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REPORT

OF THE

OSART

(OPERATIONAL SAFETY REVIEW TEAM)

MISSION

TO THE

PHILIPPSBURG-2

NUCLEAR POWER PLANT

GERMANY

11 to 28 October 2004

AND

FOLLOW-UP VISIT

6 to 10 November 2006

DIVISION OF NUCLEAR INSTALLATION SAFETY

OPERATIONAL SAFETY REVIEW TEAM MISSION
DIVISION OF NUCLEAR INSTALLATION SAFETY
DEPARTMENT OF NUCLEAR SAFETY AND SECURITY

PREAMBLE

This report presents the results of the IAEA Operational Safety Review Team (OSART) review of Philippsburg-2 Nuclear Power Plant, Germany. It includes recommendations for improvements affecting operational safety for consideration by the responsible German 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 German 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 nine operational areas: management, organization and administration; training and qualification; operations; maintenance; technical support; operating experience feedback; 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 judgments 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. It also includes the results of the follow-up visit that was requested by the competent authority of Germany for a check on the status of implementation of the OSART recommendations and suggestions.

CONTENT

INTRODUCTION AND MAIN CONCLUSIONS

INTRODUCTION

At the request of the Government of Germany, an IAEA Operational Safety Review Team (OSART) of international experts visited Philippsburg-2 Nuclear Power Plant from 11 October to 28 October 2004. 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. As part of the Technical Support review, a specific review in the area of Operating Experience Feedback was performed. 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 Philippsburg-2 OSART mission was the 126th in the programme, which began in 1982. The team was composed of experts from Brazil, Bulgaria, Canada, The Czech Republic, Japan, Slovakia, Slovenia, and United States of America, together with the IAEA staff members and observers from Pakistan, Russia and the IAEA. The collective nuclear power experience of the team was approximately 400 man-years.

Before visiting the plant, the team studied information provided by the IAEA and the Philippsburg-2 NPP 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, toured areas in the plant, 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.

The team also noted the openness of the regulatory authority to this mission. The regulator asked the team to maintain special focus on areas important to safety, and safety culture which are reflected in this report.

The team encourages the plant and the regulator to carefully consider the items noted in the report. The team believes Philippsburg-2 is a safe plant but it could benefit from studying some of the enhancement programmes developed at other plants in the world. To do this properly requires time, it is not a process to be rushed into. We have found that the best way to respond is to carefully consider each issue, plan actions to address the issues and implement the actions on a well-coordinated, deliberate schedule.

MAIN CONCLUSIONS

The OSART team concluded that the Philippsburg-2 NPP (KKP-2) has many good features that form the basis for safe operation of the plant. The plant is staffed with well-educated, highly skilled workers, engineers and managers. A high degree of professionalism exists at all levels in the plant and there is a strong desire to improve the plant activities.

The senior management of Philippsburg-2 NPP holds a long-term commitment to improve the operational safety and reliability of their plant. The team found that Philippsburg-2 NPP has several strong attributes and programmes, including the following:

- The equipment is well maintained to preserve the excellent material condition;
- The plant has a highly motivated staff who work well together as a team;
- The plant has made effective use of modern technology to anticipate the needed
- equipment changes within the plant;
- The plant also showed good housekeeping and cleanliness in most locations visited
- by the team.

Although Philippsburg-2 NPP has many good operational safety features, the team observed some areas for improvement. The most significant were:

- The plant could make greater use of benchmarking and exchanges of knowledge;
- Within the industry regarding the use of worldwide experience feedback and good
- practices;
- This is particularly appropriate for programmes related to enhancement of human
- performance;
- The plant should further develop their system for performance indicators at the department level and make better use of the results to encourage improvement;
- The plant should enhance the monitoring by managers of conditions in the field; and
- Weaknesses observed during these tours should be analyzed and the causes corrected.

An important element of the OSART review is the identification of those findings that exhibit positive and negative safety cultural aspects of operational safety performance. The OSART team used the guidance provided in INSAG-4, INSAG-13, INSAG-15 and IAEA Safety Report Series No. 11 to assess various organizational and technological aspects of operational safety culture at the Philippsburg-2 NPP.

The overall impression by the team is that the plant has many attributes associated with strong safety culture in particular reliable and well-maintained plant equipment. Recent extensive training programmes indicate a conscious effort to enhance the safety culture of employees. A stable work force with long experience in the plant has facilitated these developments.

Although a strong safety culture is evident in many ways, the term safety culture needs to be permanently and systematically re-enforced as KKP-2 faces changes in the company and retirement of experienced employees. Efforts need to maintain the focus on safety culture and periodic assessment of the safety culture should be performed within the new organization.

The plant is in a transition phase with future challenges in terms of ageing, and increased economic pressures from a competitive market. The plant should continue to address these challenges.

The Philippsburg-2 NPP management expressed a determination to address the areas identified in this report and indicated a willingness to accept a follow up visit.

PHILPPSBURG FOLLOW-UP MAIN CONCLUSIONS [PLANT SELF-ASSESSMENT]

The OSART Mission in October2004 was the second at the Philippsburg site, following the one in 1987. Looking back, the preparation process was just as important for us as the results. The preparation was done by setting up a project, in which people who were counterparts during the mission were supported by other staff members and advised and guided by senior management. The OSART Guidelines were a great help, as they give a comprehensive view.

Comparison with the OSART Guidelines, the subsequent discussion to identify and implement corrective action, and intensive engagement with the problems of other team members have enabled us to "look over the garden fence" and consciously to compare ourselves with other nuclear plants.

The plant has deliberately retained this method of working during preparation for the Follow-up and actively involved the other nuclear power stations within EnBW corporate group. Some members of the individual teams and the Steering Committee of the Follow-up Project at KKP are technical experts and management staff from GKN and KWO. Conversely, KPP is supporting them with our experience in their preparations for the GKN OSART Mission in 2007.

The results of the OSART Missions from both our own and other plants are taken into consideration in our everyday practice. In this context, we have found the OSMIR database to be a very comprehensive and readily accessible tool. We have also made use of it in process optimization for the introduction of our safety management system.

The 16 recommendations and 10 suggestions have all been assessed with a view to implementation and presented to the Steering Committee for decisions. They were assessed and prioritized individually in order to co-ordinate them with other on-going activities at the site.

As well as the actions resulting from OSART, other major projects in 2005 and 2006 are the development and introduction of the new computerized operations management system, the construction and commissioning of the on-site interim spent fuel storage facility, the introduction of the indicator-based safety management system, the condition-based preparation and execution of the annual maintenance outages for KKP 1 and KKP 2, and the EnBW mission statement dialogue with our employees. Their willingness to take ownership of decisions and changes depends on their recognizing and understanding the reasoning and purpose behind the changes. Bearing this in mind, we attempt to avoid placing undue burdens on the individual when defining workloads.

The necessity of monitoring the status and development of individual areas e.g. human performance or corrective action programmes, and the prioritization of implementation at the plant mean that progress differs, as described in this document. The OSART Follow-up Mission thus offers us the benefit of being able to see our own estimation of the relevance and progress of individual actions appraised through the eyes of the IAEA team.

Some of the actions implemented have already proved their worth. We attribute the significant fall in occupational accidents to the industrial safety improvement programme now being introduced. The goal was to achieve a noticeable reduction in accident figures by raising the awareness of management staff and other employees for various aspects of industrial safety. The programme is still on-going.

The establishment of cross-divisional functions within EnKK has resulted in shared structures and common processes in the fields of Cost Control, Finance, Material Management, Human Resources, Nuclear Fuels, Utilities and Waste Disposal. The formation of the Nuclear Engineering division as a cross-cutting technical support bureau for all the sites is almost completed. The deployment of human resources across all the power stations is driven by the anticipation of synergy benefits from the type of duties they perform.

Although regulatory approval has still not been granted as expected, the changes introduced in communication with the regulators have brought about improvements. These have been felt both at management and at work level.

Strategy meetings at station and operations management level based on the annual report on the Safety Management Efficiency offer opportunities for all parties to identify solutions rapidly and directly.

A process defined for this purpose together with the authorities and their independent technical agents assures that modifications for implementation during maintenance outages are co-ordinated and controlled during the lead time.

The release from compulsory on-going control of some documents subject to regulatory review is currently being demonstrated, illustrated with the example of the modification procedure documentation. The consequence is that the processing of modifications now falls to a greater extent within the responsibility of the plant operator, without in any way limiting the regulatory authority's work.

With regard to the search for a sound HUMAN PERFORMANCE policy, we have obtained information from international operator organisations and fed back our own experience e.g. with management walk-downs. We have resolved to reinforce existing expectations with the MARKER booklet in line with national standard and establish a common understanding of the scope and benefit of professional practice.

We are initiating changes in national specialist bodies, for instance on pre-job briefings or post-job debriefs. The results of our OSART Mission can act as a catalyst in the national context in this respect. We will push ahead in the next few years with the reinforcement of existing human performance methods and the application of new ones in the interests of continuous improvement.

The prioritization and central tracking process for corrective action has been developed, and implementation began in September 2006. The IAEA TECDOC 1458 "Effective corrective actions to enhance operational safety of nuclear installations" has been a great help with its clear and comprehensible instructions.

The 2004 OSART Mission has shown us how important communication and comparison with the international nuclear industry are. It has contributed to closer contacts with IAEA. Today, members of our staff are involved in IAEA missions or the preparation of new IAEA-documents, bringing experience back to our plants. We consider this to be an important step for continuous improvement.

FOLLOW-UP TEAM MAIN CONCLUSIONS

The team received excellent cooperation from Philippsburg NPP management and staff and was very impressed with the actions taken to resolve the findings of the original mission. In many cases the corrective action programme was much broader and more comprehensive than individual recommendations.

The plant analyzed thoroughly all OSART recommendations and suggestions. The working teams were created to develop processes and implement corrective measures. The willingness of plant management, to consider new ideas and implement a comprehensive safety improvement programme was very impressive and it is a clear indicator of the potential for further improvement of the operational safety of the plant. This is even more valuable because many of the safety improvements were implemented also at Neckarwestheim NPP. This is a confirmation that company EnBW considered the OSART recommendations as very important. The results achieved confirmed that nuclear safety is really the highest priority of management and staff. Several plant tours confirmed excellent material conditions, cleanliness and housekeeping of the plant.

The original OSART team in October 2004 developed 16 recommendations and 10 suggestions to further improve operational safety of the plant. As today 24 months after the mission 62% of recommendations were fully resolved and 38 % is progressing satisfactorily.

No one recommendation was found with insufficient progress. These results are very good.

The team was given total access to all information and personnel at Philippsburg NPP. The team was allowed to independently verify all information that it believes was relevant to its review. In addition, the team concluded that the managers and staff were very open and frank in their discussions on all issues. This open discussion very much contributed to the success of review and quality of the report.

1. MANAGEMENT, ORGANIZATION AND ADMINISTRATION

1.1 CORPORATE ORGANIZATION AND MANAGEMENT

The KKP station is part of the EnBW Production Holding Company, KWG, which in turn is part of the EnBW Energy Company of Germany. As such it is a stand alone Business Unit and has responsibility for all activities associated with the running of the Nuclear Power Station. There is no technical nuclear support provided from either the Production Holding Company or the parent Energy Company.

There is recognition amongst the Board of Directors of the Production Company that reorganization is required for their nuclear assets to better manage and deal with the special requirements of the nuclear business. In addition to make up for the lack of nuclear expertise at the Board level, an adviser has been appointed, the previous head of Swiss Nuclear Regulatory Agency, to assist the board in its monitoring and deliberations on the company's nuclear assets.

There is evidence to show that the financial support provided by the parent company is adequate when compared to international benchmarking. This financial support, in terms of operating budgets and reinvestment, was low in the years leading up to 2001 and has been substantially increased since that time to equal international levels.

The three nuclear plants of EnBW are about to be merged into a single holding company EnKK. Legal approval for the merger is expected within weeks. During the review of this merger it became apparent that while there is a clear vision for the new company, there is no transition plan in place to execute the change. Accordingly a recommendation has been developed in this area to assist management in the development of a change plan.

The three plant managers of the new EnKK group have put in writing their objectives for 2004. While the goals are different for each of the plants this is a clear indication of a common approach being developed in the company.

1.2 PLANT ORGANIZATION AND MANAGEMENT

The organization structure of KKP supports all functions normally expected in a well-operated nuclear power plant. Staff numbers reflect a deliberate and commendable policy by management to provide overlap and knowledge transfer for staff who are about to retire from the company. It was confirmed that the money to pay for this staff overlap is included in the stations financial plan over the next four years. This staff overlap policy was recognized as a good practice by the OSART team.

There is an impressive understanding of the impact of under financing a nuclear operation by station management in terms of long-term reliability and safety. The Controller group at the plant are clearly supporting the Plant Manager in obtaining the necessary funds to maintain this long-term reliability.
They understand the major cost drivers of the operation. Two significant budget items for the stations are water tax, (water diverted from the Rhine), and regulatory cost recovery.

Contractor costs were not one of the top items in the budget and again management clearly recognise that squeezing contractors at the potential expense of quality was not in the best interests of the safe and reliable operation of the plant.

The station has an excellent risk management process. There is a procedure driving this process. The model covers legal/political issues, the commercial market, labour/people issues and finally technical issues. All risks with an impact of >€500K are included. The risk data is reviewed weekly at the Management meeting for changes and the risk model is formally updated quarterly. Mitigation strategies are developed as risks are identified to minimise the impact on the plans and objectives of the station.

KKP uses several contractors to assist in the running of the station. All contractors must have approved QA programmes. Certification is completed or confirmed by the station Quality Surveillance group. The German Utilities share this certification information and KKP can therefore use a supplier/contractor who has been certified by another German utility.

Within the German political system there is a legal requirement to have a Works Council at each facility. Such a council is in place and functioning well at KKP. The Works Council is elected by all workers and its role includes negotiating and agreeing to such items as “social bonus payments” at the plant and the hiring and dismissal process for workers. They also act as the interface with management for communicating business planning and industrial safety objectives and sit on the stations Industrial Safety Committee.

In interviews conducted with station staff at all levels of the organization, the OSART team was left with the clear impression that there is a good relationship between the workers and plant management and that the workers identified with KKP, EnBW and its goals.

The stations communication programme has been significantly strengthened over the past three years. Routine communications to the workers, several per week, are produced on the station Intranet system and in hard copy. Regular meetings are held with local politicians to review station operation and plans and finally a communication protocol has been developed and implemented to ensure that local politicians and government groups receive timely information on plant events.

During the period of the OSART team visit this process was witnessed in the plant when several publications were issued about the mission itself. In addition, workers interviewed were very positive about the improvement in communications over the past three years, both from the Intranet process and face-to-face meetings and discussions with plant management.

As discussed previously the station has an excellent policy with regards to staff overlap prior to retirements to ensure an adequate transfer of knowledge. One area that still requires some further action from management is in the area of succession planning for senior management positions. Typically in the international community there are staff plans available to rotate future managers through important positions within the company to ensure they have relevant experience when there turn comes to take a senior appointment. Such a plan is not available in KKP although each manager has a recognised and approved deputy. The lack of a succession plan is recognised by station management. Such a plan is under development. The station is encouraged to continue with this work.

