesel fuel tank for the fire water pump and although wooden scaffolding is being replaced by metallic boards there remains some unnecessary quantities of wood about the plant.

Without reducing combustible material, both temporary and permanent and fire hazards within the plant, fire risk increases and this could lead to equipment unavailability and personnel injury.

Recommendation: The plant should reduce the amount of combustible material and fire hazards present in the plant and associated facilities.

4. MAINTENANCE

4.1. ORGANIZATION AND FUNCTIONS

The maintenance department is organized in four sections, Mechanical, Electrical, Instrumentation & Control and Maintenance Support. The organization is defined in the Department Administrative Procedure Number MDAP-0001 and the responsibilities are clearly defined in procedures.

The maintenance department is responsible for performing all corrective and preventive maintenance on all plant equipment. Since 1994 the plant has a clear strategy to do more maintenance work with their own staff rather than contractors. Instrumentation & Control (I&C) staff perform corrective and preventive maintenance, including the plant process computer (P-250), security system and the equipment qualified calibration program (North Anna Quality Control). Maintenance Support provides assistance to various maintenance areas such as predictive analysis, preventive maintenance, check valve testing, material and service requisition. It also provides trends for the various activities within the department.

Interfaces with other plant areas are not directly described in a single procedure but are spread across several maintenance administrative procedures. Good communication between departments was observed, as well as between the maintenance management and staff.

The plant maintenance personnel appeared well trained with appropriate working knowledge. They were generally well prepared for their work and used mock ups for less frequent activities. Procedures were in use at the observed work sites.

Quality Maintenance Teams (QMT) within the maintenance department have the responsibility for performing Quality Assurance checks during work performance. These teams are properly trained for their duties and coordinated by the QMT Coordinator. This strengthens the ownership for Quality Assurance in the maintenance department. A process has been developed by the maintenance department as a method of identifying concerns, ensuring appropriate levels of review and providing timely resolution. The process includes the Check Tech Program, Maintenance Review Board (MRB), and the Maintenance Work Around Program. Since its inception in January 1997, the Maintenance Self Improvement Process has been instrumental in identifying and tracking to resolution approximately 270 items. This was recognized as a good practice by the team.

4.2. MAINTENANCE FACILITIES AND EQUIPMENT

Each of the maintenance sections has a well-equipped workshop available for non-contaminated components. Each staff member has his or her own basic set of tools. Tools taken out from the main tool room are registered in a computer system. The Auxiliary Building Tool Room however is a free issues tool store and was found in an untidy state and to contain several damaged tools. International experience would indicate that the maintenance of good conditions and practices within such a free issue tool store is extremely difficult unless the appropriate culture exists within the work force and that of contractors. The team judged that this is not the case at North Anna and that consideration should be given to providing custodial resources to the facility.

The department has a training center adjacent to the large mechanical workshop. Mock-ups have been constructed for some of the most complex maintenance tasks; e.g., charging pump mechanical seal, valve actuator test rig, and a small process loop training rig. The training center has been developed taking into consideration equipment on which problems have occurred in the past.

Damaged tools are tagged and placed in a segregated box. Before tools are delivered for use, tool control personnel test them. The control of measuring and test equipment is carried out in a special workshop. In the Electrical and I&C maintenance workshop, all equipment was well labeled, indicating relevant test dates, etc. There is a good system in place to record and track all details concerning measuring instruments.

A plant procedure requires that lifting equipment (e.g., cranes, hooks, eyebolts) are tested annually. Although the test program is implemented, no labels are applied to the equipment to facilitate immediate identification for safe use. The plant should consider improving this area. The team observed that slings are labeled with the dates of the next inspection and test. The use of slings, however, did not always follow best international practice, this is further discussed in the recommendation in topic 4.5 of this report, regarding maintenance practices.

The storage of washing chemicals in the workshops was acceptable. A color-coding system is used to identify and distinguish between chemicals to assists staff in correctly applying authorized chemicals to tasks. However, when requested to identify the hazard associated with these chemicals via the computerized MSDS system, the maintenance personnel had considerable difficulty attaining the data from the computer system.

4.3. MAINTENANCE PROGRAMS

The Plant Preventive Maintenance (PM) program has been developed from supplier recommendations and further enhanced by experience gained on site. The maintenance team has steadily improved the PM program and currently there are about 12000 PMs performed on a periodic basis. During the year 1999, 6000 PM tasks were revised. Whenever it becomes necessary to change a PM task, an authorization has to be obtained from the engineering department through a special PM task evaluation form. The PM program was last updated in September 1999. The maintenance department has a well-implemented process for reviewing and revising the time windows for carrying out preventive maintenance activities.

The plant predictive maintenance program is in accordance with good international practices, and includes techniques such as oil sampling analysis; vibration monitoring analysis; thermography scanning; and bearing temperature trending. These techniques are controlled in accordance with the administrative procedure MDAP-0009. There is a monthly maintenance predictive analysis report. Predictive maintenance techniques are effectively used for maintenance program improvements.

ASME-boiler and pressure vessel code requirements are reflected in company procedures. Non destructive testing results are traceable and fully documented. The testing results are discussed between vendors and site management. All the results are stored on computer and can be easily accessed by all departments.

The corrective maintenance program is well conducted, and although the number of backlog work orders is higher than good international practices it is lower than the plant goal. The department has control of these numbers, including reasons for the backlog. Some of the deficiencies in equipment were noted as having been that way since 1997 however the team could not find examples of standing deficiencies that could significantly challenge plant safety.

4.4. PROCEDURES, RECORDS AND HISTORIES

The majority of maintenance tasks are covered by written procedures, which were found to be of good quality. Review of some of these procedures revealed that they are detailed and contain requirements for safety. Strict procedural compliance is expected with results well documented. The team observed that this requirement was well accomplished by maintenance staff.

Maintenance history goes back twenty years. The records contain a comprehensive plant history of repairs and activities relating to specific equipment. It also includes Deviation Reports and an engineering response to the deviation report. Results are used for improving the maintenance process. This documentation is well controlled and accessible by computer.

4.5. CONDUCT OF MAINTENANCE WORK

In general, maintenance practices were found to be good, but there were indications of lack of attention to details in the conduct of maintenance. This includes aspects of maintenance practices (e.g., use of slings) house keeping (e.g., shop work area tidiness) and storage and maintenance of tools and equipment (e.g., free issues tool storage). The team recommended improvements in this area.

There were three industrial safety events, which were maintenance related, that occurred in the plant during the OSART visit. The team also observed several other maintenance practices that were not up to international levels industrial safety. The team has made a recommendation in the area of management Organization and Administration (Section 1.5) for improvement in this area.

Maintenance staff take the ALARA concept seriously. There are many examples where the plant tries to reduce dose by improving work routines and equipment. The team observed several examples of equipment modifications used to reduce dose.

4.6. MATERIAL CONDITIONS

Overall, the plant material condition is good. The team noted a few examples of equipment deficiencies of which maintenance were not aware. Although equipment deficiency backlogs in the plant are higher than good international practices, they appear to be under control and safety items were found to receive utmost priority. However, the team found some examples where improvements are still needed to keep a consistent high standard of material conditions in the plant. Less than satisfactory standards of material conditions precludes excellence, and the team suggested improvements in this area.

The plant policy for foreign material exclusion, FME is described in an administrative procedure and contains the most important aspects to prevent damage of components or fuel elements. Nevertheless, the team found examples in the field where the plant policy was not rigorously applied and recommended a more rigorous implementation of the FME policy.

4.7. WORK CONTROL

Maintenance work planning is timely and thorough. Several daily meetings help to plan, coordinate and inform all areas of the important on-going and planned work. The work is clearly described in approved work authorization documents and when needed supplementary instructions are issued. Maintenance sometimes uses electronic pre-job briefings which contain some instructions and pictures of the components to be worked. These electronic briefs seem to be a powerful tool to prepare maintenance crews just before they perform a task. The team encourages the plant to use such a briefings but the pictures should show exemplary maintenance practices and set ups of tools and equipment. The team observed that some of these pictures need improvement in this aspect. The plant preventive maintenance to corrective maintenance ratio is about 75%, which is in accordance with international experience. This value has been maintained relatively constant by the maintenance department over the last few years.

4.8. SPARES PARTS AND MATERIALS

The general responsibility for material procurement lies at the head quarters level. At the plant, the Nuclear Material group is responsible for local aspects of material procurement. Requirements for material storage are well implemented by the plant.

The main warehouse is well organized for receipt and storage of spares. It is divided into non-safety related and safety-related areas of storage. The warehouse personnel were noted to be well trained. Safety-related spare parts are properly checked for general condition, correct documentation and quality of packaging. Acceptance testing for safety related material is well covered by quality assurance. Although the warehouse is well organized, there are no means to limit oil spills in the oil storage area, and the plant should consider improving this deficiency.

Traceability of nuclear safety relevant parts from supplier, through warehouse to work order seems to be thorough. There is a good program to monitor shelf life of components. Shelf life is clearly marked on components and chemicals.

Due mainly to aging and obsolescence, the plant has experienced some difficulties with some of the material suppliers in obtaining duplicate replacement parts, in particular some electrical components are no longer manufactured. The maintenance department in conjunction with engineering is doing a good job chasing down and providing such parts where they exist or refurbishing the old components. The team could not identify examples were nuclear safety was challenged by this difficulty.

4.9. OUTAGE MANAGEMENT

The Outage and Planning Department is organized in four sections, Long Range and Daily Planning, Planning, Unit Outage Coordination, and Turbine Coordination. The Outage Organization is well described in the Department Administrative Procedure, PLAP-0001. The responsibility of the staff is clearly defined in the procedures.

The outage department is responsible for managing the overall planning and scheduling of maintenance related work activities such that safe and reliable plant operation is optimized. During outages, the superintendent outage and planning is the individual designated as an outage manager. He has the decision-making authority to manage all outage activities. He is supported by the Unit Outage Coordinator and an outage support staff. Satisfactory planning, experience feedback and communication between engineering, operation, maintenance and radiation protection exists. The plant has implemented a good process for recruiting outage personnel which utilizes previous performance which is documented in comprehensive history information available to help facilitate recruitment of quality personnel.

A comprehensive timetable for outage activities exists, including all the pre-outage milestones and their required completion dates. This program is designed taking into consideration nuclear safety and minimization of radioactive dose and waste during the outage period.