There is a very good system of performance reviews carried out from the Plant Manager down to the working engineer level and supervisors in the operations and maintenance areas.

This is a form of personal contract, which includes elements of the station goals and objectives. In examples reviewed, the objectives agreed between manager and subordinate are measurable. However, it was not obvious that these personal contracts contained any measures or targets in the area of Industrial Safety.

Legal requirements and plant procedures clearly define the person responsible for Nuclear Safety as the Head of Operations. In addition there are approved deputies for this position to cover for off-hours duty. The Head of Operations and his deputies have clear educational and experiential requirements to meet before they can be approved for such positions. The regulator gives approval for all appointments to these positions.

The organizational structure shows a Nuclear Safety Officer who reports directly to the Plant Manager and provides independent oversight in the area of Nuclear Safety. This position and the qualification of the person filling it are defined in legal requirements. At KKP the person holding this position has been absent from the site for some time due to illness. A colleague at a neighboring ENBW nuclear power station has been assisting on an ad hoc basis. This has been recognized as an unsatisfactory situation and the position will shortly be back filled on a permanent basis. However the time taken to deal with this situation and find a suitable replacement for a position advertised to be critical to good safety practices was found to be too long.

There is a plant procedure that requires managers to conduct routine tours of the plant to review and report on plant material condition and housekeeping. This is seen as a positive step. However, the procedure is relatively new and to-date few tours have actually been completed. In addition the frequency required for these tours is less than the recommended international practice. It is suggested that these tours should become more engrained within the stations philosophy and that the results be routinely reviewed at the weekly management meeting. Such tours if conducted regularly can have a very positive impact on the station's safety culture and industrial safety.

There is a routine meeting at the station to review nuclear safety performance. Typical subjects covered include the review and evaluation of station event analysis and operating experience from other plants both in Germany and France. Station management is present at this meeting. This is an excellent forum to ensure nuclear safety events receive the correct priority for reporting, evaluation and follow up. The station is encouraged to continue this programme and look for ways to make it even more effective.

Each year the station holds a Management Review meeting where the Plant Manager and Department Heads review the performance of the station for the current year. Based upon this performance and plans for the future, goals and targets are established for the up coming year(s). These goals and targets are reviewed with the Works Council and then communicated to all managers and then through the line organization to the staff.

The goals and objectives of the station along with those of the other nuclear plants in the EnKK group are jointly published and made available to all staff individually in a professional brochure. In discussions with station staff there were clear indications that the overall station objectives had been communicated and were understood. However, there was no similar indication that they understood the goals of their individual departments or how they would translate the overall station goals to their own performance. A suggestion has therefore been formulated to assist the station in this area.

A review of the plant processes was carried out to confirm that no gaps existed between those at KKP and those expected within the international nuclear community. The review confirmed that all processes normally found in the international community are present at KKP. However, in three of the high level processes the mission felt that improvement was required. The three programmes are:

- Human Performance Programme,
- Corrective Action Programme, and
- Benchmarking Programme.

Of these three programmes it was clear that management at KKP had made the most positive steps forward in the area of benchmarking. Regular exchange visits and information exchanges are now occurring with the nuclear plants of EnBW, the German Nuclear Utilities and with EDF. Management is encouraged to continue this effort further. In many of the areas associated with the findings of this mission, the international community has also experienced similar problems in the past and has made good progress in their resolution. Further benchmarking would assist KKP in sharing in the results of these programme improvements.

Detailed observations from the mission on the review of corrective action programme are described in section 5.3.

In the two areas, Human Performance and Corrective Action, the mission has made recommendations to plant management with respect to the gaps found in both programmes.

There is a well-documented process for how work is executed in the station. In addition, no work can be approved for execution without a complete documented work package being available. In this area the station is continuously looking towards improvements and a revised process for producing the work package documentation is already under trial.

At KKP2 there is no station instruction or guidance provided on procedural compliance. Such a policy is typically found in the documentation set of the international nuclear community to train and assist workers in management expectations in this area. Accordingly a recommendation has been provided to cover this identified gap and is discussed further in chapter 1.6.

1.3 QUALITY ASSURANCE PROGRAMME

There is a Documented QA Programme in place at KKP2 that meets international standards. The programme includes an Audit element. The audit programme for 2003 and 2004 was reviewed and the subjects covered were found to be relevant to the power plant operation. There is also the first draft of the 2005 programme ready for the Management Review meeting later this year.

The audit programme typically consists of between seven and nine formal audits per year that have generated between 35 and 45 findings. It was also noted that there has been a significant increase in the audit activity since 2001 and the station is to be recognised for this improvement.

Follow up to audit actions was also reviewed. Metrics were provided to show that from 2002 there are still 5 of 40 actions outstanding and from 2003, 8 of 34. These outstanding actions are reviewed routinely with management at the station and if the QA Organisation is concerned about the delays of completing such actions they are brought to the attention of the Department Head or in serious cases directly to the Plant Manager.

Other notable items identified during the QA review include:

- QA are now doing short surveillances on the plant as well as detailed audits. This was started in 2004;
- Staff from other sections join audits for training and development;
- They are now doing audits across the three nuclear sites with joint teams;
- International staff are joining the audit teams to bring an external perspective to the process; and
- All engineer and supervisory staff at the station receive appropriate training on the Quality Programme and their roles and responsibilities in the application of the system at the station.

There is a well-documented process for the procurement of spare parts and the requirement for suppliers to be certified to the appropriate standard. A qualified Inspector checks all materials entering the station.

1.4 REGULATORY AND OTHER STATUTORY REQUIREMENTS

There are two levels of regulatory body within the German system. The Federal regulator is responsible for the writing of regulations while the state regulator is responsible for enforcement and surveillance. There are times when both regulators can be involved in enforcement and/or review activities.

State regulators have specific areas of responsibility. The regulators are not based at the site but they are required to make routine visits to the plant each week. These visits are being carried out.

To assist the regulators in dealing with the many complex technical aspects of nuclear power generation, the regulator uses independent technical experts to assist in the evaluations of station event reports, requests for modification approvals, on site inspection and surveillance activities and assessments of utility programmes. This includes reviewing station outage plans and confirming the plans have been completed satisfactorily, in many cases by on site inspections as the work is being executed and associated sign off.

Responsibilities of station staff with respect to the station license and regulatory requirements are clearly documented in the station procedures. In addition it is clear that changes to such documents require the approval of the regulator. Similarly all technical specifications are written into station documents and approval is required from the regulator for changes to these documents.

The stations staff plan is presented to the regulator annually. Changes to the staff plan require approval of the regulator. This significantly limits the potential for unplanned changes to the staff that could impact on Nuclear Safety.

The regulator reviews and comments on the KKP audit programme annually prior to its implementation. In addition the regulator does on average three of its own audits annually. The subjects appeared appropriate to the mission. Finally, the regulator audits the KKP QA programme and results annually to confirm they meet the requirements of the German quality standard.

There is a positive and open relationship between KKP Management and the regulator. The regulator was positive about the improvements that had been made at KKP in safety culture since the events of 2001. However, the mission identified some issues with the methods used by the station when working with the regulator that could be improved. The issues are discussed further below and a recommendation to station management was developed.

The technical experts used by the regulator will often provide comments to station submissions that can be at times extremely technical and detailed and often make recommendations on how to change or maintain the plant. Long negotiations can then result between the station and experts that can have a significant detrimental impact on the productivity of the station's engineers as well as delays to the approval process which end up being slow and protracted. There is a therefore a significant time effort by station staff in dealing with several hundred such comments per year. During outages, station staff will spend many hours negotiating with the technical experts on items impacting restart approval.

Given the regulator works on a cost recovery basis the above protracted negotiations will cost KKP €14 M in 2004 in reimbursing fees for regulatory services. This does not account for the time or effort of KKP personnel. At times given the cost and/or time pressures for decision making, the plant will acquiesce to the recommendations of the technical experts even when this may not be cost effective or provide real safety benefit.

KKP has a computer programme that tracks commitments and reporting requirements to all regulatory bodies. It also defines the responsible group and target date for each action associated with a commitment, which includes follow up actions to reports made to the regulator.

All meetings with the regulatory bodies are arranged through the regulatory affairs section at the station. This group must be present during the meeting. The group prepares all minutes and copies actions into the above database for tracking. The group routinely reviews the database for actions and commitments coming due to ensure they are dealt with in a timely manner.

Each morning the management team meets to review the events at the station over the previous twenty-four hours as well as to discuss and agree station priorities. During this meeting the event reports generated over the past day are checked for being reported to the regulator. If there is any doubt about it, actions are assigned at the meeting to bring this to resolution.

1.5. INDUSTRIAL SAFETY PROGRAMME

The management team and the works council believe that their industrial safety practices are acceptable. The basis for this is their comparison with German Industry. When station performance is benchmarked against WANO industrial safety indicators the station performance is below the international average.

A review of the station industrial safety statistics for the last three years shows a high rate of lost time accidents with no apparent improvement evident on a year-by-year basis.

During the plant tours there were times when members of the station management team witnessed unsafe practices and/or workers not following safety rules and failed to correct them. There is currently no programme in place to correct these deviations.

During the review of QA surveillances it was clear that KKP management had recognised a worsening trend in industrial accidents after a severe electrical accident occurred at the station earlier this year.

Given the industrial safety record at KKP, the mission has made a recommendation to station management on this issue.

1.6 DOCUMENT AND RECORDS MANAGEMENT

There is a comprehensive process for collecting all relevant safety related documentation, filtering this documentation and ensuring it is correctly archived at the plant. A dedicated section is responsible for this process. The process is well documented and understood. There is no backlog of documents waiting to be processed.

There is a QA vault at the station for archiving safety-related documents. In addition the station is moving towards a “paper less” process and documents are being scanned into the computer for easier retrieval, review and back up. Station procedures controlling all safety related documents clearly outline the retention period for each document.

During the review of the station documentation process it became clear that there is only limited guidance for staff on when procedures are to be written to cover station processes. Critical processes exist at the station that are not described in a station procedure or policy, for example the process describing regulatory commitments. The gap was not consistent with international practices. Consequently the mission has made a recommendation to the plant regarding this gap in the station documentation set.

STATUS AT OSART FOLLOW-UP VISIT

In the review area of Organization, Management and Administration there were six recommendations and one suggestion documented during the 2004 OSART mission. In each of the areas identified by the mission for improvement it is clear that station management had taken the issue seriously and had defined and executed plans to bring about improvement.

The single suggestion made by the team to improve the understanding of the roles of the individual departments in the achievement of station goals and targets has been completed to the team’s satisfaction.

In 2004 the three nuclear power plants of EnBW were about to be merged into a single business entity that recognized the special needs of this business and would allow the sharing of common processes and operating experience. In 2006 we find that this merger has still not taken place due to delays in the regulatory approvals required. However the station is to be commended for proceeding with those changes that can be accomplished without the need for regulatory approvals. Specifically we note that peer groups have been established at different levels of the organization to share experience and to work on common issues and common process are being established across the sites. It is clear that the intent of the recommendation is well on its way to being met. Given the need for final regulatory approval for the business change however this issue can not be considered complete.

In two areas the mission made recommendations related to the addition of new programmes at the station; Corrective Action and Human Performance. In both areas the station has reviewed the requirements set out by the IAEA and benchmarked other plants in the international community. They have identified programmes that meet the station needs as well as the requirements of the IAEA. Procedures and been written to guide staff in these two new programme areas and training of staff is in progress. In both areas the station is making satisfactory progress.

In 2004, gaps were identified in the stations documentation set. As a follow up to our recommendation in this area the station carried out a complete gap analysis using IAEA guidelines as the benchmark. The gaps identified have been closed with new procedures. Follow up to this issue is considered to be complete.

Regulatory relationships were seen to be in need of optimization at the time of the original mission. Since that time it is clear that steps have been taken by both sides to improve their processes and protocols without impacting negatively on safety. While recognizing the improvements that have been made we still see opportunities for further optimization. The issue has been rated as satisfactory progress.

Finally in the area of Industrial Safety the station has made improvements to its internal organization by the addition of Safety Officers who have both professional training in this area as well as experience of being workers and supervisors at the station. Improvements in the attention given by station management to this area combined with the process and staff changes have resulted in a reduction in both reportable and medically treated accidents. The station is encouraged to continue its improvement efforts in this area which has been assessed as making satisfactory progress.

DETAILED MANAGEMENT, ORGANIZATION AND ADMINISTRATION FINDINGS

1.1. CORPORATE ORGANIZATION AND MANAGEMENT

1.1(1) **Issue:** There is no transition plan in place to move the company from three individual sites to a single company with a common vision;

- A new company is being formed, EnKK, which is a combination of the three nuclear power stations, which includes KKP, in the EnBW Group. Legal approval for the new company is expected within a matter of weeks;
- The Plant Manager of KKP is the CEO of this new Company EnKK. He also sits on the Board of Directors for the Production Company of EnBW. It is not clear that one person will be able to carry out all of these roles effectively;
- Currently there is no common structure or processes at the three sites. Although the longer-term goal is to have a single, common approach to business processes, there is currently no plan in place to drive this vision. It should be noted however that as new processes are being introduced within KKP they are also being introduced at the other sites, for example the new Safety Management System;
- While it is common practice in utilities with multiple nuclear sites to have a corporate technical office which provides support in emergency planning and special projects, such a group is not yet in place;
- There are some differences in rates of pay and social bonus agreements between the three sites that will make up the EnKK Company. Harmonisation of these differences is a current focus of the management team. Until this harmonisation is complete there is a potential for staff dissatisfaction and poor morale that can impact worker performance.

Without a clear transition plan for such a merger there is the possibility of the change being poorly executed such that staff morale and performance are affected. In addition, there is a requirement for the new company to take on a central role in the area of emergency planning. Without such a role, there is the potential to place an increased workload on plant staff during an emergency event. This is a time when station staff could be already stretched and in need of assistance.

Recommendation: A transition plan should be developed, using experience from other utilities that have made such mergers and changes, for implementation once regulatory approval has been granted for the new company.

Plant Response / Action:

In order to help the three sites that make up EnKK to grow together into a single company with a shared vision and common goals, the EnKK organisation was given three cross-functional areas with staff distributed across all three locations to support them all. Experience from co-operation within these cross-functional areas, (both at the organisational and human levels), will be leveraged to help the technical organisational units grow closer as well.

In Departments K (Financial Control/Finance/Material Management) and P (Human Resources), EnKK cross-functions have been in place with effect from 1st December 2005. Department N (Nuclear Fuel, Supply and Waste Disposal) began operating its cross-functional process from August 1st 2006.

The structuring of the new KWG-NT division (Power Plant Company Nuclear Technology) is now almost completed. It will form a support function for all three sites and will also look after cross-cutting processes and tasks common to all three stations, or which can be drawn together to provide synergy effects
The main focal points are:

- Cross-functional engineering work,
- Work on regulation source books,
- Routine management,
- Safety management,
- Planning and control of reviews and missions,
- Regulatory requirements and demands, and
- Representation of EnBW in committees of joint operator organisations.

As part of the reorganisation, there are 19 cross-functional processes in the safety management system (SMS) are currently being co-ordinated with the process owners and implemented.

F1.1 Corporate goals
F2.1 HR management
F2.2 Budget and business planning
F3.1 Safety management
F3.2 Management Review
F4.1 Definition and development of organisation
F5.1 Corporate communications
F6.1 Risk assessment
F7.1 Strategic ageing management
F8.1 Knowledge management
U2.1 Staff selection
U2.2 Staff appraisal
U2.3 Introduction of new employees
U5.1 Information
U5.2 Meetings management
U10.2 Legislation monitoring
U12.1 Procurement processing
U12.2 Stores organisation
U14.1 IT security

14 of the 19 processes have already been implemented. The rest will be co-ordinated and introduced when the conditions are in place, such as the integration of the new operations management software with SAP applications.

Some activities had already been initiated at the time of the OSART mission to harmonise on-site arrangements with relevance for labour relations. These are called "internal station agreements" and concern, in particular, matters like pay (basic pay plus company benefits) and working hours.
The implementation of this project was assisted by extensive experience within the EnBW Group from recent mergers.

With the exception of a few remaining items, the harmonisation process is now complete. Some of the arrangements that have not yet been standardised represent cultural values peculiar to the individual stations. If they are harmonised, the arguments for and against any such action would have to be carefully weighed up.

Process F4.1 (Definition and development of the organization) is in place to facilitate the formation of the EnKK division. The process was cleared for application on 23rd January 2006. The cross-functional EnKK roles that have been defined so far have been elaborated with the aspects of this process in mind.

Other items such as the involvement of the Safety Issues Working Group are not yet functional due to delays in the official authorisation procedure for EnKK.

Although approval by the licensing authority for the formation of EnKK has been slow in coming, it is hoped that the improvements in communication with the regulators get a debate started on speedier solutions.

There has been discussion about concentrating the functions of the KKP Station Manager, the CEO of EnKK and the board member of EnBW-KWG in a single person. As the distribution of powers and functions is clearly distinguished between the Operations Managers (Leiter der Anlage) and the Station Management of the three locations, it is unlikely that the management role will be overloaded. This has been borne out by experience over the past two years.

IAEA comments:

The station has made significant progress in the resolution of this issue.

The following points were noted by the OSART follow up team;

- Peer groups have been established for sharing good practices and operating experience between the nuclear power plants of EnBW.
- A new work management computer system is being installed jointly across the nuclear plants of EnBW.
- Common practices are being instituted in the commercial and human resources area of the nuclear power plants.

- Engineers from KKP and Neckarwestheim are working on joint solutions to common technical problems.

These are very positive signs that the management and staff are realizing the benefits of these joint efforts between the nuclear plants of EnBW. The Ministry of of Environment Baden-Wüttemberg granted the licence of the new company EnKK in November 2006.

Conclusion: Issue resolved

1.2. PLANT ORGANIZATION AND MANAGEMENT

1.2(1) **Issue:** There are well-publicized station goals and targets for 2004 that have been communicated to staff at KKP. However, there is little evidence that station workers understand their role in helping the station meet its overall objectives.

- Interviews with several managers have identified the lack of goals and targets for their specific departments that identify how they will contribute to the achievement of station goals;
- Interviews with staff workers showed that they had heard and understood the goals of the station. However, in every case they were unclear on what they were required to do to help meet the overall objectives of the station;
- In well run stations it is typically found that each work group has its own internal goals and targets that demonstrate how they will assist the station in meeting its overall objectives. Such goals and targets are typically visible in workshops and work areas. There is no evidence of such a process at KKP.

Without workers fully understanding their role in meeting station objectives it is unlikely that they will be engaged and participate in the improvement processes aimed at making the station a safe, reliable and economic operation.

Suggestion: Management should consider developing and communicating annual objectives and targets for individual work groups that are closely aligned with overall station goals.

Plant response/action:

The corporate objectives for 2005 were presented to management and adopted on 4th February 2005. They were distributed at the end of March 2005.

In November 2005, an employee survey was conducted on the corporate goals. The survey showed a high degree of understanding for the corporate goals among KKP employees. It comprised the following 5 questions to assess the degree of awareness, understanding and application of the corporate goals.

I am aware of the EnKK/KKP corporate goals

I find the wording of the corporate goals for EnKK/KKP comprehensible

There is something I can do to contribute towards the achievement of the EnKK/KKP corporate goals.

I have been able to talk to my superior about the EnKK/KKP corporate goals during my regular staff appraisal interview.

Together with my superior, I have been able to set myself personal targets derived from the corporate goals.

The following results from the survey were communicated to the station staff in Employee Information 11/2006:

"I am aware of the EnKK/KKP corporate objectives" – 85 % of respondents agreed with this statement. Only 4 % disagreed.

64 % found the language of the corporate objectives comprehensible. Less than 9 % had difficulties with it. Judgement of their own ability to contribute to the achievement of corporate objectives was almost identical.

The picture changes when employees were asked about opportunities to talk about corporate goals in staff appraisal interviews with line superiors and whether personal goals were set in this context. In answer to each part of the question, just under half of the respondents said that this was not the case.

One possible reason for this result is that the EnKK and KKP annual objectives have not been made available until relatively late in the last two years and hence could not be taken into account in all the staff appraisal interviews. The decision was taken in the 2005 MR (management review) to have the objectives for 2006 agreed and internally distributed by the middle of January 2006, so that they are available in good time for staff appraisal interviews.

The SMS team gave the KKP heads of department advance information in mid-January about work progress in defining the objectives.
At the end of August 2006, five core goals were selected from the KKP corporate goals and communicated to staff. These goals are to receive special support and be tracked for achievement by regular monitoring in management meetings.

The 2006 corporate goals and the core goals mentioned above are a basis for staff appraisal interviews. In the "Goal Agreement" module of this process, the annual personal goals for each employee and his or her contribution to the achievement of overall corporate goals are set between the employee and line management. The results of this interview are treated by the line manager and the employee as confidential and cannot be inspected. The IAEA-OSART team will be able to review goal agreements anonymously.

Further action is:

- Another survey in Autumn 2006,
- Posters with regular information updates on KKP corporate objectives and the five core goals, and
- Visualisation of departmental and section objectives in the respective organizational units.

IAEA comments:

The team reviewed the station goals for 2006 during the follow up visit. By examination of documentation and interviews with staff the follow-up OSART team was able to see that individual departments had taken the station goals and identified their contribution for ensuring the success of the station. We were also able to trace the station goals further down to the Section Head level. We confirmed that the contribution of the section heads had been documented in their performance contract for the year.

Conclusion: Issue resolved.

1.2(2) Issue: The plant does not use some of the methods and programmes, typically known as the corrective action programme that have been developed in the international nuclear community for improving overall plant performance.

- There is no procedure describing a corrective action programme at the plant. The absence of such a procedure and the appropriate training results in the following problems:
  - Inconsistent understanding by staff of when an event report is to be written
  - A lack of a tracking process to ensure corrective actions identified from event reports are completed in a timely manner;
  - Inconsistent understanding by staff as to when a near miss report has to be written;
  - A lack of an effectiveness review on a routine basis to confirm the process is meeting the requirements of the plant;
- The current deficiency reporting process, fault reports, does not capture all items that could be adverse to quality, for example problems with processes discovered by plant staff in the execution of their work.
- There are large amounts of data contained in the IBFS system, industrial safety database and information from event analysis that are evaluated separately. They are not evaluated in totality to identify common trends or performance issues at the plant.
- The new safety management system will need input data to drive its assessment process. All data required for the new system is currently not available in the various station databases. A fully developed corrective action programme would meet this requirement.

Without a fully developed corrective action programme such as that found in many nuclear utilities today the station will miss opportunities to improve the safety performance of the plant in the future.

Recommendation: Management should review corrective action programmes that have been developed in the international nuclear community for improving overall plant performance with the aim of selecting those that can be successfully implemented at KKP.

Plant Response / Action:

The reporting rules for plant malfunction and events are contained in the following documents at KKP:

- Maintenance Manual of the BHB, Section 1, page 6
    - Every employee has a duty to report any deviation, damage, deficiencies and irregularities of which he or she is aware by preparing a discrepancy report or causing a report to be prepared without delay and in consultation with his/her line manager. The line manager will also inform the main control room if appropriate with regard to safety relevance.

- Operational procedure BAW S 004 "Holistic Event Analysis and Evaluation of Operating Experience and Events"
  This operational procedure is applicable to:
  - Analysis of all safety related occurrences, events and near-misses at KKP;
  - Assessment of transferability of events at other plants; and
  - Ensuring the feed back of experience from safety related events at KKP and other plants.

  Events in our own plant are defined by:
  - Discrepancy reports;
  - Voluntary reporting; and
  - Results of transferability from other plants.

  Section 2.1.2 "Voluntary reporting" gives possible reporting channels.

The differences from existing KKP arrangements (see above) were identified on the basis of a plan-to-actual comparison between the demands from:

- nuclear industry practice as found in WANO and INPO information; and
- IAEA TECDOC 1458 "Effective corrective actions to enhance operational safety of nuclear installations".

The review took as references:

- a systematic documentation procedure for events, including specification of what events are to be documented;
- allocation of priorities from high (detailed investigation and prompt response) to low (no investigation but trending to track whether problem is developing);
- criteria for the conduct of an investigation and definition of corrective actions; and

- a standardised and comprehensive method for the documentation of corrective actions and the appropriate monitoring thereof with regard both to progress and compliance with requirements.

The comparison shows that there is a need for a flow/process concentrating on the capture, prioritising, efficiency analysis and tracking of corrective action. This process U 11.2, Central Tracking of Corrective Action has been on trial since early September 2006. Its basic structure follows the PDCA cycle and is divided into 5 sections.

Preparation

Power station management and head of Operations compile specifications for the following areas:

- Areas in which corrective action is to be captured and tracked;
- Requirement for the priorisation;
- Requirements for the proof of efficiency;
- Who will capture and track the corrective actions and how; and
- Requirements for reporting and progress/status information.

Station manager and head of Operations plan the necessary organisation and direct the implementation of the process.

Capture/Prioritisation

Corrective action that is to be tracked is collected in the departments and sections. The respective heads of department decide whether action shall be tracked within the department or put before the management meetings for prioritisation.

For this purpose, he uses the matrix for "risk-based prioritisation". The case that has triggered the corrective action is evaluated for potential risk in five areas using the matrix:

- Nuclear safety on the basis of the INES scale;
- Plant availability;
- Impact on individual human beings;
- Costs/losses/damage; and
- Image.

Four possible priorities emerge from this analysis:

- PRIORITY 1: The corrective action is brought before a management meeting to check its prioritization. If it remains in category P1 or P2, it will be:
  - adopted into central tracking;
  - examined with regard to need for proof of efficiency and decision taken;
  - weekly report to station manager, heads of Operations, heads of engineering and other departments, nuclear safety officer and quality assurance/SMB;

- reporting in management meetings in case of deviation from planned status for decision on corrective action.
- top priority in deployment of all resources

- PRIORITY 2: The corrective action is put before a management meeting. Its prioritization is examined. If it remains P2 or upgraded to P1, further action will follow P1 with exception of the top priority.
- PRIORITY 3: The corrective action is entered into central tracking system. Its implementation will be tracked at least once a month in the department.
- NO PRIORITY: The corrective action is not entered into the central tracking system.

Management meetings at which corrective action is prioritised by company executives are:

- Heads of Departments' meeting;
- Safety Committee;
- Modification Group; and
- Daily plant morning meeting.

The process in the Heads of Departments' meeting includes the presentation of corrective action taken as a result of the transferability of external events and priority allocation.

Tracking

The agreed deadlines are compared centrally with the actual dates in priorities P1 and P2. The comparison for priority P3 takes place within the related department.

The results and any discrepancies are used:

- to develop corrective action; and
- in regular reporting on P1/P2 actions.

In case of missed deadlines, the relevant technical department checks whether it can put things back on schedule or secure the timetable.

Definition of corrective action

The head of the department informs a management meeting about deviation from timetable or corrective action for priorities P1 and P2. If he is not able to achieve the set result with his own resources, a decision is taken jointly regarding corrective action. Amendments or changes to the deadlines or milestones go back into the central tracking system.

Evaluation, Efficiency Controls, Documentation

Efficiency controls are carried out dependent on of the corrective action. For priorities P1 and P2, the results of implementation tracking (compliance with time limits, corrections, results of efficiency control) are captured centrally and reported at regular intervals with regard to progress towards target performance to the station management, heads of Operations, heads of technical departments, nuclear safety officer and quality assurance monitoring /safety management.

Talking through P1/P2 status, their possible impact and corrections is a fixed item on the management meeting agenda.

IAEA comments:

The station has reviewed the IAEA standards in this area along with examples from other utilities to develop their own corrective action programme. They have written procedures defining the requirements of the process along with detailed roles and responsibilities. These procedures meet the requirements of the IAEA in this area.

The process is in the early stages of implementation. However, it should be noted that the mechanism for bringing the events of importance to the attention of the management team and the method of prioritization of the follow up is seen to be satisfactory. Several examples of follow up to station and external events of importance were also reviewed by the team and found to be acceptable.

It was noted during the follow up review that there is a need to improve the methods of monitoring for and trending low level events to ensure items that have the potential to develop into more serious issues are recognized and dealt with early. Additionally the method for tracking the status of actions associated with follow up to events needs a more rigorous managed process to ensure completion.

Conclusion: Satisfactory progress to date

1.2(3) Issue: The plant does not use some of the methods and programmes that have been developed in the international nuclear community for improving human performance.

- A number of the reportable events in the last three years were caused by poor performance of plant personnel in the execution of their duties. While the specific response to each event is often adequate, there is currently no overall programme in place to improve station performance in this area. It is recognized that the new Safety Management Programme will go some way to improve this situation but full implementation is still some time in the future;
- While the plant compares favorably with other German Utilities in the area of industrial safety, it does in fact have poor industrial safety statistics when compared with the international nuclear community. In addition, over the past three years KKP has experienced several major industrial safety injuries to employees and contractors working at the station;
- Some event report investigations miss opportunities to identify and propose recommendations for improving performance in the area of human performance;
- There are few metrics and targets in place within the management system to measure performance in the area of human performance. Again it is recognized that this will be improved with the full introduction of the new Safety Management Programme;

- Management has stated that staff has been encouraged to report near miss incidents caused by less than adequate performance of staff. However, in conversations with workers in both the operations and maintenance areas there was evidence that this had not been fully effective;
- In 2003, there were a total of 12 human performance events identified at the KKP2 plant by the event analysis group. Not all of these events were in the station's event reporting system. None of the station's industrial safety accident events were included in this category. The number of events documented is less than the international average;
- There are very few training courses provided to workers at the station that are specifically aimed at improving human performance in the workplace;
- The team noted that there had been significant improvements in the area of follow up to human performance events since 2001 but there is still more to be done in this area.

There are different databases for recording events that may be caused by poor human performance and an indication that not all events are recognized as being human performance related. This will hamper attempts by the station to better understand the cause of such events and identify opportunities for improvement.

Without a human performance improvement programme such as that found in many nuclear utilities today the station will miss opportunities to prevent significant reportable events in the future.