The maintenance department makes extensive use of mock-up training in order to improve task proficiency and reduce dose during the outage.

DETAILED MAINTENANCE FINDINGS

4.1 ORGANIZATION AND FUNCTIONS

4.1(a) Good Practice: The Maintenance Self Improvement Process was designed to be used by Maintenance personnel as a method of identifying concerns, ensuring appropriate levels of review and providing timely resolution. The process consists of the Check Tech Program, Maintenance Review Board (MRB), and the Maintenance Work Around Program.

Check Techs are voluntary personnel acting in the capacity of a peer inspector within their discipline. A primary function of the Check Tech is to perform field observations of maintenance activities. This individual observes work and industrial safety practices, adherence to technical and administrative procedures, proper tool usage, foreign material exclusion, pre and post job briefs and other aspects of the job as appropriate.

Station management and department heads utilize documented observations made by the Check Tech to help focus resources on areas needing the most improvement. Procedural, physical and administrative barriers to performing tasks are documented by the Check Tech for inclusion in the maintenance department electronic log. This also allows review by other departments, adding to their awareness. These observations may also written down for presentation to the Maintenance Review Board.

The Maintenance Review Board (MRB) provides a focal point to facilitate addressing of maintenance issues and concerns by maintenance personnel. Each item is given a number for tracking purposes and then is presented to the MRB for consideration. The board decides if the item is to be pursued by the board or if it could be handled internally within that department. The board is composed of and chaired by maintenance personnel. Management participates in an advisory capacity only. Issues that cannot be resolved or are felt to be beyond the scope of the MRB are escalated to the Maintenance Work Around list.

Maintenance Work Around items are assigned a number and priority based on the area of significance. Personnel safety deficiencies, procedural technical inadequacies, ALARA concerns, and rework items, which have alternative actions pending, are given highest priority. Enhancements to procedures, processes, and work practices fall into the next category. The status of these items are periodically presented to upper management. This increases attention to the items by the responsible department heads.

Since its inception in January 1997, the Maintenance Self Improvement Process has been instrumental in identifying and tracking to resolution approx. 270 items.

In addition, Quality Maintenance Teams (QMT) have been appointed with the responsibility to perform Quality Assurance checks during work performance. This strengthens ownership for Quality Assurance in the maintenance department.

4.5 CONDUCT OF MAINTENANCE WORK

4.5(1) Issue: In general, performance of the maintenance program at the plant was noted to be good, but there are some indications of lack of attention to details in the conduct of maintenance.

Examples of lack of attention to details in maintenance practices include:

- Powdex Precoat Overlay pump 2 CP P 6A was left uncoupled, with screws and nuts left untidily on the base of the pump, coupling on one side was poorly covered by a cloth with no work area owner sign;
- Two personnel, in the Auxiliary Building tool crib free issue area, were observed drilling holes in a metal plate without proper equipment. (One person held the plate while the other drilled, a vice to secure the plate or use of a drill press is the normally accepted method.)
- A maintenance person was measuring the internal diameter of a coupling from the charging pump 2C on the floor of the work area with tools and other equipment lying around. (A table or bench for such work would have enabled the work to be completed in a more professional manner, with greater accuracy and would have created a better environment.)
- When a group was assembling scaffolding around the changing pump motor, pieces were thrown up and down, with clear disrespect for safety equipment and personal safety;
- Several slings were found in the plant that were not always applied in accordance with the best international practices;
- Deficiencies were noted in the application of the Foreign Material Exclusion Plant Policy. See issue 4.6(2);
- Maintenance staff had difficulty locating MSDS (Material Safety Data System) information from the computer.

Examples of poor maintenance house keeping included:

- The service water pipe line repair work area was very cluttered due to the congested work space, some equipment and tools were not stored tidily and the housekeeping needed improvement.
- The free-issue material control entrance area exhibited very poor housekeeping;
- The auxiliary building tool crib was very congested, housekeeping was poor and, as it is not staffed, there appeared to be little quality control of the stored equipment;
- Many work shop areas were somewhat untidy, with clothing and other material on the benches. Some material was stored in corners and some equipment pieces stored haphazardly.

Examples of tools and equipment poorly maintained and stored included:

- On the working area of the charging pump 2C, a piece of discarded piping with extremities protected from FME was found mixed up with scaffolding tubes, wood pieces and a ladder;
- In the auxiliary building, free issues tool store, some hammers, measuring tapes, and hydraulic press were found to be faulty;
- In the large mechanical machine shop, calibrated measuring devices found stored in a box together with non-calibrated measuring devices;
- A maintenance tool box used for changing the refueling purification filter exhibits an RP card with the indication of fixed contamination of <1,000 dpm/cm2, 0.2 mrem/h. The box contain facial masks mixed with tools and several other pieces of equipment in a disordered and untidy condition;
- The turbine building storage cage for laborers and welding equipment;

Without attention to detail in the area of maintenance, plant conditions may deteriorate and affect overall reliability of the plant. Use of faulty tools and poor housekeeping could cause personnel injury.

Recommendation: The plant should improve the conduct of maintenance with a increased focus on attention to details. Tools and equipment storage areas should be well controlled and tidily arranged. Supervisors and managers in the field and training for maintenance staff should reinforce the importance of all aspects of maintenance conduct as a way to strive for excellence.

4.6 MATERIAL CONDITIONS

4.6(1) Issue: Although the plant overall material condition was good, the team found a few examples where improvements are still needed to maintain consistent high standard and indicates some lack of attention to detail by maintenance personnel.

Examples of poor material conditions are followed:

- In both units, the Steam Driven Auxiliary Feedwater Pump sumps contain steam traps steam valve steam pipes and pipe support with some surface corrosion. Some insulation was also missing.
- Several galvanized electrical conduits and junction boxes, outside the plant, are corroded;
- Some general corrosion around Refueling Storage Tank and Refrigerant Unit 2 QS MRIA
- Insulation was damaged on piping in the area of the bottom of the main condenser;
- Blow down cooler: water on the floor
- Oil leaks generator-sealing system
- Oil leaks on the Charging pumps and piping
- Emergency Diesel 1/ 2 EE- EG 1H, 2H, 1J, 2J several oil leaks
- Clarifier building: Heating steam system 1HV boiler, valves and pipes corroded;
- See Issue 3.5(3) in Operations part of this report.

Small deficiencies in material condition, if left unattended, could become precursors to the development of less than satisfactory standards of material conditions in the plant could lead to deterioration and hence unreliability of plant equipment.

Suggestion: The plant should consider reinforcing their program for identifying and correcting small deficiencies in material condition. In addition, the plant should consider training staff and supervisors in techniques for field inspection and deficiency reporting. Managers and supervisors in the field should coach and enforce a high consistent standard for material conditions and enhance attention to detail.

4.6(2) Issue: Although the FME Program is rigorous, instances were found in the plant where the concept of the administrative procedure VPAP-1302 for Foreign Material Exclusion (FME) was not rigorously applied. Examples are as follows:

- In the Service Water pipe repair project working area, sensing lines are stored on the floor with the ends protected by tape. This tape is not always well applied and in one instance, the tape was open and the end of the pipe unprotected;
- Some piping removed from the service water system was placed on the floor, with FME implemented, but some of the ends of the pipes were covered by clear tape, against the instructions given by the VPAP-1302;
- When observing the preparation for a major maintenance work in the charging pump 2C, the team observed that some of the piping was taped to avoid foreign material. Nevertheless, these tapes were not always well secured and the area was found dusty and containing considerable debris.
- In the Spent Fuel Pool, the entrance corridor is narrow, the barrier is open and not enclosed there were no restrictions on material entering the area and hence there is a risk of things falling into the pool;

In discussions with the training department and reviewing some of the training programs, it was noted that specific training on the procedure VPAP 1302, Foreign Material Exclusion Program was applied to plant staff. It included main concepts and industry experience. The training department also informed the team that scenarios were arranged to simulate deficiencies in FME implementation. Nevertheless, deficiencies in the plant implementation of the FME were not recognized and not specifically targeted during the training scenarios. See recommendation 2.5(1).

Lack of attention to plant procedures and targeted FME-practice could lead to foreign material entering safety-related systems and causing damage to components or fuel elements. This could lead to unreliability of safety systems, fuel damage and increased dose to plant personnel.

Recommendation: The plant should rigorously apply its FME-policy. Supervisors and managers in the field should coach staff in applying FME. The plant should also consider improving the staff training in FME by including actual deficiencies found in the plant. Furthermore, the plant should consider installing a solid barrier alongside the Spent Fuel Pool.

5. TECHNICAL SUPPORT

5.1. ORGANIZATION AND FUNCTIONS

A re-organization of Nuclear Engineering, including the nuclear stations and corporate office, was completed in October 1996. On-site design, systems, component and testing groups, managed by on-site superintendent of engineering, report to the new Engineering Department. The on-site design group is an extension of the corporate design group and is matrixed to the site superintendent of engineering. Project management, design authority, configuration management, core management, fuel and information technology are located at the corporate office in Innsbrook. The team found strong evidence that good teamwork and communication was aiding in the success of this new organization.

Due to this new organizational concept, corporate engineering is developing and controlling workflows and procedures and enforcing standards jointly for both Surry and North Anna NPPs. Corporate high level weekly screening meetings are conducted to discuss potential technical problems. During team observation of such a meeting, it became evident that it was aware of its responsibility to take a decisive position on deviations affecting the operability of equipment and of its responsibility to inform operations immediately of the consequences of any such conditions. The continuous effectiveness of this matrix concept is strongly dependent on personnel awareness and responsiveness to on-site needs.

Within the same matrix concept the on-site engineering groups are encouraged to be strongly involved in the "daily operational tasks" including functional and acceptance criteria for surveillance testing, post maintenance testing requirements and playing a lead role in operations short term trouble-shooting. This matrix works very well and the engineering staff show strong ownership for the plant. Very effective interaction was observed between the on-site system-engineering group and operations, strongly supported by regular meetings (among matrix partners) and a strong and well-adapted integrated computerized information system.

In-service inspection programs, preventive maintenance programs, operating experience (industry) program and "System Health Reports" are well established and focus on present system and component status. The newly introduced "System Health Report" process provides a powerful tool to give an oversight of system status and helps to communicate this status to plant management in different areas. The team considered this to be a good practice.