Recommendation: Management should review methods and programmes that have been developed in the international nuclear community for improving human performance with the aim of selecting those that can be successfully implemented at KKP.

Plant Response / Action:

KKP employees took part in the following programmes to assess the methods used in the nuclear industry:

1. Human Performance Workshop in Mohovce in April 2005;
2. Human Performance in Cattenom (EDF);
3. 4th WANO Human Performance Expert Group;
4. WANO PC LL/Near Misses Meeting, January 2006;
5. 5th HPEG in Edinburgh on 5th-6th April 2006; and
6. Topical Conference "Improving Nuclear Safety through Operating Experience Feedback" (29. – 31.05.2006, GRS Köln).

Debrief at OSART 2 Follow-up Steering Committee on 24th January 2006 and 24th February 2006 with the following proposal for implementation:

- Many essential HUMAN PERFORMANCE (HP) practices are already in place at KKP. They are described in the MARKER booklet, which was introduced in 2004 and represents our HP principles. The MARKER has been the subject of periodic training since its introduction. As the issue of HP moves forward, it is necessary to create a general understanding of human performance:

- What is Human Performance;
- What does Human Performance include; and
- What is already being done?

The British Energy Group in the UK "leads the field" in HP. It has prepared a very useful and easily comprehensible HP manual presenting the reasons for the use of HP methods and their effects. Some good examples from it are the chapters on communication and work preparation. The translation of the British Energy HP Manual was presented to the KKP-management.

The following decisions were adopted:

a) The MARKER booklet and continued to train will be maintained as a guide document. When next revised, it should be supplemented to accommodate essential contents of the HP manual of British Energy.

b) An explanatory supplement to the MARKER booklet will be prepared with content similar to that of the British Energy HP Manual and used for training purposes.

c) As a supplement to this, information on communications, preparatory talks before work (pre-job briefings) etc. will be put on credit-card-sized cards.

Notes

a) The booklet was revised and the revision completed in a small working group from KWO, GKN and KKP. The new, revised MARKER has been reviewed and is now with the employee representatives for approval.
It will be distributed and used throughout EnKK in staff appraisals and discussions of guiding principles. The aim is to use the booklet when discussing the EnBW guiding principles. Refresher courses on the MARKER topics will commence from October 2006.

b) The "MARKER Commentaries" leaflet is now being drafted. At present, two sections (Individual Work Practice and Management practice are being drafted with the training staff as examples. Experience from the MARKER training courses will provide the basis for the decision how to communicate them.

c) The drafting and distribution of the information cards has been completed in the Maintenance-Department.

Training units on the MARKER are scheduled in the curriculum for autumn 2006. In parallel, projects are being developed for the incremental introduction and testing of supplementary human performance methods from 2007.

The reporting of near miss events will be encouraged further. In particular, the existing pathway for voluntary reporting, especially for information concerning the man-machine interface will be utilized. The employee representatives (Works Council) will be involved in this work.

Some EnBW staff are working in the EdF major project DPN "Déployer la démarche Performance Humaine". KKP also takes an active role in the WANO PC HUMAN PERFORMANCE EXPERT Group, where it reports on its own developments and adopts those of other operators. Thus, EnBW maintains comparisons within industry practice with the aim of establishing Human Performance in its power stations and drawing benefit from it.

Our report on Issue 4.5(1) deals with the improvement of human performance in the crucial area of maintenance work.

IAEA comments:

Station staff have been active in the international nuclear community in order to benchmark human performance programmes and identify one that meets the station needs. The MARKER process, adopted by the station, is seen as an acceptable method of meeting the IAEA requirements associated with Human Performance programmes. The MARKER process is used by several nuclear communities including the UK. A training programme based upon the MARKER has been developed by the station and station staff are being scheduled to take this training.

In the Maintenance Department workers and supervisors have joined a working group consisting of plants across Germany to prepare communication and training material to help improve human performance in their areas. This material is available at the station and is widely displayed in the maintenance shops. This involvement of the front line workers and supervisors in the roll out of the programme is seen as a very positive approach.

Supervisory workshops have been conducted to ensure the goals of the human performance programme and the role of the supervisor in the execution of the programme are understood. These workshops have been led by line management with help from the Training Department.

While it is still in its early stages of implementation the metrics used to monitor the impact of the new human performance programme at the station, especially those associated with industrial safety, and are encouraging.

Conclusion: Satisfactory progress to date.

1.2 (a) Good Practice: A staff overlap programme exists to ensure the transfer of critical skills and knowledge as staff depart the company for retirement..

In all critical workgroups at KKP, an analysis is carried out annually of the plans for each individual employee with respect to retirement. As staff approach retirement a replacement person is brought into their department. The overlap period is dependent upon the specific skill and knowledge of the person about to retire. The new individual is given a personal development programme to ensure that the transfer of essential knowledge takes place and that when the individual person retires, the new employee will have all of the skills required to provide the equivalent level of expertise.

This process requires a staff budget that is over normal complement. The station has built this concept into its business plan for the next four years. All levels of senior management up to and including the main board of EnBW support the concept.

1.4. REGULATORY AND OTHER STATUTORY REQUIREMENTS

1.4(1) **Issue:** The methods and practices used between the station and the regulator to carry out day to day business are not optimal and have the potential to delay modifications.

- The regulator and its agents act as the approver of many of the normal day to day processes at the station for which they are reimbursed;
- The technical experts used by the regulator provide comments that are at times extremely technical and detailed. They often make recommendations on how to change or maintain the plant;
- There is a significant time effort by station staff in dealing with numerous comments and questions from the regulator each year. INSAG-15 paragraph 3.4 encourages the regulator to have a balanced view and avoid over reaction which could stifle long term safety enhancements;
- At times the response from the regulator and its agents on items for which the station must gain approval can be extended due to protracted negotiations;
- Reimbursement charges from the technical experts acting on behalf of the regulator are difficult to substantiate;
- At times station staff will acquiesce to the recommendations of the technical experts acting for the regulator even when this may not provide real safety benefit.

Without improvements in the methods used between the regulator and the station for conducting everyday business there is the possibility that future changes to station processes and systems will be delayed.

Recommendation: The plant should develop and implement a strategy for improving its working methods with the regulator to ensure that required changes to their systems and processes are carried out in a timely manner.

Plant response / Action:

The plant has taken various initiatives aimed at improving co-operation with the regulators. The expectation is that issues will be identified and solutions found quickly as a result. Periodic meetings at different levels will be used to this end, as will the setting of timetables and co-ordinated procedures to reduce the number of review cycles.
The following specific activities have already taken place:

1. - Strategy meetings between the regulatory authority and KKP at departmental and station management level
   - Operations managers meetings based on the annual SMS report, evaluation of these reports and inclusion in the SMS annual reports. The first round of meetings was completed in 2005/2006. The second round with GKN has begun.
2. It was agreed between KKP (S, U, UZ), the licensing and regulatory authority (department management) and independent technical expert that, in special situations such as plant start-up following an outage, unscheduled outages or particular activities

with special relevance for plant safety or availability, the flow of information and control of processes may run via designated management individuals.

It will be their duty to co-ordinate all organisational measures in their respective hierarchies, in order to assure timely and effective processing of the work.

3. A defined process with the regulatory/licensing authority, the independent technical expert and KKP defines how modifications to be executed during the outage periods are co-ordinated and controlled during the lead time. All planned modifications are assessed for their safety related significance, and the important reports are scheduled to a strict timetable, which also includes the regulators. Status meetings review progress in all three organisations involved.
The procedure was put into practice starting from the KKP outages in 2006 and has proved its worth well.

4. The regulatory/licensing authority will commission an alternative independent technical expert if it is apparent that their general contractor is unable to process a particular work package on time, for instance due to lack of capacity.

5. A process has been developed with the regulatory/licensing authority establishing how the expert analysis and reports on PSA packages are processed within a defined time window and financial framework.

6. Release of documents from routine regular assessment. To make the modification of the SMS processes more flexible, further applicable documents are to be released from routine regular assessment by the independent technical expert. To this end, meetings were held with the regulators and the independent technical expert on February 15th 2006 and April 17th 2006 to define and apply a criterion.

   „There was consensus that the defined criterion is helpful in selecting and discussing documents for release from routine assessment, but cannot replace discussions in individual cases. Using this criterion in relation to individual subject areas / processes, EnBW will identify the documents for which release is appropriate. EnBW will argue the case for these documents by demonstrating which remaining documents with compulsory review define the higher significant demands, what changes have been, and which documents the routine assessment is to be dropped.
   For documents on which basic agreement has already been reached in technical discussion (modification procedure, key control management, chemistry), EnBW may submit appropriate notices of amendment directly. If necessary, further discussion can then be held as part of the modification process.“

   Preparation of modification requests has already begun at KKP chemical documents and the modification procedures. Notices of modification 14/06 for KKP1 and 27/06 for KKP2 on the modification procedures of the BHB and operating procedure U001 "Operational Modification Procedure" were submitted to the regulators on September 13th 2006.

7. Establishment of a timetable for each station for planning external visits and inspections such as:

   - OSART,

- WANO Peer Reviews,
- national Peer Reviews,
- VGB SBS,
- QA audits.

and comparing them with regulatory actions. It should define what purpose is served by which inspection.

This should allow a sensible reduction of the workload on management personnel resulting from the above list of inspections so as to allow some breathing space.

IAEA comments:

There is evidence to show that relationships with the regulator have improved since the OSART mission in 2004. Protocols have been established to improve processes used between the station, regulator and technical experts for approving modifications and the exchange of information. Noted examples of this improvement are as follows:

- Milestones have been established for review and approval of modifications implemented during outages to provide increased certainty for outage planning.
- The review and approval process has been concentrated at the implementation phase for some non safety related changes such as IT upgrades.
- Single lines of authority have been established at both the station and regulator level to allow for improved communication and decision making.
- Improvements in routine communication of activities and plans for the station at all levels of both organizations.

No examples were noted where these changes had caused a negative impact on the regulators ability to provide independent oversight.

The OSART team noted this improved working relationship and that further improvements are still possible. The parties are encouraged to continue to work together to optimize their processes while at the same time maintaining the essential independent role of the regulator.

Conclusion: Satisfactory progress to date.

1.5. INDUSTRIAL SAFETY PROGRAMME

1.5(1) **Issues:** While KKP compares favorably with other German Utilities in the area of Industrial Safety its performance is in fact below the average of international nuclear experience.

- There have been a number of lost time injuries in the plant in the past three years. The rate of these injuries is much higher than the WANO benchmark in this area;
- During plant observation tours there were several instances witnessed by the OSART team were staff failed to comply with station requirements in the area of industrial safety;
  - Hard hats not being worn;
  - Smoking in unapproved areas;
  - Hearing protection not being worn in required areas;
- While several of the plant practices and rules observed during the mission were consistent with German requirements, they are not always consistent with current international standards;
  - Wearing of safety glasses in the machine shops;
  - Confusing or missing signs concerning industrial safety requirements in the plant area, for example hearing protection requirements in the power house;
- During station tours station supervisors and managers accompanied the OSART team members. Several failed to correct the observed non-compliance with station safety rules.

Without a change in the performance of the management team and the practices of the workers, safety performance will remain below the International Standard.

Recommendation: Management should correct poor worker practices and identify opportunities for improvement that can be used to develop an action plan to improve performance in the area of industrial safety.

Plant Response / Action:

In the frame of the preparation of the Follow-up-mission we compared our numbers of accidents at the station with the level of WANO-, europian and german NPP. By consideration of the different legislation, liability and culture we noted to be close to the best quartile of WANO-assessment. To reach the international top level by continuous improvement we decided an action plan to improve industrial safety. This was discussed at a preparatory meeting on 8th March 2005 attended by KKP/KWO/GKN/CBM/Holding. These were the main points:

- Change mindset of line managers and provide basic knowledge;
- Assistance from an external consultant; and
- Check whether more restrictive action is necessary at KKP location.

In order to improve the industrial safety situation, an external consultancy (CBM, Gesellschaft für Consulting, Business and Management) was retained. The following CBM action has already been completed:

- Analysis of actual situation regarding industrial safety in the plant with a final evaluation report (A 53-2005 dated 26th September 2005)

- Monthly presentation of work-related issues lasting one hour at the section and department management meetings. This activity runs for a total of one year.
  The following issues have been presented up until 13th August 2006:

  1. Basic principles of industrial health and safety;
  2. Acting within the law for technical and management staff;
  3. Effective and lasting ways of shaping the processes of changing people;
  4. Hazard assessment;
  5. How to act properly in investigations and examinations;
  6. Contractor management;
  7. Responsibility when using agency personnel;
  8. Hazardous materials legislation, including operational procedure BAW U 205;
  9. Industrial Safety Ordinance.

- CBM drafts of hazard and risk assessments for permanent workplaces in the Maintenance Department. Corresponding assessments are currently being generated for the Surveillance Department and then for System Engineering. The seminars continue at weekly intervals.
- CBM is drafting a blast protection document for the KKP site.

A systematic recording system has been introduced for inappropriate industrial safety behaviour by employees with reporting to line management if it persists.

The number of working accidents among station and contractor staff (according to the WANO indicator – one or more days lost working time) was reduced from 6 in 2005 to 3 as per September 30th 2006.

Efforts to improve industrial safety are continuing.

IAEA comments:

The station has made impressive progress in reducing the number of accidents at the station both in the lost time accident and non reportable categories. However, these numbers are still above the average levels of top performing nuclear plants. While the programme for improving industrial safety has progressed well, further work is still required at the implementation level.

Significant positive points identified during the follow up were:

- The use of the Safety Officers to monitor and trend low level events.
- The use of the management team plant tours to identify and correct unsafe practices at the job site.
- The training programme initiated to ensure the management team and supervisors understood their role in creating a safe work environment for their staff.
- The comprehensive hazard assessments now underway that will be built into the station systems for processing work packages to improve safe working conditions.

Finally, it was noted during station tours that hazard signs requiring the use of protective equipment in specific plant areas were not always followed. In addition some low level conditions that could have a negative impact on worker safety were also identified during these tours. These were reported to station staff for follow up and correction.

Conclusion: Satisfactory progress to date.

1.6 DOCUMENTATION.

1.6 (1) Issue: There are gaps in the coverage provided by plant policies and processes within station documentation. In addition, there is only minimal guidance provided that describes those policies and processes that need to be covered by procedures.

- There is currently no procedure describing the process or the roles and responsibilities of station staff in the tracking of regulatory commitments. At the same time there are several low-level procedures within the station documentation set, for example within the process describing the storage and archiving process for documents. This demonstrates that there are inconsistencies in the requirement for and writing of procedures to describe processes at the station;
- The audit process will at times identify gaps in station documentation. It will also identify areas where too many procedures exist;
- There is no policy on the use of procedures at the station. Such a document is typically found in nuclear power station documentation within the international community;
- There is currently no official policy on Nuclear Safety at the station. Once the new company EnKK is approved such a procedure, Personal Organisation Procedure currently in draft will be issued. The need for this major revision has been recognised by station management and significant communication has taken place with staff on the subject. Such a document is typically found in nuclear power station documentation within the international community;
- OSART team members found examples of documents in use in the field that had been altered without the appropriate approvals and where the alterations did not conform to station requirements.