On-site, engineering support is organized and managed by a well-implemented routine including a prioritization process involving operations and maintenance. The team also noticed a positive trend in controlling and reducing the amount of identified engineering issues but there are still a significant amount of old engineering issues, which are not expected to be completed in the short term. Resources need to be evaluated to determine if they are adequate to ensure plant configuration is maintained and sufficient support is provided for developing resolutions to long-term aging issues. Attention needs to focus on ensuring access to sufficiently high levels of competence, as new technology is expected to replace some of the older (1960's vintage) technologies installed in the plant. A coordinated program identifying long term system or component refurbishment and/or replacements is presently not an actual part of the planning and budgeting process and the team has made a suggestion presently in this area.

The on-site engineering management is strongly committed to the station performance indicators as well as indicators specific to the Engineering Department. Management is also very actively involved in the on-going training follow up and self-assessments using monthly meetings and soliciting participation from other departments. Increased focus needs to be maintained to systematically evaluate long-term needs for new competence and expertise.

5.2. SURVEILLANCE PROGRAM

There is a link, which is fully understood by on-site engineering management, between the design basis documents, the Final Safety Analysis Report (FSAR), the plants Technical Specification Manual, and/or Technical Requirements Manual for the surveillance testing program. An ongoing corporate Configuration Management Project expected to be ready for review in spring of this year will make this data more accessible and easier to update.

Engineering has the overall responsibility for the surveillance-testing program, including providing assistance to ensure the surveillance tests are conducted at the required frequency and implementation of the ISI programme. The departments responsible for carrying out the surveillance tests are required to approve the surveillance test procedures as well as evaluate and approve the test results after completion of the testing. All surveillance test procedures require approval by a safety review committee.

Distribution of responsibilities and routines for the surveillance program are well implemented as well as the process for updating test procedures.

Where appropriate the specific surveillance test procedure prescribes an “Alert Range”, according to ASME requirement. This "Alert Range" will trigger corrective actions before a Technical Specification acceptance criterion is challenged. Practical and well working routines have been established to ensure that system engineers will be involved in the analysis and trending of the surveillance test result. The team reviewed several test examples some meeting the "Alert Range" criteria. Each of the events appeared to be correctly identified and appropriate corrective actions were taken. However increased effort could be put into a more systematic evaluation of margins and establishing the alert concept on a broader base (outside ASME requirements).

Test scheduling involves the Engineering Department test coordinator as well as involvement by the Planning & Scheduling Department. Appropriate computer based tools supporting test planning and follow-up are well implemented.

A review of the Event Reports submitted during the last year indicates some problems related to performance on surveillance tests. Most of these deficiencies are related to supplier’s documentation and could be difficult to detect during review. Improvement of the program will be more and more important as the plant grows older and is affected by aging mechanisms. Further efforts in systematic follow-up on program effectiveness are encouraged in this area with cooperation from Operations.

Testing of redundant safety trains is sometimes intentionally performed using the same individuals and within a short period of time. The North Anna basic philosophy to prevent Common Cause Failure (CCF) is to use the same experienced person relying on strong preparation and test verification techniques. The team felt that insufficient consideration is given to eliminate, as far as practical, potential common cause failure mechanisms which could be introduced by sequential work on redundant safety trains. A recommendation has been made in this area.

5.3. OPERATIONAL EXPERIENCE FEEDBACK (OEF) SYSTEM

The INPO Nuclear network acts as clearinghouse for industry event reports, vendor notifications, NRC correspondence and others dealing with the operation and maintenance of nuclear power plants. Each day this information is transferred, via OE coordinators (corporate level as well as on-site), to a database easily accessible to all plant staff. This process is well defined in procedures and well implemented.

A powerful tool "auto-mailer" is used where the staff can sign themselves up and select keywords or categories (INPO Newsgroups) that they are interested in reading. Auto-mailer automatically forwards industry event reports to the employees' e-mail address. The team understands that the tool is effective in selecting / reducing volume and giving very prompt feedback. An OE-newsletter is distributed to the staff who do not have email. This tool was regarded as a good practice by the team.

Plant internal experiences are accessible in the Plant Issue (PI) database. A Team who can initiate Root Cause Evaluation (RCE) level 2 analysis carry out an initial screening daily. The weekly screening meeting is multidisciplinary where all actual PI, self-assessment tasks, licensing tasks, etc., are discussed with a questioning attitude. The overall impression is that the information flow and OE function are working well with appropriate resources allocated. The OE program could be improved by implementing a more systematic approach for following up to the effectiveness of the OE system since, at present, only the number of RCE reports and corrective action backlogs are monitored.

The RCE technique is well developed and performed in a professional manner. Three categories are used where category 1 (highest priority) has to meet a specific format and the results reviewed by the station safety committee. In category 1 and 2 there are typically 15-25 RCE/year and in category 3 a greater number, in total a well-balanced screening level.

On a quarterly basis a trend analysis is distributed but the team found it difficult to trace which conclusions and/or actions are taken based on the conclusions drawn from the trend analysis.

Exchange of OE between North Anna Power Station and the older twin plant, Surry Power Station, works well.

5.4. PLANT MODIFICATION SYSTEM

Off-site Engineering is responsible for the Design Change Process (DCP), project management and design engineering. Appropriate criteria and review/approval hold points are established as well as comprehensive checklists and "installation problem" routines used for controlling the process. The planning approach with time deadlines before the next outage is creating a good planning culture.

Separate organizations, reporting directly to the site VP, are responsible for installation of all plant modifications and ensuring high installation standards. This on-site organization enables close interaction with Operations.

There are appropriate routines, checklists and time requirements included in the DCP for the handling of documentation as well as managing tests during the different installation phases.

However, plant practices and checklists for the installation of modifications or major component rebuilds on redundant safety equipment does not specifically address the issue of potential risk of introducing common cause failure (CCF).

As a compensatory tool, more attention could be paid to performing more functional testing of component/systems to verify engineering data. The team has made a recommendation in this area.

The station safety committee has the final responsibility for reviewing and approving safety related modifications and is composed of appropriately skilled staff. The team observed a good standard in meeting preparation, decision-making and open questioning attitude.

The plant has a rigorous design change and temporary modification program, however, the team observed some poorly installed cables and some unlabeled cables. The team has made a suggestion that a simplified process could help the plant in more effectively controlling some of these cable installations.

Unused/abandoned equipment is not consistently marked (labeled or tagged) as prescribed in procedures. Some unused/abandoned equipment in the plant does not meet plant standards of material condition and housekeeping. The team has made a suggestion in this area.

The team noted that plant management demonstrated a strong regard for and understanding of the importance of configuration control.

5.5. REACTOR ENGINEERING

Core management and fuel procurement are carried out in the corporate office "Nuclear Analysis And Fuels." Core design maps and fuel movement schedules are also developed by the corporate office and reviewed by on site reactor engineering.

There have been frequent problems of leaking fuel where different failure mechanisms have occurred over time. The team noticed that information actions (placards) are in place in the plant to encourage personnel to be aware of the consequences of debris, since a number of debris induced failures occurred, mainly after the replacement of steam generators. The present focus is on another potential failure mechanism –vibration induced fretting which is showing an increased frequency, fortunately, so far, with low leakage rates. Engineers are aware of the possibility that even small changes in design/manufacturing process/sub-manufacturing process, could be important for fuel performance. The team also noticed that for some leaking fuel the defect mechanism was unknown. The plant is encouraged to continue with efforts to reduce the risk of debris induced fuel failures or other mechanisms to meet the objective of zero defects as stated in "Fuel Integrity Monitoring" (ENNS-2904). There is a "North Anna 2 cycle 14 failed fuel action plant implementation" for the present situation, which has been communicated to the site.

5.6. FUEL HANDLING

Fuel handling responsibilities lie with the Operations Department under the direction of the Supervisor Operations Support, who reports to the Superintendent Operations. The Supervisor Operations Support has the fuel-handling supervisors reporting to him. The duties and responsibilities of the fuel-handling group are described in a self-contained procedure. Responsibilities are clearly delineated in this procedure and an explicit link is provided to the higher level station administrative procedure. A clear line of responsibilities is thus established and reporting duties are clear.

Fuel is received at the site in the fresh fuel receiving area of the fuel storage building. The team observed the off-loading of several new fuel assemblies. The off-load process, as well as the inspection activities for the new fuel was observed. An appropriate pre-job brief was conducted with the working team (total 8 persons) and covered all activities expected of the team. Procedures and checklists were in place and strictly followed. A detailed procedure is in place to control fuel handling activities during the refueling outage.

The spent fuel storage pool cooling system consists of redundant trains where suction and discharge are of a design which precludes inadvertent loss of pool water inventory. The facilities were toured and found to be in good working order. There is also a separate skimmer system to remove floating crud. The pool water quality, as judged by visibility, is very good.

Once every year the total fuel inventory in the fuel building is verified independently using computer generated random verification requests. Traceability of fuel assemblies from manufacturing to fresh fuel storage, to loading into the core, unloading and transfer into spent fuel storage until on site dry storage was verified by spot checks.

Actions required to be taken by the fuel-handling group, should a unit be required to shut down due to Technical Specification requirements on coolant activity set points being exceeded, do not appear to be covered by a dedicated procedure.

5.7. COMPUTER APPLICATIONS IMPORTANT TO SAFETY

The purpose of the process computer is to provide a rapid source of information to the control room operator, aiding in the overall operation of the plant.

The original process computers (from late 60s) are still in operation but are posing availability problems. The staff has had the foresight to obtain "surplus units" to use for spare parts while waiting for replacements. A corporate driven modification project has introduced the next generation of plant computer systems (PCS). The first phase, which partly replaced the old ones, is in operation after a period of parallel operation and output validation. The safety review committee has approved the use of information from both computer systems on the condition that information is compared between the two and lies within a defined band. Back-up functions are available as follows: Processing on twin unit computers; PCS; and Manual Verification. No formal safety related computer hardware requirements are in place but some of the applications are covered in Tech Spec.

If the plant takes a strategic decision to introduce computer control on a larger base, there is a need for complementary work in different areas.

The Process Computer System runs on specific software and on dedicated computers. No connection to the site LAN exists. Only computer consoles inside the control room can access and alter software parameters / data which justify absence of firewall (access rights). Back-up runs are done once a week, which is a somewhat low frequency compared to industry practices.

The company general virus-checking concept is up to a good standard. Workstations and servers are checked on a day / week base, and files and e-mail will automatically be checked when opened.

The INTERNET firewall is also to up a good standard and consists of one dedicated hardware address protected by firewall software. To dial into any VA POWER installation, the client must have a random number access key to pass through a state of the art firewall software.

DETAILED TECHNICAL SUPPORT FINDINGS

5.1. ORGANIZATION AND FUNCTIONS

5.1(1) Issue: A coordinated program, identifying long term system or component refurbishment and/or replacements, is not an active part of the planning and budgeting process.

A matrix organization has been established on and off site for managing plant status through different programs. In-service inspection programs, preventive maintenance programs, operating experience (industry) program and "system health reports" have been established and focus on present system and component status. The team noted, however, that the plant status time frame is short and does not, as yet, offer long-term performance predictions.

The team also noted a positive trend in controlling and reducing the amount of identified engineering work but there is still a significant amount of older engineering issues which are not expected to be completed in the near term. Resource needs have not been evaluated to determine if they are adequate to ensure plant configuration and support in developing resolutions to these longer-term and other aging issues.

Lack of a comprehensive program, including competence and resources to support long-term aging management programs could lead to degrading equipment and safety performance

Suggestion: The plant is encouraged to continue, with high priority, the "Life Cycle Management" program presently in early development including the resourcing aspects. Attention needs to also focus on ensuring access to critical competence, as new technology is expected to be used to replace some of current older (1960's mostly) technologies installed in the plant.

5.1(2) Issue: There were some examples where insufficient consideration is given to eliminate, as far as practical, potential common cause failure mechanisms which could be introduced by sequential work on redundant safety trains.

Testing and calibration of safety trains is often performed and independently verified using the same crews in a consecutive time sequence.

The team witnessed a surveillance test on both trains of a safety related ventilation damper system. The second train surveillance was performed immediately following the first using the same crew members. The surveillance was completed in accordance with approved procedures using appropriate independent verifications.

The practice of using the same crew members on the same day to perform testing and calibration on multiple redundant trains is used by the plant to provide maximum experience and skill to the task. This practice has in the past aided in identifying problems, however it does not eliminate to a high degree, the potential significant consequences of a common human error affecting all safety trains.

Plant practices for the installation of modifications or major component rebuilds on redundant safety equipment is similar. During a previous Unit 2 outage, all four of the vital bus inverters were refurbished. This refurbishment resulted in unpredicted voltage behavior on all four buses. This condition was detected during post maintenance testing and corrected prior to returning the inverters to service. However; it represents an example for potential common cause failure effects on multiple trains. New style frequency meters were also installed during the refurbishment. Several of the new frequency meters are Work Order tagged due to erratic indication.

Even though the probability of error may be small when using the same people to perform work on consecutive safety trains the potential consequences to safety could be extreme if a common human error should be introduced into all trains. In addition the practice of allowing major rebuilds on redundant safety related components in all safety trains, during a relatively short time, could introduce a common cause failure mode significantly affecting plant safety.

Recommendation: The plant should review the practice of allowing consecutive testing, modification or major maintenance activities of redundant trains to eliminate, as far as practicable, or ensure compensatory measures are in place for instances where common cause failures could be introduced.

5.1(a) Good Practice: The Engineering department has developed a System Health reporting process that provides a systematic compilation of system status presented in a very easily accessible concept using window color status concept. The report is a very powerful tool giving an oversight helping to communicate system status, which support management and staff in concentrating on improving system performance for those systems needing the most attention.

System Engineering produces System Health Reports quarterly. A pilot program was established for the 3rd quarter, 1999 that included only Risk Significant Systems. The 4th quarter program includes all systems. This report documents the general health of a system, and defines that health as follows:

- Green (Excellent Performance);
- White (Acceptable Performance);
- Yellow (Needs Improvement);
- Red (Not Acceptable).

Based on criteria below, the System Engineer evaluates and determines the health of the system. The report includes a system improvement plan and a prediction as to the performance for the next quarter (based on previous performance, the improvement plan, and any known adverse or improving trends).

Each system is evaluated against specific criteria to ascertain its health. These criteria follow:

- Plant Issues (Deviations);
- Temporary Modifications;
- Safety Deficiency Reports (Industrial Safety);
- Equipment tagged out for > 30 days;
- Pumps in ASME Section XI "Alert" status (degraded but operable);
- Operator Work Arounds (meets INPO definition);
- Operator Distractions (does not meet INPO definition, but still distracts the operating crew);
- Corrective Maintenance Work orders that were initiated during the quarter;
- Corrective Maintenance Work orders that were closed during the quarter;
- Outage Corrective Maintenance Work Orders that are > 18 months old;
- Non-Outage Corrective Maintenance Work Orders that are > 4 months old;
- Total Corrective Maintenance Work Orders that are open at the end of the quarter;
- Level I Action Items;
- Justifications for Continued Operation;
- Regulatory Issues;
- Lost MWe hours due to a particular system's performance;
- Unplanned Technical Specification LCO Action entries;
- Maintenance Rule - Maintenance Preventable Functional Failures;
- Maintenance Rule status (A1 or A2).

5.3. OPERATIONAL EXPERIENCE FEEDBACK (OEF) SYSTEM

5.3(a) Good Practice: Virginia Power has developed a process to quickly and effectively transmit relevant Operational Experience (OE) information to employees throughout the nuclear organization using an "auto-mailing" system and the employees electronic "E" mail.

A Corporate OE group downloads daily the INPO distribution for the previous day and converts it into a text file. The OE Auto-mailer automatically forwards industry event reports to the employees' "Lotus Notes" e-mail address. Employees can sign themselves up on the auto-mailer and select keywords or categories (INPO Newsgroups) that they are interested in reading about. The auto-mailer will then search the database and electronically send files that contain the keywords predefined by the employee to his/her "Lotus Notes" E-mail address. This entire OE Database file is available for review on the nuclear licensing and OPS support page of the Dominion Intranet and can also be used as the auto-mailer source file. Because the employees can tailor their selections to suit their needs, extraneous events are minimized. Employees having read about events are encouraged to bring concerns to the attention of their site OE Coordinator for formal consideration by a site OE evaluation team. OE information received through the auto-mailer is also used at safety meetings and/or job briefings at the discretion of the line departments.

5.4. PLANT MODIFICATION SYSTEM

5.4(1) Issue: Several poor cable installations were observed in the plant, many of which were not labeled.

Examples include:

- Several cables around Refueling Water Storage Tank and Refrigerant Unit 2-QS-MR-1A;
- Communications cables with open ends close to the entrance door, coming from the external area to the Radiological Controlled Area;
- Cable inside 1 EG D IHA, Starting Air Dryer to DG 1 EE EG 1H, Unit 1, appears to be a plant modification, but the cable is not well fixed within the panel;
- Several heat trace cables are installed loose around the plant;
- In the turbine building, several cables apparently for communication and power supplies during outages were not labeled with identification and were loose, crossing several levels of the building, e.g. location between YI 301 and ZI 303, phone cables C13/279 to C16/279 and three power supply cables C13/303 twisted together. Cables not fixed or identified going down the turbine wall, column ZI 303;
- Feeder power cables for the "Ionic's" trailers have been on the ground for many years.

Non controlled cables can potentially affect performance of other electrical systems or create industrial safety hazards.

Recommendation: Cable installations should be properly identified and meet plant standards and/or eliminated in the plant. If appropriate, a simple process should be adopted to evaluate, approve and label these installations as well as implementation of appropriate installation standards.

5.4(2) Issue: Unused/abandoned equipment is not consistently marked (labeled or tagged) as prescribed in procedures. Most of the unused/abandoned equipment throughout the plant is maintained with a good standard of external condition and housekeeping, however, some unused/abandoned equipment in the plant is not meeting plant standards for material condition and housekeeping, which can affect staff behavior.

VPAP 0301 "Design Change Process" provides guidance to allow abandoned equipment to remain in the plant if disconnected, or equivalent action is taken to prevent operation of the equipment. No guidance is given in step 6.15. on how reactor safety is to be judged/ valued when taking the "practical decision" to abandon a selected component or portion of a system. The team understands that other administrative procedures address the requirement to assess the nuclear safety impact of these activities, however, it would be appropriate to acknowledge these requirements in VPAP-0301.

Some unused/abandoned equipment in the plant does not meet plant standards for material conditions and housekeeping. For example, in the Turbine building, Load Break Switch G-22 and 2-EP-CB-205 is unused. The team found grounding cables disconnected, back panel covers missing, foreign material inside the panels, and the general area left dusty. Several alarms panels have the alarm windows (13 of 25) removed. Unauthorized handwritten tape is placed on the cabinet, and piping was noted with open ends not properly covered.

The majority of unused/abandoned equipment and local annunciators are not specifically tagged as "spare" or "abandoned" as required in step 6.15.4 of VPAP-0301.

Only a few items were found with the correct "abandoned" labels affixed. One of these signs was not properly fixed, bringing up the issue about long term readability and attachment.

The possibility of human error by incorrect handling of unused/abandoned equipment can occur if active equipment cannot be easily identified among unused/abandoned. In addition it creates a subliminal message that under certain circumstances low standards of material condition and housekeeping are tolerated by the plant.

Suggestion: Consideration should be given to reinforce the existing policy to maintain unused/abandoned equipment's external conditions at the same standard as operational equipment and permanently label unused/abandoned equipment making it easy for personnel to distinguish between active and inactive equipment to minimize the possibility of incorrect handling.

6. RADIATION PROTECTION

6.1. ORGANIZATION AND FUNCTIONS

The station has a well-structured radiation protection program, and an independent radiation protection group. Staffing of RP is more than adequate. RP staff are well trained, have a good technical knowledge and have a good understanding of management expectations. Line managers are frequently seen in the field, reinforcing expectations. Responsibilities in radiation protection, within the radiation protection group and in other departments, are clearly defined and understood.

The radiation protection program however (e.g. individual dose limits) is based upon the 10CFR20 regulations, which are based on the 1976 ICRP26 publication. The more recent ICRP60 recommendations (1990) have not been implemented. As most plants outside the USA have already adopted these recommendations, at least for individual dose limits, or established an even more restrictive set of limits, the team recommends that the ICRP60 principles for individual dose limits should be implemented. The team made a suggestion to the NRC that they should consider implementing the 1CRP60 recommendations in the federal regulations (10CFR20).