Without a complete document set, there is the possibility of loss of institutional knowledge and people not completing tasks as per the expectations of management. This is of particular relevance during periods of staff turnover and retirement/replacement of staff.

Recommendation: The station should carry out a gap analysis of its documentation set using IAEA Safety Standards and good international practices as its baseline. Additions and deletions to the documentation set should be carried out once the gap analysis is complete.

Plant Response / Action:

The design concept of plant documentation was checked against IAEA standards and international practice.

The main source references were:

- IAEA Guidelines;
- Practice at Leibstadt, Beznau and Gösgen power stations;
- ONTARIO Power Generation documents;
- Standards from German regulations KTA 1201 (6/98): Requirements for the Operating Manual BHB, in particular:

Part 1 "Rules for Operation" (operational documentaion)

- KTA 1204 (6/96): Documentation for the Construction and Operation of Nuclear Power Plants
- BMI (German Ministry of Home Affairs) Directive: Documents to be maintained during the operation of nuclear power plants (known as Safety Specifications).

Result:

The IAEA standards laid down in the Codes and Safety Guides Q1 to Q14 contain only elements and documents of quality assurance.

The Swiss nuclear power plant operators have merged their governance documents with the process related management system and placed them at the tip of the document pyramid.
At KKL, rules, governance documents and procedures are assigned strictly to the respective process. In this way, they can be called up on screen at every workplace when being processed.

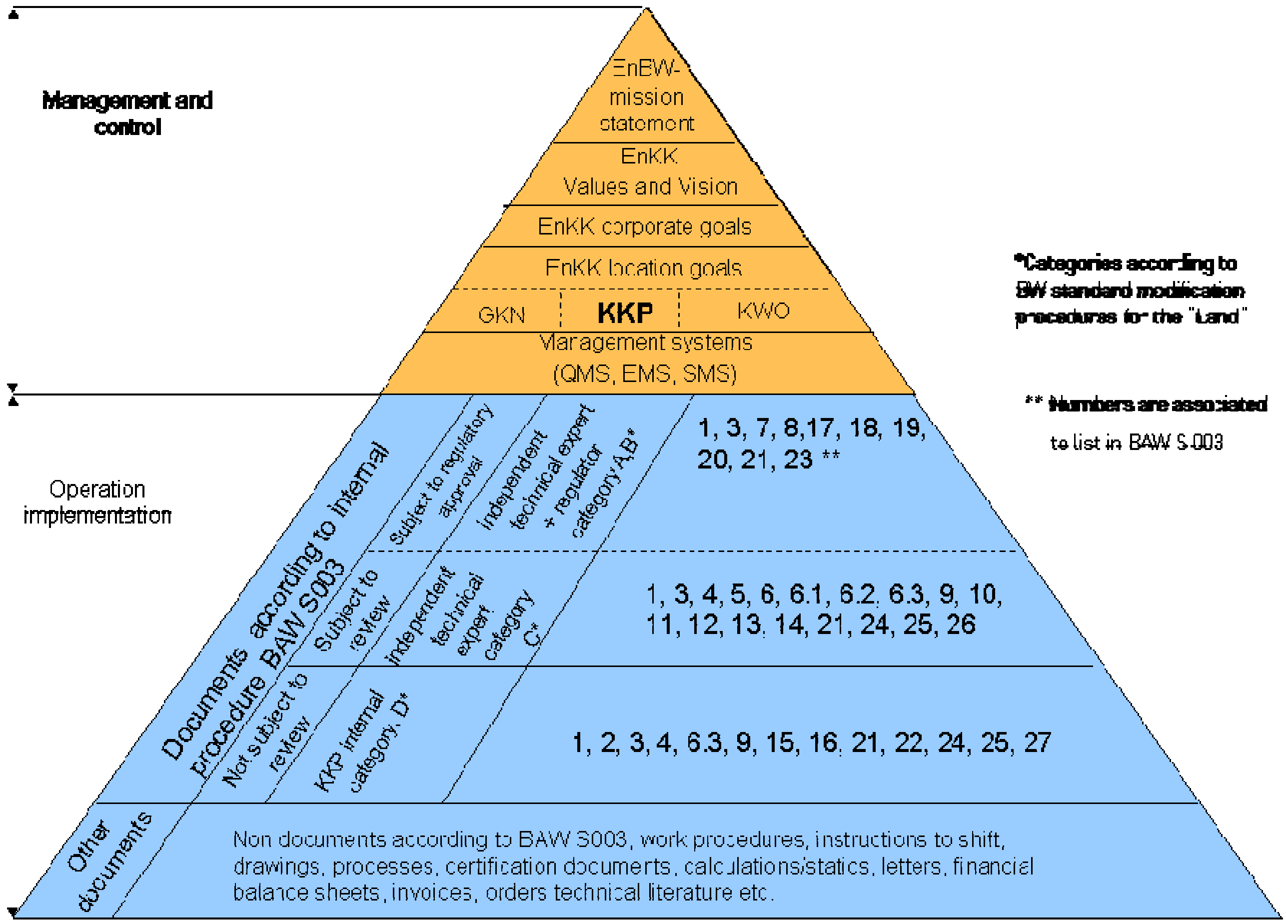
Documents from ONTARIO Power Generation: The document hierarchy as shown does not meet the structure required by German source books.

The document entitled "Regulatory Commitment Management" is a good example of the process of "Case Management in the Licensing Process" in a separate database.
The document entitled "Procedural Usage and Adherence" sets out in detail the requirements for handling procedure documents and contains rules on the need for referring to procedures and the form/content thereof.

We regard the use of the document pyramid as beneficial. For this reason, the OSART Follow-up Steering Committee meeting on February 24th 2006 decided to implement the following action:

- Visualisation of the hierarchy of written operational regulations in the form of a pyramid.
- Supplemented with: specifications for
  - When and which document must be drafted?
  - How is the document to be handled with reference to
    - Scope of validity
    - Drafting, checking, clearance
    - Updating?
  - How is the document to be used in application?

The following diagram shows the structure:



Short description of the diagram:

The hierarchical structure of operational procedures is shown as a documentation pyramid (see above). The pyramid is divided into a management and control section and an operational implementation section.

The EnBW group mission statement is placed at the tip of the pyramid in the "Management and Control" section. It is followed by the goals set by the nuclear power station company and those of the locations as described in the goals booklet and presented in a readily comprehensible form with key numbers. The quality, environmental and safety management systems form the link with operational implementation. A high priority is attached to nuclear safety in this structure. This is also clear from the safety goals in the same booklet.

The operational implementation section of the pyramid lists written internal procedures according to internal procedure BAW S 003.

Based on the documentation pyramid in conjunction with the specifications of the documentation manual and internal procedure BAW S 003, it is clear that specifications for the classification, drafting, checking, release and management of written internal procedures are in existence. Documents that do not fall under this defined documentation are listed in the bottom section of the pyramid. Thus, the whole extent of KKP documentation is covered.

Actions to integrate into the documentation manual (DHB) and operational procedure BAW S003 are in the process of implementation under notice of modification nos. 18/06 and 31/06

IAEA comments:

The recommendation of the OSART mission from 2004 have been used to complete a review of IAEA source documents and benchmarking within the international nuclear community. Based upon this work a gap analysis of the stations documentation set has been completed and changes made to deal with those identified issues.

Conclusion: Issue resolved.

2. TRAINING AND QUALIFICATIONS

2.1 ORGANISATION AND FUNCTIONS

The Atomic Energy Act requires appropriate staff to be licensed and to have necessary technical qualification. To assure this, the government has developed guidelines for the training of all responsible staff. Scope of knowledge is based on requirements from "Personelle Betriebsorganisation" (Personnel Organisation Procedure). Every year, in the summer, each line manager is requested to identify the training needs of their subordinate personnel for the following year. All proposals are adopted and training is carried out taking into account the needs to adequately support job responsibilities.

To provide training, several different methods are in use; simulator exercises, lectures, videos, On-the-Job training, workshops, mock-ups, laboratory training, and computer based training (CBT). Learning objectives are provided by Simulator Instructors during pre-simulator briefings. The analysis, during debriefing, of how well these objectives are met help define effectiveness of the exercises. Nuclear Safety and Safety Culture are presented in the training materials. According to the IWRS-II "Radiological Protection Measures during Commissioning and Operation of the Plant", there is a procedure for minimisation of possible collective and personal dose. Use of this procedure is included in the training materials.

Feedback forms filled out by trainees and discussion between trainees and training staff support every training session. After simulator observation by line or training managers there is discussion between the manager and trainer as well as between manager and trainees to assess the training effectiveness. Unfortunately, for other than simulator training there is no procedure for how often regular participation for making observations of the training process of responsible shift personal by the line and training managers takes place. And there is no procedure for regular participation for making observations of the training process of other staff by the line and training managers.

A Special Register Centre exists to store and maintain the records of the training provided to the staff. The records are kept as hard copies in folders on shelves. Each folder contains the records for one person and even if the person is retired, the record is retained under a special code. There are no time limits for the storage of these records.

Line managers have responsibility to assure that the subordinate staff qualification is maintained. However there is no procedure to guarantee that qualifications are sustained and the line managers perform few assessments of the training provided. The team suggested that the plant enhance the assessment of training.

Training is shared among the departments. The Training section carries out initial training, and the departments in the corresponding area provide specific technical training as well as continuous training. There is no uniform centre to co-ordinate all the training activities at the NPP. Moreover, there are only a few special training liaisons with the departments for co-ordinating the training activities inside departments.

In the organisational structure there is the "Training and Qualification, Staff Development Section" led by a Section Head who can be considered the Training Manager. "Guidelines related to the proof of the technical qualification" issued by Federal Ministry of Environment and Reactor Safety provide requirements for each key management staff position. In particular, the Training Manager is responsible for the programme of instructing and maintaining the technical qualification of the responsible shift personnel, for the coordination of the programme and for the uniform assessment of the training results. Continuing staff training in the departments is the responsibility of the departmental staff.

The training unit consists of four people including the Section Head, his assistant, and two full time instructors. Part time trainers from the other departments are used to provide necessary training in the corresponding areas. There are three simulator instructors for each unit of the Philippsburg NPP in the Essen Training Centre. For training of the trainers, external organisations are used (e.g. vendors or special training organisations).

Attendance at the scheduled training is regularly checked and in case of non-attendance a special notification issued to notify the person to communicate with the staff of section FP using the phone number provided in order to plan a new session. If no communication is made, the respective line manager is notified about the missed attendance. If the validity of the previous training has expired, a request is issued to suspend the person from duties.

All training courses provided by organisations used for external training have certificates issued by government or quality certification organisations. Checking the instructor skills and performance are part of such a certification. Training provided is assessed by full time Instructors and corrective measures are undertaken if appropriated. The organisations that are certified under the ISO 9001, are under the supervision of certification organisation and should be audited no less than once per year.

Once a year the job description of each staff member is analysed and discussed between line manager and subordinate staff individually to ensure currency with job requirements.
Simulator Instructors have to pass through the initial training on the relevant plant at least every eighteen months. This training ends with examinations similar to the Shift Supervisor. The Examining Board consists of the Line Supervisor, a Corporate Head, and the Training Manager.

There aren’t procedures or requirements to assess instructor skills and performance after nomination for the job. Each instructor makes individual decisions on how to perform training sessions. Except for simulator training, few training plans are developed in advance to detail how lessons are carried out. Training plans may not be fulfilled if the instructor decides to change. There are few records made after the training session with an explanation of the training method used. The team provided a suggestion to help the plant in this matter.

A Training Manual, the FHB, establishes that all the instructors who are regularly used as trainers for initial and refresher courses are to be employees who have long operating experience in the field they are teaching. They can also submit proof of teaching skills and participation in adult education. Simulator Instructors have to have annual refreshing training of at least four weeks, of which two are to be at the relevant NPP during it’s start-up or shut-down.

2.2 TRAINING FACILITIES, EQUIPMENT AND MATERIAL

There are fifteen classrooms on site, most of which are well equipped. The Information Technology (IT) training rooms are equipped with workstations for trainees and the instructor’s server can communicate with every workstation to exchange screen information and assure better understanding by trainees of the use of the computer and the corporate network.

There is a study room in the Training Centre next to the archive, where trainees can obtain all required reference materials. In addition, all of the classrooms are equipped with computers tied to plant network with all required information. There are some mock-ups of real plant components.

Simulator training for responsible shift staff takes place in the simulator centre run by the German nuclear power plant operators in Essen where they provide initial training and refresher courses. The simulator centre has a plant-specific full scope simulator for KKP 2. The simulator facility has capabilities to support normal, abnormal regimes as well as both design and beyond design bases emergency events with exclusion of severe accident management. There is a “Glass model” that provides visibility of the thermo-hydraulic processes. Combination of exercises on the “Glass model” along with the lectures and the exercises on the conventional simulator provides the operators more clear understanding of the process flow. The team considers it is a good practice.

There is a possibility to repeat every session with all the actions made by operators. The Training Centre has well equipped classrooms for briefing and debriefing. However, the design of the simulator does not allow separating instructors from the trainees and there are no video cameras in use to provide recording of the actions and behaviors of the operators to give them the possibility to make their own self-assessment.

Every plant modification is sent to the Training Centre and analysed by the training staff along with plant staff and ranked in one of three categories: urgent (to be implemented as soon as possible), to be planned for implementation, and to be considered. The requirements for the urgent category should be included into the next working package. Working packages are developed twice per a year normally in spring and autumn.

Training material is well organised and is amended if necessary by the Instructor just before providing of the training. However, except for the simulator training, there are no requirements and time limits to amend the materials shortly after modifications are made.

2.3 CONTROL ROOM OPERATORS AND SHIFT SUPERVISORS

For at least eight weeks (normally eleven to twelve) initial training in both technical and non-technical courses are provided, including different kinds of operating regimes and emergency actions. Skill training in communication, teamwork, decision-making behaviour, and leadership behaviour of the shift supervisors is also provided.

It was observed that the quality and content of practical training are good. Training materials are developed according to the Job Requirements and in co-operation with the operation and training responsible staff. Finally, the Training Manager approves training materials.

According to the Training Manual, “Fachkunde Handbuch” (FHB) Annex 6.4, there must be at least 20 days of refresher courses over 3 years, including at least 5 days in a row each year. KKP holds two simulator-training courses of 5 days each year, i.e. 30 days in 3 years for each trainee. Refresher courses include coverage of incidents at KKP, incidents at other plants, guidelines of the BMU, plant modifications, changes to the operating instructions, and individual requirements. The team did observe some areas for improvement, and a recommendation was provided to the plant on this topic.

Information about short-term modifications of the plant or procedures as well as events which are of importance for the trainees’ activities are passed on to the shift personnel without delay: depending on the urgency the shift is informed orally by the Operations department head/deputy head.

There is a computerised database to ensure the qualifications of all responsible shift staff are current.

2.4 FIELD OPERATORS

Training materials are developed based on the job requirements and in co-operation with the operation staff. While developing the training course, specific requirements of line managers are considered and adopted. Training materials along with instructions used for the classroom training look good. Additional use of colour could be used to enhance training materials.