Performance indicators are in place to monitor all important RP parameters. Also, a self-assessment program and peer reviews amongst technicians are implemented in order to gain a periodic evaluation of RP as a group. These tools are used at a management level. RP workers however are not very familiar with the performance indicators (generally they only know that they are usually good), neither are they familiar with the results of the self-assessment program. As the performance indicators have been continuously showing more than adequate performance, they are not considered by the team as being real drivers for continuous improvement. It was also noted that each level in the RP organization has a different view on the important objectives.

There is a low threshold for reporting radiological events. The more important events are analyzed and corrective actions are taken when needed. The team assessed the internal operating experience program to be effective.

There is good cooperation with other departments, such as operations and maintenance. This helps the station in establishing an effective ALARA program.

RP training programs are well established and relevant to the duties and responsibilities of RP staff.

All together, the team assesses the organization and functions of the RP program and the RP department adequate, except for the fact that the ICRP60 recommendations have not yet been incorporated. The team encourages the plant to establish a limited number of well-defined objectives and goals for the RP department. Also, the team encourages more involvement of RP workers in establishing and monitoring goals, improvement programs, and in the self-assessment program.

6.2. RADIATION WORK CONTROL

All work in a Radiation Controlled Area (RCA) is subject to a Radiological Work Permit (RWP). The RWPs contain all the necessary and useful information, including industry experience. RWP briefings are extensive and mandatory for work in the RCA. Adequate training is provided before working in the RCA. A full mock-up of the RCA entrance and of the containment entrance is used for training new employees. Mock-ups are also frequently used for training on a specific job. These practices make the radiation work authorization program very effective.

There are a large number of RCAs, each with its own entry and exit facilities. The issue of electronic dosimeters issue is only available at the entry of the 'Auxiliary Building.' This is also the only RCA exit where radiation protection staff are readily available. All other RCAs are adequately equipped with personnel contamination control monitors or friskers. However, the correct use of dosimeters and contamination control monitoring relies completely on peoples discipline in behaving according to procedures and expectations. No significant infringements were noted by the team during the visit.

Additional high performance gamma contamination monitors are installed at the site security exit. This final contamination check gives additional assurance that nobody leaves the site with even small amounts of contamination.

Posting of contaminated and high dose rate areas is adequate. Green flashing lights at low dose rate waiting areas is a good idea and can help in keeping doses as low as reasonably achievable (ALARA). The team learned that workers effectively use these low dose rate areas during the outage, but observed a lack of use during normal operation. The use of these areas during non-outage periods could be promoted more effectively.

The storage of contaminated tools in the hot tool crib, as well as in individual tool cabinets, could be improved.

Extensive routine surveys are conducted for dose rate, as well as for contamination assessment. These surveys are carried out in a very professional manner. Several minor weaknesses were found in the area of contamination control. The team suggested to the plant that additional improvements could be made to better control contamination, especially in case of incidents where larger amounts of contamination would be present.

The potential for internal exposure is monitored adequately by means of air samples, continuous particulate air monitors or individual particulate sampling devices.

6.3. RADIATION DOSE CONTROL

The ALARA program is well established and well understood by everyone. Extensive and well prepared pre-job briefings are conducted, mentioning lessons learned from previous occasions as well as industry experience. Lessons learned are assessed in post-job reviews and taken into account. The team learned that these lessons learned were known not only by RP staff, but also by maintenance and contractor staff.

A centralized control center allows RP staff to follow by means of video cameras, audio links, and remote alarming dose and dose rate monitoring, a large number of workers in a very effective way, these practices save dose for workers and RP personnel. The team considered the ALARA program, which has decreased doses, considerably over the last years, to be a good practice.

Internal contamination is evaluated on a sound basis. The use of engineering controls and of respiratory protection is evaluated, comparing the savings in internal dose to the predicted additional external dose as a result of the use of respiratory protection. As a result of this, no respiratory protection was used for radiological reasons during last year, including the outage. The team considered this to be a good approach.

The team showed some concern knowing that drinking from water fountains are allowed in the RCA and in the containment during outages, which is a contaminated area. However, the personnel gamma monitors at the site security exit monitor each person leaving the station. These are set with a limit of detection that is sufficiently low to detect and properly assess internal contamination. The internal exposure program is therefore considered to be adequate.

In the rare cases where internal contamination is detected at the site security exit monitors, a more extensive evaluation of the internal contamination is made by means of a whole body counter. The station developed a method that takes into account the presence of nuclides that decay predominantly by alpha or beta decay and thus, are difficult to detect in a (gamma sensitive) whole body counter. This makes the station a very good performer in assessing internal contamination.

The program for assessing external dose is adequate. The station uses 'Digital Alarming Dosimeters' (DADs) as well as TLDs. Quality control of the DADs is performed by the station itself, while the TLDs are handled by an accredited vendor. Periodically, the results of the DADs and the TLDs are compared and an investigation of discrepancies is conducted when needed.

In a few cases, the TLD reading is between 20 and 25 percent higher than the DAD reading. This is considered to be acceptable. The station could consider taking this possible deviation into account when establishing administrative limits that prevent individuals reaching the individual dose limit. When needed, neutron dosimetry and dosimetry of extremities is performed.

6.4. RADIATION PROTECTION INSTRUMENTATION, PROTECTIVE CLOTHING, AND FACILITIES

The station is adequately equipped with portable and fixed dose rate and contamination measurement instrumentation. The latest personal contamination monitor is sensitive to beta/gamma, as well as alpha contamination. This facilitates the identification of alarms originating from natural noble gases.

The historical files are not easy to access, which could make the evaluation of recurring deficiencies more difficult.

Sufficient individual dosimeters (DADs) are in place. The failure rate of 5 to 8% when calibrating the DADs seems to be high and is probably caused by their age.

Fixed radiation monitors to monitor gaseous and liquid effluents, as well as environmental monitoring equipment, are in place.

During emergencies, no special equipment is needed, the usual instrumentation is capable of dealing with emergency dose rates and contamination levels.

Sufficient amounts of protective clothing, lead blankets for temporary shielding and other useful equipment is available; laundry and decontamination facilities are considered to be adequate.

6.5. RADIOACTIVE WASTE MANAGEMENT AND DISCHARGES

Classification, storage and packaging of solid radioactive waste is adequate. The total amount of solid waste that is disposed of is rather low compared to industry performance. However, the volume has not significantly decreased since 1996 and challenging goals were not established. The team suggests that a comprehensive solid waste reduction plan should be established with appropriate goals and targets.

For liquid and gaseous releases, administrative limits are established well below regulatory requirements. All possible pathways are monitored and procedures exist for the operation of secondary systems in order to keep liquid releases ALARA. The introduction of a dose goal for liquid releases is a good idea.

Containment exhaust filters generally are not in service during refueling operations. Investigation to see whether the existing ventilation isolation system acts quickly enough to eliminate any radioactive release in case of a fuel handling accident could be useful.

The recording of gases from routine gaseous releases could be improved by decreasing the high alarm setpoint of the radiation monitors or by a routine check to see whether the RM reading has remained stable.

The environmental monitoring program is adequate. The use of a vendor as an independent assessor for evaluation of the data should strengthen public confidence.

6.6. RADIATION PROTECTION SUPPORT DURING EMERGENCIES

RP staffing during emergencies is well organized and adequate. Responsibilities are clearly defined and understood for the coordination of RP efforts, off site dose calculations, on site radiological assessments and damage control team response.

RP training, exercises and drills for emergencies are adequate. RP staff and workers have a good knowledge of their duties, and of the radiological situations that can be expected during emergencies.

DETAILED RADIATION PROTECTION FINDINGS

6.1. ORGANIZATION AND FUNCTIONS

6.1(1) Issue: The plant individual dose limits are higher than good international practice, since the plant Radiation Protection Program (VPAP-2101) is based on 10CFR20, which is based on the outdated ICRP26 principles.

The Radiation Protection Program is in accordance with the national regulations (10CFR20). However, this is still based upon the ICRP26 recommendations, published in 1976. More recent ICRP recommendations exist (ICRP60 and following publications, 1990) and are already adopted in most countries and in the majority of the nuclear industry in the rest of the world. The most visible difference concerns the recommended individual dose limits, where ICRP60 recommends a 5 year limit of 100 mSv (10 REM), in addition to the existing 50 mSv/year (5 REM/year) limit. Many power plants have now individual dose limits of 20 mSv/year (2 REM/year), or even lower.

The ICRP60 recommendations clearly state that the older ICRP26 recommendations are not satisfactory any more and that continuing to follow ICRP26 recommendations could lead to consequences for the individual that would be widely regarded as unacceptable.

Recommendation: The plant should lower individual dose limits to good international practice and adopt the individual dose limits, as described in ICRP60.

Suggestion: The NRC should consider incorporating the ICRP60 limits in 10CFR20. [Comments received from the NRC indicate that it has considered this change and has decided not to include it at this time].

6.2. RADIATION WORK CONTROL

6.2(1) Issue: Contamination control may not always be sufficient to prevent spread of contamination in case of an incident where large amounts of contamination are involved.

This is due to a large number of small contributors, showing a lack of attention to detail, each in isolation may not be a significant issue, but as a whole present a risk to the spread of contamination.

Examples are as follows:

There is a lathe and a milling machine in the decon facility. In case of an incident while using this machine, the potential spread of contamination is important. The place is very difficult to decontaminate. Also, although filtered ventilation is present, and requirements on keeping this place under negative pressure while performing work are in place, no physical interlock is present to keep ventilation running and to keep the equipment access door closed to avoid spread of contamination to the outside.

In the non contaminated RCA, loose surface contaminated equipment is present and can be touched:

- A number of catch containers and fixed drain systems or other internally contaminated equipment (this equipment is labeled 'internal contamination') is present.
- Potentially contaminated drains in the clarifier building are collected in open canals in the floor, covered only by a grating and with no signs warning for contamination

Some cases were noted where workers did not behave according to procedures or expectations:

- A worker, standing outside a contaminated area, took a hammer from a tool cabinet in a contaminated area. He was stopped and monitored by a HP technician.
- Two people, leaving the RCA, having alarmed the exit personal contamination monitors, were rubbing the lower part of their trousers trying to "pass" the monitors. They were told by a HP technician to wait for the natural isotopes to decay. If there had been other contamination, they could have removed it and left without further investigation. The same phenomenon, but with the hard-hat happened several times with the team members.
- When the exit monitor alarms, most workers try a second time without notifying health physics.
- One occasion was noted where a worker stepped across the gray/green floor border at the aux. building RCA exit without monitoring.

Knowing these facts, some concern exists about the 'free' entry and exit of most RCAs, which relies on peoples' discipline to behave according to procedures and expectations.

There is a lack in management expectations not to touch hair or face in the 'clean' areas in the RCA. As a result of this:

- One worker, using gloves, carrying bags apparently of compressible waste, frequently arranged his/her hair.

- A maintenance technician, involved in the change of the refueling purification filter, handled crane cables, and after that he rubbed his face and mustache several times.

Tool boxes and lockers are generally not maintained in an orderly fashion, presenting a high risk of contamination. Due to this condition, they are very difficult to check completely for contamination:

- A Maintenance tool box used for the change of the refueling purification filter had facial masks, mixed with tools and other equipment;

- An Operations' equipment tool locker (a vertical cabinet) with a RP card indicating Radioactive Material, 0.3 mrem/h contact and last inspected by RP on 1/20/00 was found in very poor condition, with tools, fittings, tubing, flow totalizer device, some cloth, padlock and chain, several Tygon tubes, a container with liquid leak detector and another with joint sealing compound. It is very dusty and it is not tidy at all;

- An Operations tool locker in the waste solids building was found in the same general condition. This locker was not closed.

Some weaknesses exist in performing contamination measurements:

- When checking equipment for shipping, the HP technician took smears on a number of places, however, not in areas where the contamination risk was highest.

- A wet smear test was taken; this is useless for alpha counting and underestimates significantly the beta contamination

A large number of contamination surveys are performed outside the RCA (warehouses, offices...). However, no road surveys are performed to search for contamination on the roads outside the RCA, for example, at the RCA gates. Together with the personnel exits, these are the places with the highest risk of contamination outside the RCA.

On the other hand, it must be recognized that the team did not find evidence of existing contamination problems, the source term being well controlled with only small leaks of contaminated liquids.

Nevertheless, these minor deficiencies may contribute to an uncontrolled spread of contamination in case of an incident where larger amounts of contamination would be involved.

Suggestion: Consideration should be given to perform road surveys on a periodic basis (e.g., after each outage) and to eliminate the majority of the above cited practices to minimize the potential spread of contamination in case of an incident.

6.3. RADIATION DOSE CONTROL

6.3(a) Good practice: The ALARA program is very well established and very well understood by everyone. Effective use of remote monitoring techniques and a central radiation protection control room have improved radiation protection monitoring of workers, reduced personnel dose and decreased the needed level of technician support. The system uses numerous video cameras, radio communications, and telemetric electronic dosimetry to monitor both worker and area dose rates during normal operation and outages.

In addition, work groups and individual workers exhibit strong awareness and ownership of their doses. Dose reduction is an integral part of work and outage planning. The program is especially effective, because all parts of an excellent program are in place and are of high quality:

- Adequate staffing and efforts from RP
- Source term reduction efforts have been continuous and successful;
- Extensive, well-prepared and high quality pre job briefings are conducted; Attendance at these briefings is recorded and mandatory before entering the RCA. Industry experience is systematically assessed during these briefings;
- Well-documented and high quality post job reviews are completed. Lessons learned are incorporated in the procedure or in the briefing for the next time;
- Mock-up training is extensively used before performing the work;
- Maintenance supervisors and workers, including contractors, are well aware of the importance of ALARA and of the lessons learned from previous outages for their own work;
- Graphs are widely distributed daily, showing actual versus predicted dose;
- Temporary shielding is put in place wherever required.

6.5. RADIOACTIVE WASTE MANAGEMENT AND DISCHARGES

6.5(1) Issue: The volume of solid radioactive waste is not being further reduced.

It is noted that the total amount of low and intermediate level solid radioactive waste that has been disposed of has not decreased significantly since 1996. The yearly volume has been 51.8 m^3 in 1996, 49.7 m^3 in 1997, 53.0 m^3 in 1998 and 50.7 m^3 in 1999.

Contributing to these facts is:

- The annual goal has remained unchanged at 60 m^3 since 1997. For 2000, the station proposed the same goal, which was reduced by corporate management to 55 m^3;
- The 'lock-out' principle (this means: no items are to be taken in the RCA when not needed) has been in place for several years, but according to a number of workers, has been more rigorously enforced in the past;
- Apart from this principle, no program is in place that aims at further reducing the volume of solid waste.

This may lead to unnecessary amounts of waste to be disposed of and unnecessarily burden the environment.

Suggestion: Consideration should be given to the establishment of an effective program that further reduces the total amount of low and intermediate level solid radioactive waste.

7. CHEMISTRY

7.1. ORGANIZATION AND FUNCTIONS

The responsibility for the plant chemistry at North Anna rests with the chemistry department.

The department is well defined and organized into two sections, which are a daytime group and a shift group including 2 support staff. Communication within these sections and with other departments is good and facilitated well at daily and monthly meetings. Shift workers and daytime workers are changed about every two years to ensure they have a chance to experience different and challenging work.

Interfaces with the Surry Station and corporate organizations are clearly defined and working well. There is a good interface with Operations. The chemistry shift leader is always present at the Operations turn over meetings. Regular reports are sent to Operations and other departments by computer. Responsibilities and authorities are well documented and described in procedures.

The plant and chemistry performance indicator program, which is mainly based on the INPO program is practiced well and monitored carefully. The chemistry department's staff have university degrees or equivalent education to fulfill the chemistry requirements and no contract personnel are needed on a routine basis. A technical support person takes charge of research and development if required. For example, such a person discussed the cause of the microbiological problem in the service water lines. Such a policy gives the chemistry people ownership of their work and raises their awareness of safety. The chemistry department implements effective response to abnormal data.

The manager informs the staff of plant policy at several meetings and in the training program. Most of chemistry department people understand the plant policy "safety and competition" very well and put considerable effort into harmonizing the two policies.

All chemistry department people are trained according to a defined program. Training facilities and teachers are good.

Assessments of staff performance, via Job Performance Measures, are clearly defined, well documented, and used effectively.

7.2. CHEMISTRY CONTROL IN PLANT SYSTEMS

North Anna has well documented chemistry specifications and chemical management criteria. In the chemical treatment program for primary and secondary systems, the chemistry specifications are clearly explained. Chemistry parameters are routinely checked by 2 or 3 people. Records demonstrate that chemistry parameters are regularly maintained within specifications

North Anna has replaced the copper materials in the secondary system and the chemistry department is now able to decrease iron concentration in the feed water. This is done by maintaining a high pH and also injecting ETA (EthanolAmine), which is unique in the PWR industry at this time. As a result, iron concentration in the feed water is below 1.0 ppb and the team recognized this as a good practice.

North Anna only uses the condensate water polishing system in the start-up and shutdown period and the condensate water purifying filters have been changed to the pre-coat type from the spool type to improve the efficiency of removing impurities. This operation is very effective.

On the secondary side, most of the important sampling lines run to the laboratory and are analyzed automatically. On the primary side some important parameters are monitored automatically.

Chemistry staff demonstrated a good understanding of primary system chemistry operation.

Though shutdown chemistry is good, the dose rate in SG channel head is somewhat high due to a lower pH value of the primary system during operation than is normally found in the industry. There is a plan to improve the Li control operation after confirming the effect of pH change on the fuel, which has suffered minor leakage recently.

7.3. CHEMICAL SURVEILLANCE PROGRAM

Chemical surveillance programs are clearly defined in documents and understood by staff. Work schedules, including sampling plans, are displayed for each shift from the computer system and checked by the Asst. Supervisor.

All instruments are calibrated twice a day before use and the data recorded on the computer to check the long-term trend. All chemical standards are based on The American National Standards Institute.

A third party periodically checks the workers' ability to perform good chemical analysis. This has resulted in a raising of standards of chemical analysis and the retraining of some employee skills.

An assessment system calls for workers to perform a crosscheck of analysis results, which is very effective for chemistry QC.

The Chemistry section has a common file named "Chemistry Special Orders" which includes many reports regarding important events in water chemistry and which is accessible to all staff. North Anna receives worldwide information and uses it effectively.

7.4. CHEMISTRY OPERATIONAL HISTORY

Chemistry data is stored in a computer database, which is used effectively for routine work.

This network system is also connected to the corporate level network to export and import data, evaluate results and provide experience feedback. This computer database is also effectively used for carrying out trend analysis.

The chemical department of Va. Power Company has a special Home Page in the company net work, which all company people can access for information on chemistry in both the North Anna and Surry plants.

Lessons learned from past occurrences and from extensive testing, including experiences from other plants are effectively integrated into laboratory practices and used for corrective actions.

The team observed that the Asst. Supervisor and Supervisor always check the daily report and feed chemistry information to the shift and other departments as required.

The Supervisor repon 'he results of the chemistry program at the manager meeting once a month.

The team noted some delay in reaction to an increasing Oxygen level in the condensate during the OSART mission. During the increase of the Oxygen concentration in the condensate system, the chemistry department took approximately 5 days to effectively interact with the operations department to search for the oxygen inleakage even though they have experienced these events at least 15 times in the last five years. Furthermore, there are no suitable chemistry department procedures and insufficient measuring equipment for oxygen ingress.

7.5. LABORATORIES, EQUIPMENT AND INSTRUMENTS

All the analytical instruments are properly maintained and calibrated twice a day before using appropriate procedures.

The laboratories do not have enough space to store all reagents and some reagents are safely stored outside of the facility.

The sampling systems are reliable and useful because the most of secondary side samples are concentrated in the laboratory.

The plant chemists, themselves, devised primary circuit sampling equipment, which appears to work well.

The RCS water sample container is sent to the laboratory using a pressured air system, which decreases the dose exposure of chemistry personnel.

The team noted some problems with the labeling and sample identification practices used by the chemical section and made a recommendation for improvement in this area.

Important facilities and equipment, which are used for routine analysis, are provided with some redundancy but this is lacking for some equipment for example; portable oxygen monitor and there is no list of required measuring equipment.

Chemicals are separated and stored safely according to the "Chemical Compatibility Color Code" manual.

Most of the installation and work practices are framed in accordance with good industrial safety and ALARA principles.

The post accident sampling system is good and the chemists take an actual sample for training once every month.