It was observed that quality and performance of the practical training provided to the field operators is good and very interactive. During the training session observed, explanations were made not only by instructors but also some of trainees.

There is an informal trainee assessment provided by instructors during training session but there is no specific trainee assessment and no requirements to do this.

There is an assessment of performance of all field operators made by line managers and decisions are made to provide special training to those who need it. About 50% of training provided to the field operators is practical training. However, it was difficult to verify this because there are few records on the training method provided in each particular session.

The training programme includes refresher training on the systems important for safety as well as on emergency procedures and actions. Immediate information about plant modifications is provided at the shift meetings and thus this information is included in the training. There are neither requirements nor time limits for this process.

Once a year, there is a discussion between line managers and each worker along with his/her assessment. This helps to provide assurance that the qualifications of the field operators are current for assigned duties.

2.5 MAINTENANCE PERSONNEL

Specific training is provided only by the line maintenance department or by external training organisations. It was observed that training materials provided by the both internal trainers and external training organisations are of good quality. Training is based on the job descriptions, but there are few specific learning objectives and requirements provided in the training materials.

Practical on-the-job training starts from the very beginning, when students come to the station to get work oriented vocational training. While being coached, trainees do real work on the equipment and mock-ups that represent real plant components.

Assessment of trainees is carrying out in several stages by means of testing during the training, discussion at the meeting of the line manager, coach, and trainee, and finally issuing the certificate of AVO (On the spot job supervisor), VDA (Responsible person for total work performance), or FSB (Responsible person for technical clarification).

Yearly, line managers meet subordinate staff individually to define needs for training.
There is a computerised database to ensure the training is provided in time. At least once per

three months, line managers check the database to define deviations. Balance between lectures and practical training is built according to the experience of the trainer/coach and the trainee's ability.

Every week accidents and malfunctions that have occurred are discussed at the section meeting to define need for additional training. All equipment modifications are subjects for training before their implementation. Every year there is meeting between the line manager and each of subordinate staff to define need for refreshing training.

2.6 TECHNICAL SUPPORT PERSONNEL

Every two months there is a meeting of line managers and subordinate staff, and at least one item of discussion belongs to Safety and Safety Culture matters. There are no special learning objectives in the training materials made in the department, and most training is provided by special external organisations. In the departments the most skilled people with the greatest experience are used as trainers.

Assessment of trainees is provided by instructor's observations made during the training. Any concerns are brought to the attention of relevant line manager.

Continuing training is provided by the line organisation or by special training organisations under the request of line managers to deal with new technologies, equipment, and plant modifications. Questions of QA and Safety Culture are included in the training.

2.7 MANAGEMENT PERSONNEL

In the training provided by training section and during outside training there are modules that deal with supervisory skills, management, communication and human behaviour. Questions dealing with decision-making, leadership, and problem solving are also included in the training programme.

Measures for maintaining competence, assure that all key staff provide their input and participate in training. The Nuclear Safety Committee assembles 4 to 5 times per year where key staff provides input into training through exchanging information. In addition, there are Modification Committee meetings, Shift meetings, audits, and meetings with the Regulator.

Requirements exist to provide line managers training including training at the plant simulator to maintain the knowledge of plant behaviour. These are based on 3-year period and ensure the minimum training requirements are met.

2.8 GENERAL EMPLOYEE TRAINING

All new employees along with contractors pass through training on security, radiation protection and industrial safety that include video films and tests. They also have some lectures that deal with possible dangers at the working places, industrial safety, insurance, radiation protection, and fire protection. Practical training on use of personnel protective equipment (PPE), dosimeters etc. is provided for those who deal with work in possibly contaminated areas. QA and Safety Culture questions are included into the training programme.

Those who deal with specific work like crane operating, operating of the conventional steam generators, fire fighting devices etc. are trained according to the special training programmes.

Unfortunately, after the training for the level one was complete, it was observed that the tests required of the candidates were not sufficiently demanding.

KKP FOLLOW-UP SELF-ASSESSMENT

The OSART mission recommendations prompted us to observe and compare procedures for the evaluation of training performance in foreign nuclear power stations in their plants and simulators.

First results are:

- Creating and using seminar feedback sheets at all times.
- Revising feedback sheets due to daily experience.
- Questions for assessments during safety briefing level 1 are made more sophisticated. These specifications are binding and are part of the Training Manual.

The plant has included in the simulator courses improvements observed in French, Spanish and UK simulators. In particular, this applies to instructors in the role of field operators and support personnel, communication at the simulator and specific courses supported by video cameras. Before they were introduced, all these measures were discussed intensively with the simulator staff at the simulator centre in Essen with regard to implementation. This opens up the possible application of these improvements to other nuclear plant simulators in Essen.

STATUS AT OSART FOLLOW UP VISIT

The OSART team noticed that good progresses were made in training purposes linked to the proposed suggestion and recommendation.
- At KKP the department managers are accountable for the qualification of their personnel. The manager is involved in defining training needs, evaluating job performance of the personnel, providing feedback to the training department and ensuring that the training provided reflects operating experience in accordance with the safety guide [NS-G-2.8 para. 4.9]. Furthermore progresses were made by developing new evaluation sheet for training activities', which are filled out by trainees and provided to trainers and training management to take any appropriate actions to improve training materials or trainers' skills. The team evaluated this suggestion as resolved.
- In the case of the recommendation, all facts are adequately solved, programmes and procedures were developed to support the improvement of training and booklets were issued to advertise new tools for improving human performances. For simulator instructors there is very little possibility to miss any observation of the trainees in the simulator control room, because no barriers or windows separate the instructor from the trainees. Nevertheless, the team encourages the KKP plant to use video camera in simulator as a mean "to assess the trainee's ability in oral questioning and performance demonstration" in accordance with the safety guide. [NS-G-2.8 para. 4.21]. This modern tool is now widely used in the nuclear world and generally considered as a good practice.
The issue is classified as resolved.

DETAILED TRAINING AND QUALIFICATION FINDINGS

2.1. ORGANIZATION AND FUNCTIONS

2.1(1) **Issue**: Except for the feedback coming from the trainees and impressions made by trainer himself there is no assessment of the effectiveness of the training provided during the training session with exclusion of the responsible shift staff training.

- There are no arrangements to provide on regular basis observations of training session by line or training management. For the assessment of the training effectiveness there are only feedback forms filled by trainees and impressions of the trainer made during the interactions in the session in use;
- There are neither procedure nor regular activities provided for assessment of the trainer skills and knowledge after the nomination to the work position;
- Lack of adherence to the VGB policy "Sicherheitskultur in deutschen Kernkraftwerken", which stipulates chapter 2,4 Qualification/training: "Regular activity checks must be undertaken to ascertain whether the knowledge levels achieved by individuals remain up to the standard"; and
- Not sufficiently demanding tests were provided after OSART team got training for the level one.

Improper assessment of the training effectiveness can lead to the future possible fault made by trainees and therefore can decrease safety.

Suggestion: The plant should consider establishing an effective programme for assessment of the training performance.

Plant Response / Action:

Observation by line managers or the head of training units; evaluation of training effectiveness

The Training Manual prescribes testing that training has been effective by interactive means or written answers to test questions. The instructor reports the result to the training section (FP) unless the training is being observed anyway by FP for the purpose of quality assurance. If deficiencies in learning are identified, the participant's line manager is informed by FP. In addition, the line manager will check whether training has been effective by observing the employee at work and during regular staff interviews. If the training has not been effective, the line manager, in consultation with FP if appropriate, will decide what action needs to be taken.

In the past, standard EnBW seminar assessment sheets have been used for training feedback from the participants. Last year, completely new seminar assessment sheets were developed with a work psychologist. Since 2005, they have been used and evaluated with all training units and not, as in the past, with selected ones only. If appropriate, later training units are adjusted on the basis of the evaluation of feedback sheets. The result of the evaluation of the feedback sheets is communicated to the trainers.

Regular assessment of trainers

Evaluation of the new seminar assessment sheets and observation by the organizing section is the basis for judging the expertise of trainers. This method is now anchored in the training manual. The rules for maintaining the skills and qualification of full-time simulator instructors are given in the "Compendium of Simulator Training".

Regular observations work

Line managers observe their staff during their daily work activities as required by the training manual. Further work observation is carried out and evaluated by:
- the "Clean Team" according to internal procedure BAW I 030 during outages,
- special "Workflow Procedures" audit during outages, and
- Maintenance (I) Department for contractor staff assessment.

Reporting is by experience feed back reports (Clean Team) or audit reports.

Level 1 safety briefing

More demanding questions have been developed for assessing the level 1 safety briefing. They have been in use since 2006.

IAEA comments:

Several improvements were done in the way to improve the assessment of the training activities.

The training management creates a new evaluation form of the training course for the trainees. The team encourages now the training management to further use it as a tool to manage internal training department goals and objectives in improving training materials and training performance.

Attendance lists with confirmation of success to the training course, certificates, annual trainer reports provided to training management on results of training, training feedback sheets and training deficiencies reported to line managers are others improved tools to communicate on assessment of training performance.

Line managers used also several tools as recommended in IAEA safety guides to evaluate on field the effectiveness of the training programme. This is well described above in the “plant response and action” chapter.

Knowledge, pedagogic skills, experience in adult training are assessed by the training department when trainers are recruited. These considerations are clearly described in the training manual and procedures as part of the continuing training for simulator instructors. The team encourages the plant to be consistent and to apply it to any other trainers.

In parallel to these improvements, the plant made several strategic decisions for future training programmes:

- to enhance the general quality of the training materials,
- to harmonize training management for the KKP and GKN fleet,
- to develop new training materials based on catching tacit knowledge (“know why” seminars).

The team evaluates this as good development to enhance training performance and encourages the plant to benchmark other utilities to take advantage of good results already recognized by OSART missions.

Conclusion: Issue resolved.

2.2. TRAINING FACILITIES, EQUIPMENT AND MATERIAL

2.2(a) Good practice: Combination of training at full scope simulator and glass model

The thermo-hydraulic phenomena and effects which occur in the essential operating and transient conditions in the primary circuit of a PWR reactor can be visualised in the glass model at the simulator centre.

The glass model has been used for this purpose during many years. It had been located in a building of Biblis NPP, so it was less opportunity for the operators of the other plant to be trained on it. Now it is located in the building of the simulator centre of the Society for Simulator Training (GfS) in Essen. In order to help observe the thermo-hydraulic processes, all process parameters are being recorded and displayed on a screen behind the glass model along with schematic diagram.

There was found that it is particularly effective to use of the glass model in context of simulator courses: the combination of theoretical instructions, process control/observation at the simulator and visualisation of phenomena in the glass model is didactically optimal form of training. That is why corresponding glass model presentations are incorporated into the simulator training programme, e.g. in context of practical exercises on such incidents as “LOCA”, “TMI event”, or “Steam Generator Tube Rupture”.
A special instructor who is an expert in the field of thermo-hydraulic processes is used to show and explain the glass model presentations.

2.3. CONTROL ROOM OPERATORS AND SHIFT SUPERVISORS

2.3(1) **Issue**: During simulator training, some weaknesses were observed in the training performance.

- There was no communication between shift staff and instructor as a field operator. Shift staff prefers to interact with the instructor directly owing to the fact that instructor is not separated from the training area by one-view-mirror instead of make phone call as it is going on in reality. Instructor did not insist on them to use such a technique. After remark came from observer operator did not remember the phone number of instructor;
- The simulator instructor does not reinforce communication skills. There is often no three way communications between staff contrary to the requirements of the document KSG/GIS "Communications at the Main Control Room" and the instructor didn't insist on three-way communications.
- Only one instructor was in control of the simulator, the exercise and monitoring of operators' performance. So many duties (control of the simulator, observation of the trainees, communications with trainees on behalf of field operators, etc.) interfered with his ability to closely monitor and evaluate performance; and
- The simulator is not equipped with video cameras and the instructor has no chance to make detailed observations in the Control Room and debrief actions and behaviour of the operators after the session.

Inadequate training can raise wrong operation shift staff habits and lead to a degradation in operator performance and communication.

Recommendation: The plant should strengthen the training performance during simulator training.

Plant Response / Action:

The simulator training method is standard for all nuclear power stations that use the simulator centre in Essen. The rules are set out in the "Compendium of Simulator Training".

Visits were made to the simulators at Cattenom, Bugey and Saint Alban in France, Heysham in UK and Technatom in Spain for a better comparison with international simulator training methods as recommended. The experience gained was shared and evaluated with the Essen simulator centre. The recommendation will be implemented as follows:

Instructors in the role of field roundsmen and other support personnel

The telephone system has been altered such that participants can call the instructor in any desired function on a specific telephone number for each. They are given a telephone contact list. The instructor's telephone is positioned such that there is virtually no direct acoustic feedback from the instructor to the participants. The use of the telephone for communication between the shift group and the instructor in the role of external support personnel is now established practice. There is no intention of making open communication at the simulator between instructor and participants in the course more difficult by placing a two-way mirror between them.

Communication

The rules of communication are described in the documents "Communication in the Control Room", “Communication tools in the control room”, and "MARKER for Professional Action". Staff training courses have been held to train the application of these rules.

The use of these communication rules is now required as standard practice in simulator training. Simulator instructors must regard for compliance with the rules of communication.

Number of simulator instructors

Simulator training with just one instructor is part of the concept at the Essen simulator centre. However, there are designated simulator courses with particular emphasis on the observation and evaluation of participants' performance, the so-called "assessed courses". A second simulator instructor (if available) plus the head of the section FP or a head of section from the Operations department or the head of Operations at KKP 2 attends courses of this kind to observe and evaluate participant performance.

Video camera

The best guarantee of detailed observation of course participants is the direct and immediate presence of the instructor in the simulator control room. Irrespective of this, a mobile video camera has been used in three special simulator courses. The participants were all shift supervisors. The courses were focused on communication and decision making. They followed a pilot course attended by the head of the section FP, the section heads from the Operations department and the Operations Manager (LdA) from KKP 2. The Works Council was also involved. The recordings were reviewed with the participants and their actions and behaviour discussed with them. It is not part of the concept at the simulator centre in Essen to use permanently fixed video cameras in simulator training.

IAEA comments:

Willingness to strengthen the training performance at KKP is evident. The plant took decisions and corrective actions to improve communication (including telephone communication) between shift staff and instructors in the simulator. Training manual was updated and training material on communication was developed and provided to plant employees.

The EnBW fleet staff is provided with training programmes, pamphlets and face to face discussion between managers and workers to enhance communication skills, team working, leadership, worker behaviour, etc.

The plant successfully contributed to influence the Essen simulator organization to increase the numbers of simulators instructors. Furthermore the simulator centre trains instructors for more than one specific simulator.

The training management made the choice to use the video camera mean to validate specific training courses and improve the effectiveness of the lesson on communication. This tool is well adapted to fulfil the recommendation of Safety Guide [NS-G-2.8 para. 4.22], which states that “continuing training should also be directed to the permanent improvement of skills, and attitudes, which is necessary for safety related activities”. Because it is well accepted (under certain rules) the KKP plant management decided that it is going to be further implemented in simulator for training usage of operations' crews. To step forward, the training department management of KKP should persuade other utilities and partners, which use simulator services in Essen to implement modern techniques to evaluate the efficiency of the training by recording training sessions and use it as tool to improve worker behaviour. The team encourages the plant to consider good practices in that topic already successfully implemented in neighbour countries.