Post accident sampling and analysis processes are clearly defined and the system is well designed to decrease personnel exposure.

7.6. QUALITY CONTROL OF OPERATIONAL CHEMICALS AND OTHER SUBSTANCES

The control of chemicals and other substances is outlined in VPAP-2202, "Control of Chemicals and Hazardous Substances."

The "Consumable Material Evaluation" system details are defined in the document "VPAP 0406". But the quality of chemicals are only verified by documents and not by analysis of every shipment. Instead, sampling and analysis of the chemical is performed when it is first purchased.

The shelf life of all reagents is clearly defined and none were found to be expired.

A few labels on the reagent bottles were not well attached.

DETAILED CHEMISTRY FINDINGS

7.2. CHEMISTRY CONTROL IN PLANT SYSTEMS

7.2(a) Good practice: High pH operation with ETA (EthanolAmine) treatment in the secondary system is very effective in reducing the feedwater iron concentration.

North Anna has replaced the copper materials in the secondary system, which makes it possible to adopt high pH control. However, they control feedwater with high pH operation and also inject ETA.

As a result, iron concentration in the feed water is below 1.0 ppb due to the effectiveness of ETA in preventing the erosion corrosion on drain lines.

The plant periodically carries out sludge lancing in each steam generator and removes only a few Kg of iron-oxide. This demonstrates the effective use of the secondary side chemistry control.

The station checks the erosion/corrosion rate in the drain line pipes during every outage and confirms the good results.

7.5. LABORATORIES, EQUIPMENT AND INSTRUMENTS

7.5(1) Issue: Some of the labeling and sample identification practices used by the chemical department do not always assist in minimizing human errors.

Plant system sample bottles are not always clearly labeled. Instruments for the secondary water monitoring system, which are out of service are not always well identified, and the chemical storage tank was found without sufficient identification. A few labels on the reagent bottles were not well attached.

Labeling of the Reactor Coolant System samples was found illegible, not easy to distinguish between unit one or unit two and they were placed close to each other, increasing the chance of mixing the bottles. Secondary side sampling bottles were found hand-marked with magic pen.

If sampling bottles are not clearly identified, and equipment has no clear indication of identity and status, human error may occur when performing analyses and readings.

Recommendation: The chemistry department should enforce the process of clearly identifying sampling bottles, equipment identity and status to prevent human error when performing analyses and readings.

8. EMERGENCY PLANNING AND PREPAREDNESS

8.1. EMERGENCY ORGANIZATION AND FUNCTIONS

Virginia Power (VP) operates two nuclear power stations, North Anna and Surry. A response to a nuclear emergency will involve the co-operation of the Federal Government, State Government, County Government and the Nuclear Station's emergency response organization.

The Federal Government has established a Federal Radiological Emergency Response Plan (FRERP) which establishes a framework document and assigns responsibilities between federal agencies for a co-ordinated response to radiological emergencies. FRERP determines the Lead Federal Agency, which for a nuclear power plant is Nuclear Regulatory Commission (NRC). The NRC is responsible for leading and coordinating all aspects of the federal response. Responsibilities for regulatory oversight of nuclear emergency preparedness is shared between the NRC and the Federal Emergency Management Agency (FEMA).

The State of Virginia provides management and co-ordination of offsite emergency response. The state organization and responsibilities for nuclear emergency response are based on normal governmental structures and channels. The County Government is independent in decision making from the State Government.

Virginia Power's emergency preparedness staff is organized on a corporate level. The director of nuclear emergency preparedness is responsible for the overall emergency preparedness. He reports to the same vice president as both station managers. At the site the manager for safety and licensing is the direct link with the emergency preparedness personnel

Proper coordination is ensured through regulatory requirements at the Federal, State, County and Station level using approved emergency plans. Station and corporate emergency preparedness is reviewed on a yearly basis and corrective actions timely implemented. Furthermore a self-assessment process is implemented to further strengthening performance. A Performance Annunciator Panel provides management with an indicator on emergency preparedness.

8.2. EMERGENCY PLANS

The on-site emergency plan of the North Anna NPP, Station Emergency Plan (SEP), appears to be good and meets international practices. It is based on the NUREG-0654 guideline. The SEP defines potential types of emergencies, establishes the organization, provides measures for coping with an emergency, provides facilities from which to perform measures, and describes the recovery program and methods for maintaining the SEP. Classification of the event and identification follows NUREG-0654 recommendations and is made plant specific.

Procedures for source term determination and the specified equipment follow international standards. Post accident monitors are installed and included into the Technical Specifications. Post accident-sampling system (PASS) and associated procedures are implemented and periodic tests are performed successfully.

The station is committed to recommend protective actions within 15 minutes after declaration of a "General Emergency". For other event classes there are no protective actions recommended. Therefore a short, easy to use and effective procedure was developed for protective action recommendations. Recommended protective actions are conservative and are aimed at evacuation of the local population before the radioactive release. Sheltering of population was evaluated against design basis accidents with evacuation times estimates when the procedure was prepared, but the procedure does not reevaluate the sheltering versus evacuation based on actual conditions. The team noted a few shortfalls in the off site emergency planning in relation to good international practices and has suggested consideration of such good practices for the future.

The State Radiological Emergency Response Plan (State Plan) is maintained by Virginia Department of Emergency Services. The County Radiological Emergency Response Plans (County Plans) are approved by county governments. Both plans include information on task assignments for state and federal agencies, state and local government organization, notification and warning and emergency response operational concepts. The coordination between state and county emergency response is very well balanced in terms of jurisdiction.

A siren system is employed to alert the public within 10 miles of the nuclear power station. A siren system design analysis has been performed and sirens are radio controlled. On hearing the signal, the public has been instructed to turn to local Emergency Alert System radio and television stations.

The emergency plans are well structured, comprehensive, and very detailed for all levels. Responsibilities and response are clearly described, and interfaces precisely determined.

8.3. EMERGENCY PROCEDURES

The Emergency Plan Implementing Procedures (EPIPs) are attached to the Station Emergency Plan and cover all aspects of the station emergency response. The EPIP procedures are written in a dual-column format "response obtained/response not obtained". There are 48 EPIP procedures, which are revised in acceptable time periods. 29 EPIPs cover on and off-site radiation monitoring and sampling. EPIPs provide a firm guidance for the plant's emergency response.

A single EPIP procedure provides guidance on protective measure recommendations, which are required within the first 15 minutes after the general emergency has been declared. The state and county plans include very detailed procedures on implementation of protective measures.

Although no evacuation drills are performed, there are regular personnel accountability drills 2-3 times per year, which are run in accordance with the EPIP procedure on "Personnel Accountability". There are 11 emergency assembly areas in the North Anna Power Station.

Radiation exposures and limits for emergency workers are accurately determined. The administration of Potassium Iodide to emergency workers regulated by the EPIP procedure and can be done only upon approval of the station emergency manager.

There is an EPIP procedure on the transportation of contaminated injured personnel. The ambulance is on site and a drill with the transportation of an injured person to the hospital is run once a year.

8.4. EMERGENCY RESPONSE FACILITIES

The Emergency plan details 4 emergency facilities, the Technical Support Center (TSC) and the Operational Support Center (OSC), located on-site inside the fence. The Local Emergency

Operations Facility (LEOF) located on-site co-located with the training building and the Corporate Emergency Response Facility (CERC) located in the Corporate office in Richmond Virginia.

A minimum-staffing requirement has been established for activation of each of the emergency facilities. Minimum as well as full staffing requirements are clearly depicted on the special status board at the entrance to each facility.

The TSC is adjacent to the control room with a separate entrance from the turbine building. The facility has its own ventilation system similar to that in the control room. The TSC is well equipped with radiation monitors. The facility provides several CRT monitors using the Emergency Response Facility Computer System (ERFCS) and provides real time data on key plant systems to the Emergency Response Team in the TSC. A monitor is provided for the Station Emergency Manager and each of the 5 different emergency directors; Operations, Maintenance, Technical Support, Administrative Affairs and Radiological Assessment. Several side rooms are provided in the TSC. During normal operation these rooms are occupied by plant personnel. The TSC was found to lack some attributes usual in good international facilities. The team has made a recommendation in this area.

The OSC is in the maintenance building, with an alternate location in the Unit 1 Emergency Switchgear Room. The OSC is also the designated reporting location for the fire, first aid, damage control and search & rescue teams.

The LEOF hosts the recovery manager who is the leading person on-site in the event of an emergency. State and County representatives, responsible to co-ordinate protective actions, NRC representatives, and station personnel responsible for deployment of field radiation monitoring teams and for dose assessment, reside in the LEOF. Communications with the TSC, the state and local county EOC's as well Corporate Emergency Response Centre (CERC) are provided. The LEOF provides excellent working conditions for its personnel.

The CERC has been recently refurbished. The CERC provides emergency support on a corporate level, especially for core damage assessment, and can serve as an alternate for the LEOF personnel, if the LEOF had to be evacuated. The new CERC has not been used in a full exercise yet.

The state Emergency Operations Center (EOC) in Richmond has a communication centre, which is manned round-the-clock. The state EOC is built as a shelter and provides for the coordination of emergency response at the state level. The siren system for alert and notification can be activated from the state EOC. Each of the counties within the 10 mile emergency planning zone has its own EOC with the communication centre which operates round the clock. State and county EOCs provide appropriate working conditions and are adequately equipped with communications.

There are two remote assembly centers for the plant personnel approximately 5 miles from the plant. They are accessible by individual cars only, no bus transportation is foreseen. Contamination checking and accountability is performed there.

There is no medical center on site. The Medical College of Virginia has appropriate facilities for treatment of injured persons.

8.5. EMERGENCY EQUIPMENT AND RESOURCES

Emergency equipment in the emergency response facilities of the North Anna power station and at corporate level is good and up to date. This includes: means of communication, computer hardware as well as software, printers and photocopiers, furniture, status boards, maps, lighting, ventilation and heating systems, radiation and sampling instrumentation, power supply, and access control. Redundant and/or backup systems also exist. The quantity and the quality of most of the aforementioned equipment substantially exceeds the average, but dedicated vehicles for the transportation of radiation monitoring equipment are lacking. The team has made a suggestion in this area.

The state and local EOCs are adequately supplied with equipment to be issued to emergency workers including: TLD and pencil dosimeters (range 0-20 R), handheld radiation monitors, portal contamination monitor, KI pills and radio communication means. An information card is issued to emergency workers which is a plastic card which can be attached to clothing with reminders on the use of dosimeters, intervention levels and information about the use of KI pills.