Conclusion: Issue resolved.

3. OPERATIONS

3.1. ORGANIZATION AND FUNCTION

The Operations Department is divided into two sections, the Operation Support section and Shift section. The Operations organization and responsibilities are clearly defined and understood. The responsibilities and tasks are stipulated in the organizational procedures. The Operations Support Section has an administrative staff that relieves the operating crews of administrative tasks. Observations in the control room show that this is effective.

The team found that goals and objectives exist and have been communicated down through the management levels. Interviews with personal at lower levels in the Operations Organization provide evidence that the goals have been communicated to all levels. Since the goals are not specific to Operations, the value of these goals in shaping operation's staff behavior is questionable. (This is also discussed in the MOA section of this report.)

In some areas there are no formal policies or programmes which lead to uneven behaviors and failure to perform to international practices. An example is in the conduct of operations where there is a gap between the plant's current practice and international practices in the areas of closed communications, error reduction peer checking techniques, hard hat usage in the control room, etc. The team has included a recommendation in this area.

The design of the KKP units is such that each unit is nearly independent and does not rely on the other for critical functions. There are some common systems, which include the house-heating boiler and make up water systems. Additionally, there is a common Site Fire Brigade and common Maintenance and Support Organizations. During an event, the non-affected unit's Operations Organization is tasked with providing support, as required, in performing notifications.

Responsibilities and relationships with other departments are well defined. There are several levels of meetings between operations, maintenance and technical support department members, etc. These meetings are carried out in an effective way, so that relevant information about operational conditions, issues and preventive maintenance work are shared. The Operations Organization recognizes the importance of maintenance activities and adheres closely to the daily plan. Scheduled activities are reviewed at the start of each shift and this attention to the daily plan has been very successful in completing maintenance work as planned.

There is an effective system for timely support to the shift that includes an on call Plant Manager or Deputy to support the Plant Shift Leader. If an event occurs, this manager is informed and is responsible to support the Shift Leader.

Shift staffing levels are correct for normal and emergency conditions. The shift staff is functionally classified into several positions and the minimum required number of shift personnel of each classification is clearly defined. A University Degree is required for the Shift Leader position. Each shift must be manned by at least seven people to operate the plant and there are six shifts. In addition, a plant fire brigade commander (senior fireman) and a plant safety officer work on shift. The experience level and proficiency of the operational staff are judged to be very good and they normally operate with 10 persons versus the 7 required.

To deal with the impact of rotating shift work on employees, the plant has developed, with the help of their company physician, and improved shift rotation schedule. This schedule minimizes many of the negative aspects of rotating shift work and has strong support of the shift workers. It is judged to be a Good Practice.

3.2 OPERATIONS FACILITES AND OPERATOR AIDS

The Main Control Room (MCR) is large and modern. It is well organized to provide the relevant information to the operators on overall plant and individual equipment status. The control room has separate offices for the Shift Leader, and the two shift “Meisters” who direct the activities of the field operators. (shift electricians and machinists) The reactor operators have large consoles with human factored controls. The operators are supported by computer based plant status displays. There is a plan to replace the plant process computer in 2005, which will permit the enhancement of these displays plus provide higher reliability. The plant is designed with a “black board” concept for MCR annunciators. It is management’s goal to maintain this and they do so with a high level of success.

It was noted that the MCR does not follow the international practice of designating an “at the controls” exclusion area that may not be entered without licensed operators’ approval. This international practice ensures that non-operations personnel do not obstruct the operator’s access to their controls. Note no examples of observation of operators access was observed during the team visit.

There is a remote shutdown panel in the emergency feed water building. This shutdown panel is in a separate hardened room. This is an excellent facility and it provides all the necessary controls, procedures, power supplies and pumps to shutdown and cool down the plant if the main control room becomes inaccessible. It is designed to be habitable for extended periods with filtered ventilations systems as well as a supply of food and sleeping facilities. The building is “hardened” and designed to withstand natural and manmade events.

All necessary operational procedures, manuals and other operational aids are readily available in the main control room to support both normal and emergency activities. Some unauthorized operator aids were found at various locations in the plant. A suggestion has been made to improve the system of authorization and control of these aids.

Communications equipment for the operators is adequate using landline telephones, beepers and radios in some areas. The plant paging system is also available and the team was pleased to note it is infrequently used.

Recently control room renovations have been made to improve the lighting and ventilation at the request of the control room operators. Note the MCR lighting is the same as that used in the MCR simulator.

Plant equipment isolations were clearly identified both in the control room and in the plant as necessary.

Material condition is exceptional and plant cleanliness and housekeeping are generally excellent.

3.3. OPERATING RULES AND PROCEDURES

A review of the Operating Manual shows that Operating Limits and Conditions (OLC's) are clearly stated and discussions indicate that they are clearly understood. The organization has adequate controls and procedures to ensure compliance. An effective process exists to ensure deviations are appropriately reported and properly documented. A review of the Shift Leader's logs indicates that OLC's were well documented both for entry and exit.

The Normal Operating Procedures are of high quality and the level of detail is good. There are procedures steps that require a sign-off when appropriate. The respective operating manual includes all procedures, which are necessary for safe operation and which are required to run the plant in normal operation. Operational procedures are periodically reviewed to determine their accuracy and improve their usability. The system for changing and up-dating operating procedures is described in a specific procedure. Generally, changes are made quickly and personnel are trained in a timely manner.

Emergency Operating Procedures are clearly written and readily available to the control room operators and field operators as necessary. Symptom Based Emergency Procedures are in use. They have recently been updated to reflect the latest thoughts on Emergency Procedure processes.

It was noted that alarm procedures exist, contain the appropriate information and are properly used.

Temporary changes to procedures are appropriately reviewed and authorized prior to their use.

There is a formal system in place to control and evaluate the duration and number of temporary changes to procedures. Operators are informed and trained on temporary changes to procedures prior to implementation.

Status control check sheets are routinely used to verify the line-up of safety systems and completely independent checks are required.

3.4 OPERATING HISTORY

Operating Experience information is provided to the Operating Organization and it is promulgated via the Shift Leader to his shift team. Additionally, where appropriate, relevant operating experience is covering in operator re-qualification training both in the simulator and classroom.

Plant data and history are used by the system engineers and plant management to improve system reliability. This is generally focused on the technical (hardware) aspects of system performance. There is not an effective "corrective action programme" in line with the international practice to capture and analyze all adverse conditions including those of a human performance nature. This issue is covered in more detail in the Technical Support Section of this report.

The "Events Analysis Group" performs Root Cause Evaluations. It is noted that for some events the root cause is listed as "not determined"

3.5. CONDUCT OF OPERATIONS

During the review, control room operators demonstrated a professional and competent attitude. Operators are attentive to plant parameters and conditions. They were given clear direction by the Shift Leader to perform assigned tasks.

Shift turnovers were conducted in a very professional and systematic manner. A detailed turnover is conducted at each level and is followed by a shift meeting to ensure everyone understands the scheduled and unscheduled activities. An effective meeting of all shift personnel is then conducted by the Shift Leader before turnover is started. This is considered a strength. However the formality of the “Conduct of Control Room Operations” falls short of international practices as discussed in 3.1 and a recommendation is included on this issue.

System component status changes are appropriately documented and communicated. Activities affecting the status of systems and components important to safety are well planned, authorized and controlled by the Shift Leader.

The Maintenance Planning Group schedules all the periodic tests (surveillances) for the station. They are entered into the work management programme, which plans when they will be completed. The Shift Leader must authorize a test just before it is conducted. Periodic tests have acceptance criteria and the Shift Leader must approve the results of the test and record it when it is completed.

Operator tours were very professional and thorough. All relevant areas are covered within specified intervals. However, the team noted that the deficiencies in the field are not labeled locally after being reported to the control room.

Four small pocket procedure books “Black Books” give the field operators all the information, which they need during shift tours. The team recognized this as a strength.

Operations field personnel frequently identify important as well as less important plant equipment material condition deficiencies. Although the plant material condition is generally excellent, some plant equipment material condition deficiencies are not reported.

Plant housekeeping practices: painting, condition of components, thermal isolation, floor surfaces, lighting and route posting are excellent and the field operators do their part to help maintain these practices. The team did however observe some isolated cases where the field operator did not pick up pieces of debris.

The Shift Leader is member of morning meetings with the Maintenance and Technical Support Department members, etc. The meetings are carried out in an appropriate way, so that the relevant information and operational problems are shared among them. The Operations Department effectively communicates problems and lessons learned to each of the shift crews and to all other affected departments.

The plant has detailed procedures including checklists that control restart after a scram. The cause of the scram must be known and corrected. The plant also has detailed procedures including checklists that control restart after a refueling outage or maintenance shutdown. Management approval up through the Operations Manager plus the regulatory body must approve restart. It is noted however, that no collegial review, by the plant staff, is required as is done by many international plants.

3.6 WORK AUTHORIZATIONS

The work authorization process is well laid out in a clear and comprehensive maintenance manual (IHO) procedure. The procedure includes a process flow chart to improve understanding and detailed sections that clearly lay out the process and responsibilities.

The work authorization process is supported by an integrated plant wide computer system that documents and controls all aspects of the process. This includes, identification of work, approval and prioritization by the shift leader and management, capturing the maintenance planning process, identification of radiation controls, scheduling, providing the clearance tagging, authorization to conduit the work, the removal of the clearance tagging, system alignments, retesting and return of the equipment to service.

While the computer based process works well and is similar to international practices, the plant is developing an improved system that will be more user-friendly and integrate additional processes like material management.

The work authorization process is effectively used and the shift personnel have a clear understanding of which equipment is out of service and what is available. The process includes the requirement for independent verification of system line-ups on designated systems (safety related)

This work authorization process is used to control periodic tests and the installation of plant modifications as well as control temporary modifications. It was noted that there are a few temporary modifications in the plant (expansion tank fill hoses in diesel rooms and the leak off drains in containment) that were not part of the plant design and were not properly controlled by the temporary modification process. This is covered in the technical support area of the report.

3.7. FIRE PROTECTION PROGRAMME

The Fire Protection Programme is well established according to national regulations and the responsibilities for the fire protection programme are well described. The fire protection procedures describe the essential measures for the prevention and spread of fires. The fire protection plans contain details of structural fire protection measures.

An effective programme is in place for inspection of portable fire fighting equipment. The team checked many portable extinguishers and every one was within its inspection interval.

The methods being used to maintain the fire barriers are adequate. The fire detection system provides appropriate information to control room personnel. The team did note that fire protection doors were not uniformly marked. Some were marked as required on both sides; some on only one side and two doors were unmarked.

Observations carried out in the plant provide evidence that personnel smoke in areas where there are risks of fire and smoking is forbidden. The team found cigarette butts and ashes in a many areas. The team made a recommendation in this area.

The periodic tests of fire protection related equipment are properly carried out. The plant does external as well as internal tests of fire equipment in the stipulated periods (e.g. ladders, fire engine, fire valves, spray systems, breathing equipment).

All people working at KKP are acquainted with the fire protection programme as part of their initial training.

The plant fire brigade is made up of personnel from all technical departments and the building security organization. The staffing of the fire brigade guarantees the constant presence of a fully qualified fire-fighting group. The firemen have been trained to perform rescue work in conditions specific to a nuclear power plant and the fire brigade conducts regular drills. During basic training, the members of the plant brigade acquire knowledge of fire brigade regulations and the necessary information about the fire protection equipment; both how to handle it as well as details of fire-fighting measures. Regular training events (theoretical and practical) are held to keep the plant fire brigade and its members in a constant state of readiness. KKP has excellent fire training facilities (Fire Drill Mockup).

There are mutual co-operation agreements with several local towns' fire brigades. Comprehensive assistance of the local fire brigade can be provided and this helps improve the level of fire protection at the plant.

3.8 ACCIDENT MANAGEMENT

The plant has an excellent set of Emergency Procedures that cover "Beyond Design Basis" events. These have recently been updated (Feb 04) and they clearly define what needs to be done, who needs to do it, approximately how long the action should take and how quickly one should expect the action to produce the desired result.

These procedures are flow-chart driven and also contain detailed mini-procedures to be given to the operators to accomplish the required supporting equipment operations. The quality and format of these procedures is in line with the best international practices.

These emergency procedures (emergency manual) are designed to restore the plant to a condition where it can be controlled by normal procedures. The procedures are designed to be completed by the minimum required operating shift and with the help of the normal fire brigade. Where required, special tools, equipment and hoses have been staged to support the required actions. Normally available communications methods are adequate to support these procedures.

The plant has a designated "crisis team" that is available to deal with emergencies. During the workweek they are part of the on site staff and during non-working hours and weekends they are called out as required with an expected response time of 30 minutes. The shift leader of the non-affected unit makes the calls by landline or cell phone. These calls are not automated and it is suggested that they could be. The crisis organization has available to it appropriate technical information and calculation programmes.

The plant conducts training for the operations organization and "crisis team" on a periodic basis, one to two times per year. It is noted by the OSART Team that the frequency of this training is less than other international plants. This is further discussed in the Emergency Planning and Preparedness section of the report.

The plant has completed a Probabilistic Safety Analysis (PSA) and the results have been incorporated into their Emergency Procedures.

The plant has not yet completed “Severe Accident Management Guidelines”. For now, they rely on the crisis team to provide directions if conditions deteriorate beyond or outside procedural guidance. “Severe Accident Management Guidelines” are being developed jointly with other German nuclear plants and a vendor. The team encourages that they expand the development process to include information from the international community.

KKP FOLLOW-UP SELF ASSESSMENT

The OSART Mission has occasioned changes in the Operations Department which will improve operations management.

- The introduction of access control to the main control room has resulted in a marked reduction of coming and going. This means that there is far less to distract the operators from their proper work.
- The revision of the MARKER including refresher training, especially in conjunction with communication training, has created a better understanding of the human factors and the error potential associated with them. This appreciation is an essential pre-requisite for improvements with regard to the use of error prevention strategies.
- The communication courses given to shift supervisors by a competent trainer in association with the simulator trainers have prompted the desire to go deeper into this topic with their shift crews.
- Other improvements of training procedures have developed from discussions with trainers at the simulator centre.
- The observations by the IAEA OSART Team on formalities in the control room have supported and accelerated the implementation of the smoking ban.

Upon recommendation by the OSART team, contact has been made with other plants in Germany and abroad by various sections. In addition to answers to the actuating questions, they have received suggestions on other topics and established personal contacts.

STATUS AT OSART FOLLOW UP VISIT

In 2004 the OSART mission made two recommendations and 1 suggestion in the Operations area.

The suggestion related to unapproved documentation in the field has been resolved. Clear instructions are now in place to control and limit such documentation. No evidence of unauthorized operating documentation was identified during plant tours.

Of the two recommendations, the first related to MCR conduct has been resolved. It was obvious to the team that significant work had been completed by the KKP2 plant staff to make physical changes to the building to better control unnecessary access to the MCR. In addition both management and the shift managers had accepted the need for change in the conduct of all staff working in the MCR. The conduct in the MCR was noted to be more professional and of a higher standard than during the 2004 mission.