The state mobile laboratory for radiation monitoring is run by the Virginia Department of Health and is carried aboard a large truck. The mobile laboratory instrumentation is used several times per month for the regular radiation-monitoring program. The mobile laboratory has impressive equipment, which comprises a gamma spectroscopy system with NaI and Ge crystals, low background alpha/beta counting system and a liquid scintillation counter and 21 handheld ion chamber instruments.

8.6. TRAINING, DRILLS AND EXERCISES

A comprehensive training program for general employees is described in the "Nuclear Employee Training Manual," which has 4 pages on nuclear emergency preparedness.

The training program is designed for particular profiles (jobs) in the emergency response organization – all functions are covered by the program. Job task analysis was performed before the initial training program was set. Programs for initial training comprises 13 lesson plans, which include teaching materials and handouts. The team found the training program, the method of sending retraining materials with exercises via e-mail, and receiving feedback on the same medium, as a good practice.

The training of off-site emergency personnel, which are mainly emergency workers such as fire fighters, police, transportation workers and first-aid specialists, is designed as a 4-hour course on radiation protection and nuclear emergency preparedness. In 1999 about 500 people attended such course.

The type and scope of drills and exercises is described in the SEP. The procedure, "Drill and Exercise Program Manual" describes drills and exercise's objectives schedules development and conduct and facility training activity scenario development. Guidelines for scheduling exercise/drill preparation are well defined. There is a comprehensive step by step schedule for the preparation of each exercise to insure all necessary activities are performed. The drill and exercise performance objectives are scheduled 6 years in advance to assure performance of all required activities. After each exercise a critique is issued and all deficiencies found during exercises are resolved before final revision of the critique is issued (2-months after the drill).

Separate drill commitments are usually incorporated into larger functional and training exercises and the team made a suggestion to increase training frequency for all field teams for practice frequently.

Frequent drills/exercises provide adequate opportunity for key Emergency Response Personnel to exercise skills at least once a year. Full scope exercises are required to be staged biennially, and once in 6 years exercises shall be unannounced. Regulatory authorities FEMA and NRC participate at biennial exercises as evaluators (inspectors). Full scope exercises activate all emergency response facilities in the state and provide a good opportunity for test all interfaces and coordination on state level as well.

8.7. LIAISON WITH PUBLIC AND MEDIA

The Office of the Governor may assume the responsibility for coordination of news releases, otherwise, at the state level, the Virginia Department of emergency Services Public Information Office (PIO) will co-ordinate the release of information to the public.

Mass media representatives will be briefed at the Joint Public Information Center (JPIC) in the VP corporate office building. The VDES PIO is located at the JPIC, where NRC and FEMA media representatives are also hosted. The JPIC can therefore serve as the focal point for mass media briefings and provide for eventual co-ordination between various representatives, although these representatives act independently. Information for the media is also available from the Local Media Center located at North Anna Information Center. The different information centres are equipped with modern equipment and appropriately staffed. Rumor Control Room is established when needed and information is also available on a web site.

General information to the public about the emergency planning is provided in form of; a calendar, pamphlets for transitional population, evacuation maps in telephone book yellow pages, toll-free numbers for information about emergency planning. The Nuclear Emergency Media Guide is an excellent document for journalists. It is issued once a year and keeps them updated with information, needed to prepare high quality messages. The liaison with public and media is very well covered in afore mentioned emergency plans and procedures, facilities are very good and the staff is well trained to deal with the public and media.

DETAILED EMERGENCY PLANNING AND PREPAREDNESS FINDINGS

8.2. EMERGENCY PLANS

8.2(1) Issue: There are some shortfalls in the off-site emergency planning in relation to good international practices.

Shortfall related to plant emergency planning:

- The protective action recommendation procedure does not evaluate the evacuation dose versus sheltered dose when there is a release in progress.

Shortfalls related to federal emergency planning:

- There is no evidence that decision making on protective actions would be made promptly. In international good practices for the Precautionary Action Zone (PAZ) the immediate evacuation after the declaration of general emergency is assumed without any additional decision making. Presently and due in part to federal guidance, the State of Virginia requires approval of the Governor or designee in all cases.

- There are cases in which use of projected dose as the concept for protective action recommendation can not be justified. E.g. evacuation in the radioactive plume, if the protective action had been delayed due to any reason. The intervention levels, which provide guidelines for protective action recommendation (PAR), can not take into account the dose, which, has been or is likely to be received;

- There is no assurance of standardization of sampling methods for samples which will be later spectroscopically analyzed. The sampling method can substantially influence the results of the measurements, therefore making the comparison and evaluation of results obtained by different sampling methods, almost impossible;

- The FEMA exercise guidelines call for locating peak exposures in the plume and to determining peak readings by plume chasing through the center. This practice is not used by most countries where it is common practice to locate plume edge (side), which is enough to confirm or introduce protective actions.

Lack of consideration of international practice could lead to substandard practices within the country with associated results.

Suggestion: Consideration should be given to reviewing the national emergency planning programs to consider incorporation of the latest good international practices.

8.4. EMERGENCY RESPONSE FACILITIES

8.4(1) Issue: Although the Technical Support Center (TSC) is functional it lacks some attributes usually found in international facilities.

An inventory listing of documentation, which can be found in the TSC, is not readily available. The documents for use in emergency response in the TSC are not uniquely marked (there are other documents in the TSC not related to its function). The emergency layout of the response center can be compromised by the staff that occupy the space normally as there is no restriction on them moving emergency equipment from designated locations. The remote sections of the TSC (health physics and chemistry premises) are not clearly labeled and do not have fixed area radiation monitors. Their direct telephones to the TSC main room are not easily visible and labeled.

A food supply does not exist in the TSC. Telephones that are used specifically for exercises have been left in place instead of removed when not in use. Dedicated respiratory protection does not presently exist for the TSC. Sockets providing UPS are not labeled. This becomes significant as access to information and documents relies heavily on computer support. Status boards fixed on the wall are difficult to read because of their small letters and angle of view.

The present state of readiness of the Technical Support Center could challenge the implementation of prompt actions in an emergency situation.

Recommendation: The plant should upgrade the Technical Support Center facilities in a manner that ensures its functional requirements can meet good international practice.

8.5. EMERGENCY EQUIPMENT AND RESOURCES

8.5(1) Issue: There are some shortfalls in the equipment provided for emergency situations, compared to good international practices.

- There is no dedicated vehicle, which can carry the valuable measuring equipment for field radiation monitoring (i.e. spectrometer), should the existing in-plant or LEOF facilities become uninhabitable.
- The emergency kit did not when examined, contain relevant procedures although Emergency Plan Implementing Procedures (EPIPs) are provided to the monitoring teams prior to field monitoring activities, sampling trowel, pencil, notepad, spare labels for samples and a length measuring device. Additional items, which are necessary for the off-site monitoring team to perform its function without difficulties may be identified through drills. The instruments which are stored separately should be organized in a way that enables quick pack up.

Less than optimal equipment could reduce the timeliness and effectiveness of protective actions taken.

Suggestion: Consideration should be given to enhancing the equipment dedicated to nuclear emergency use to a level of international good practices.

8.6. TRAINING, DRILLS AND EXERCISES

8.6(1) Issue: Generally the exercise/drill scenarios have been found very realistic and their frequency sufficient or above average. Nevertheless, during observation of a training evolution which was being provided to health physics shifts, an opportunity was missed to provide a true representation of the field monitoring experience.

The dedicated field kits were not used and the simulation of the kits was not complete. Also, the teams were not expected in the training to demonstrate complete familiarity with most aspects of the field monitoring activities. For example they were not required to demonstrated knowledge of sample locations and obtaining samples under field conditions. The Drill program meets the required frequency of at least once a year, however, since any of the technicians could reasonably be expected to perform the duty, they should be given the opportunity to perform at least once a year. This approach would ensure familiarity with the process and give them an opportunity to assess the needs of the field monitoring teams in relation to equipment and support items needs. Additionally, contamination awareness under field conditions, which are outside normal confines of the station, could be increased.

The less than optimal performance of field monitoring teams may delay or have adverse effects on the longer term protective action.

Suggestion: Consideration should have been given to provide additional program for field monitoring team exercises, which require more practical (hands-on) skills.

8.6(a) Good Practices: The Emergency Plan training staff uses the plant electronic mail system to supplement the instructional needs of the emergency response organization between annual re-training requirements. This maintains a high level of awareness in the various disciplines. For example, changes in response procedures that have been made and changes caused by a drill comment that provides immediate corrective action. Electronic mail is also used as a medium for delivering annual retraining materials. Training uses self study packages assigned by electronic mail with electronic read receipts returned to the instructor.

The Emergency Plan training program is conducted as if it were an accredited program. A job task analysis was prepared initially for each position. A set of specific modules (Lesson Plans) for each profile (job) of the emergency organization has been developed. Each module comprises teaching materials and handouts. After the initial training and test have been given, there may also be a psychomotor job test required, which should prove that the candidate could accomplish given tasks in predetermined timeframe. A database for scheduling the retraining exists which also provides a forecast of when personnel will become overdue.

During the procedure revision process, each procedure is evaluated for any potential training needs. If training is determined to be required, then it is given prior to procedure implementation. This may be by electronic mail or, if necessary, full classroom instruction.

DEFINITIONS

OSART MISSION

Recommendation

A recommendation is advice on how improvements in operational safety can be made in the activity or programme that has been evaluated. It is based on proven, good international practices and addresses the root causes rather than the symptoms of the identified concern. It very often illustrates a proven method of striving for excellence which reaches beyond minimum requirements. Recommendations are specific, realistic and designed to result in tangible improvements.

Suggestion

A suggestion is either an additional proposal in conjunction with a recommendation or may stand on its own following a discussion of the pertinent background. It may indirectly contribute to improvements in operational safety but is primarily intended to make a good performance more effective, to indicate useful expansions to existing programmes or to point out possible superior alternatives to ongoing work. In general, it is designed to stimulate the plant management and supporting staff to continue to consider ways and means for enhancing performance.

Good Practice

A good practice is a proven performance, activity or use of equipment which the team considers to be markedly superior to that observed elsewhere. It should have broad application to other nuclear power plants and be worthy of their consideration in the general drive for excellence.

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