In the final area of fire safety it is obvious that station management is determined to change the culture related to smoking in unapproved locations. This determination coupled with the actions in place to enforce expectation is expected to produce positive results. The team gave this issue a "satisfactory progress" grade.

DETAILED OPERATIONS FINDINGS

3.1. ORGANIZATION AND FUNCTIONS

3.1(a) **Good practice:** Many workers find working rotating shifts difficult. Most conventional rotating shift schedules result in some measure of degraded human performance as the worker's circadian rhythms adjust to the new schedules. Research shows this is most severe after several shifts on nights. Additionally, after years of continuous rotating shift work, some employees are subject to more health disorders.

To deal with these issues, KKP endeavored to improve the schedule for rotating shift workers at KKP1 and KKP2. Following a recommendation of their company physician, an improved system was created, which was designed to have less impact on the shift personnel compared to the old shift rotation schedule (7 consecutive days of morning shift, afternoon shift and night shift).

The improved schedule employs a short-segment shift rotation. The shift workers voted 55 % in favor of a one-year trial of this new rotation schedule. After the one-year trial, the employees liked the new system so much they voted 98% in favor of retaining it.

Note that KKP employs a six-section shift rotation. The short-segment shift rotation is characterized by frequent shift changes with rotation always in the forward direction. I.e.: morning shifts are followed by afternoon shifts and nightshifts follow afternoon shifts. Within a period of seven consecutive days there are a maximum number of 3 consecutive days in morning, afternoon or night shift. Between shift sequences, there is a full 5-day week of regular working days followed by a 2-day week as well as days off. The plant has a graphic depiction of this schedule and can provide details.

This short-segment shift rotation provides the following advantages:

- Improved health and well-being of shift workers,
- Minimization of sleeping disorders,
- Less impact on human performance,
- Improved family life results from short segments in a shift sequence and blocks of identical working hours,
- Better integration of employees in plant activities,
- Improved, interface of shift workers with other departments or sections, and
- A larger pool of employees finds shift work acceptable resulting in easier recruitment of operations staff.

3.2. OPERATIONS FACILITIES AND OPERATOR AIDS

3.2(1) **Issue:** The team noted several hand-written instructions, unauthorized operator aids and some inconsistency in the plant's labeling practices.
For example:

- Several pipelines in the turbine hall, the reactor building, the diesel generator buildings were observed with hand-written instructions;
- Hand-written instructions on the floor in the turbine hall;
- Hydraulic turbine control system – hand-written instruction;
- A damaged drawing without authorization at the KPL06CQ002 gas measuring cabinet;
- Hand-written instruction without authorisation at the KPL06CQ002 gas measuring cabinet;
- Equipment for measuring surface contamination of in RB instruction without authorisation;
- Measuring instrument with hand-written range limits at SAL 10 BT 001 (emergency feedwater diesel);
- On the insulation near valves LBA 82 AA001 1/3 and 1/3 "1" is crossed out and by a hand-written "3";
- At LDB 11 AA012, 009 there are two different kinds of labels– hand-written label and a standard label;
- At PAH 10 AA 002,001 and QMK 13 AA 001, there are hands written labels on the isolation;
- At LAR 46 AA013, there is hand-written label on the valve;
- At XJV 80 CP 501, XJN 80 CP 503, 501 two different kinds of label;
- At the CJN cabinet of GEN-SPG-REGLER – operator aid hand-written correction without authorization;
- Two "Fire doors" without marks (at room BA 07 TAD 26028 the label is torn down, at room BA 05 TAD 29018 the label is missing); and
- Fire doors are mainly labeled at one side only.

Uncontrolled operator field aids (instructions and labels) are not verified for correctness and could lead to incorrect operation of plant equipment due to inappropriate instructions.

Suggestion: Consideration should be given to identify and eliminate all non-authorized operator field aids in the plant. The plant should consider reviewing the plant labeling practices.

Plant Response / Action:

The matters raising comment from the OSART team have been corrected / eliminated. Unofficial operator aids were removed. The rules and documents associated with them have been checked and, where necessary, supplemented.

The following general principles apply:

Hand-written instructions
Hand-written instructions may be used in the plant as a temporary measure if necessary for work. They must bear the date, name and signature of the author of the instruction. Otherwise they will be deemed unauthorised and removed during inspection rounds. The roundsmen have been told to look out for unauthorised instructions and notify the shift supervisor if they find any.

Checking for hand-written instructions has been added to the internal procedure for management inspections (BAW S 028).

Contractor staff are reminded about how to handle instruction documents as part of the new K1 safety briefing, or alternatively during the pre-job briefing.

Worker aids
System diagrams on fixed display in the plant are subject to document management. They carry a red stamp stating the place where they are positioned. Replacement follows the replacement procedure with the associated distribution list instructions.
Any extracts from the Operating Manual kept in the field (e.g. emergency control room, diesel control panels etc.), are also subject to the proper amendment procedure. Replacement follows the replacement procedure with the associated distribution list instructions.

Plant labelling
Labels on plant items must always follow the plant labelling system (KKS). The established fixed label system (made by Stell) is used in the field.

Any labels that have to be removed during fitting work, or new labels required in case of plant modifications or new installations, will be made by the system-responsible shift before the work commences and installed in the field after the work is completed.

Any incomplete or missing labels noticed during plant inspections must be rectified or replaced by the duty shift.

Checking for incomplete or missing labels has been inserted into the internal procedure for management inspections (internal procedure BAW S 028) and the B2 round instructions.

During outage, the manually and remote controlled valves are checked using the Operating Manual list of positions. If, as a result of maintenance work, KKS labels are damaged or missing, they will be documented in the position list and replaced or exchanged by the system-owning shift after the outage.

Any labels in the plant other than those mentioned above are not officially binding and have no authority for the plant personnel.

IAEA comments:

Clear expectations related to the use of hand written instructions have been communicated to operations staff and documented in a station procedure. During plant walk down activities no examples were observed of unapproved hand written operational procedures or instructions.

Those instructions identified in the field all had the appropriate stamp to show they were approved documents. In addition there is a process in place that identifies the location of and routinely updates these “field aids” to ensure they reflect the latest revision to operating procedures.

Conclusion: Issue resolved.

3.5. CONDUCT OF OPERATIONS

3.5(1) Issue: There is a lack of formality in the Conduct of Control Room Operations

- Direct observation reveals that access to the Control Room area is not effectively restricted to personnel who must conduct business in the control room. The number of personnel present and noise level often exceeded what is accepted international practice;
- It was observed that a smoking table existed in the control room and that non-control room personal were entering the control room with the purpose of smoking a cigarette;.
- While there is a stated expectation that hard hats should not be taken into the control room, it was observed that some personnel entered the control room with their hard hats. No one challenged the personnel with the hard hats;.
- There is no formal “Control Room Communications” policy. An excellent guide has been drafted but has not yet been adopted as a policy expectation by Operations Management. A formal Control Room Communications policy is an international practice that reduces the potential for misoperation of the controls due to a misunderstandings in communicating an equipment operation order or the verbal transfer of critical plant information;
- Use of accepted international error reduction techniques are not uniformly practiced. This was evidenced by observations of evolutions. International error reduction techniques include “peer checks”, STAR, (Stop Think, Act and Review), etc.
- There is no designation of an “at the controls” exclusion area that may not be entered without the licensed operators approval. This is an international practice that ensures that non-operations personnel do not obstruct the operator’s access to their controls; and
- The policy guidance for procedural usage should be improved. The determination whether a procedure is used as a “reference only”, “in hand” or “continuous use” is left up to the user based upon his training and experience. The international practice has management designate which procedures must be used as “Reference Only”, “In Hand” or “Continuous Use”.

While no specific safety issue has been identified at KKP-2, there is international experience that shows that a lack of formality in the Conduct of Control Room Operations may lead to a higher incidence of errors in the conduct of control room operations. This may have an adverse affect on safety.

Recommendation: The plant should adopt clear policies and expectations to improve formality in the Conduct of Control Room Operations that are similar to good international practice.

Plant Response / Action:

Control room access

Direct access to the MCR is authorised by a badge reader. Access is limited to a particular circle of people (Operations Department Unit 2 staff, IT staff working on computers, security officers, regulatory staff, independent experts and individuals authorised to enter by the shift supervisor).

The conversion of the physically separate annexe to the MCR to a work permit issuing office during power operation and outage has been completed.

The room (Work Control Office) is in the immediate vicinity of the workstations used by the foreman mechanic and electrician, who are in charge of issuing work permits.
This means that it is no longer necessary for workers to enter the control room to obtain their work permits. All briefings or discussions connected with work permits are held in the Work Control Office.

Section 2.5 "Conduct and Access Control in the Control Room" has been added to the Control Room and Shift Procedure (WSO) of BHB in respect of access arrangements and behaviour in the control room.

Ban on entering the control panel area
Visible markings will be placed in the appropriate area as part of the control room alterations. This item has lost some of its significance as a result of access restrictions to the control room and the ensuing reduction of staff numbers present there. The reactor operator already has authority to move staff from other departments out of the area around the panels.

Smoking in the control room
In the wake of non-smoking rules, a smokers' corner with a fume extractor has been set up in the control room. It is available for use by staff with authorised access to the control room.

Wearing of hard hats in the control room
Wearing a hard hat in the control room is not allowed. Hard hats must not be taken into the control room. There is a hard hat shelf outside the control room. Attention is paid to compliance.

Communication in the control room
A training programme in "Control Room Communication" has been developed with an external instructor. In addition to the basic principles of communication, the course comprises practical exercises at the simulator using video recordings. The objectives of the training programme are defined as follows:

- hardening up the theme of safety culture for shift supervisors and reactor operators;
- deeper comprehension of practicable rules of communication for the control room;
- teaching a practical management concept and the associated decision making techniques;
- opportunity to practise on the simulator immediately after the lesson and optimise the techniques by means of video evaluation; and
- sharing experience of real-life practice from the control room.

Implementation will take place in the following defined steps:

- pilot course by Operations management;
- courses for the shift supervisors; and

- courses for licensed personnel including shift supervisors.

The first two steps have been completed, the third step is scheduled for 2007.

Error prevention techniques
The "peer checking" method is used for switching operations on important and safety relevant systems. This applies both to operational switching other than normal routine and periodic testing.
The method used in complex decisions and the decision making conduct of shift crews is described in the MARKER booklet and reinforced by training.

Use of written procedures
The Control Room and Shift procedure (WSO) list the documents kept at the control panels. The control room documents as a whole are divided into three basic categories:

- control room instruction documents;
- descriptive control room documents; and
- informal control room documents.

Internal procedure BAW 123 describes the shift crew's obligation to use particular documents and the requirement for the Operations office to check the control room documents.

IAEA comments:

In 2004 during the OSART mission the Main Control Room (MCR) was found to be operated at a standard below that defined in IAEA standards and guidelines. By comparison, in 2006 significant improvement was observed to have taken place. The MCR is now being run in a very professional manner; access is restricted for non licensed staff such that distractions are minimized and overall the standard of housekeeping is much improved.

It was also noted that the modifications to the visual displays for licensed staff within the MCR were much improved and of the highest international standard.

Interviews with plant management and reviews of training material showed that the station had accepted the need to improve the communication practices between MCR staff. Training had been provided to individual shift crews on a team basis related to improved communication methods. A handbook had been issued to staff covering all aspects of human performance which contained specific details of good communication methods. Finally further training was scheduled for licensed staff in this area.

Conclusion: Issue resolved.

3.7. FIRE PROTECTION PROGRAMME

3.7(1) **Issue:** Inspection in the field revealed that although smoking is forbidden in the industrial areas the team found evidence that personnel are smoking in places with fire hazards.

Observations carried out throughout the plant demonstrated that personnel smoke in areas where there is a risk of fire and smoking is forbidden. The team found cigarette butts in the following areas:

- Cable bridge in the emergency diesel building;
- Cable duct BA 0109 (three fresh butts);
- Turbine hall;
- Main steam and feedwater valve compartment where the safety valves are located;
- Turbine lube oil tank room;
- Fresh cigarettes ash was found in the emergency diesel building;
- Furthermore smoking or evidence of smoking (butts) was observed in many areas around the NPP, where smoking is not forbidden but where fire hazard exist:
  - Near gas cylinder warehouse;
  - Near the transformers; and
  - Near the emergency diesel building.

Smoking in industrial areas is a fire hazard and therefore a risk that can jeopardize nuclear safety at the plant.

Recommendation: The plant's smoking policy should be clearly communicated and enforced to all personnel and controls should be established to ensure that personnel do not smoke in industrial areas defined by the plant.

Plant Response / Action:

Internal agreement "Implementation of the EnBW general agreement of 15th June 2004 for the protection of non-smokers at Philippsburg Nuclear Power Plant (KKP)" was promulgated on 9th September 2005. This provides a clear policy statement governing smoking on the power station site. Although this agreement is intended to protect non-smokers, it is also has the added advantage of avoiding fire hazards.

Regulations for all work places within the EnBW Group have been agreed with the local employee representatives (works council) at each site to protect the health of non-smokers in accordance with the general internal agreement. The objective is to provide the greatest possible health protection for everyone working on the Philippsburg site and to safeguard non-smoking employees effectively against the health hazards caused by tobacco smoke.
This arrangement applies to all buildings on the Philippsburg Nuclear Power Station site and vehicles in the station car pool.

Under the general internal agreement for the protection of non-smokers, smoking is banned in canteens, on-site restaurants, corridors, staircases, elevators, offices and conference rooms, toilets and sanitary installations, common rooms (e.g. tea kitchens) and fleet vehicles, except in specially designated smoking areas.

Smoking areas are designated in or outside buildings. A plan showing where these areas are located has been communicated.

Employees who are smokers and wish to use this agreement to stop smoking are offered support and assistance in various forms by the occupational medical service.

Enforcement is by walk-downs by shift personnel and fire officers. No conspicuous abuse has been noted from their observations to date.

IAEA comments:

Written expectations from the Station Manager have been communicated to all staff on the no smoking policy. Non smoking areas are clearly signed in the plant. During plant tours by management and Safety Officers, any violations of the smoking policy are identified for follow up. Contractor staff can be removed from the site. KKP staff are subject to the plant's disciplinary process.

During plant tours there was little evidence of smoking having taken place in unapproved areas. It is recognized that this is a cultural change that will not be 100% successful overnight and that continued management reinforcement of expectations will be required in order to be able to totally resolve this issue.

Conclusion: Satisfactory progress to date.

4. MAINTENANCE

4.1. ORGANIZATION AND FUNCTIONS

The Maintenance Department (I) is a production directed organization, responsible to keep and maintain both units, KKP 1 and 2. The maintenance activities are managed by three sections, Preparation (IP), Machine Maintenance (IM) and Electrical Maintenance (IE), which are organized under the supervision of the Maintenance Department Manager.

The maintenance staff is considered to be adequate and a reasonable number are engineers. The KKP maintenance staff is sufficient to perform the maintenance and control functions, considering that most of maintenance activities are performed by contractors or equipment manufacturer. The contractors follow all KKP policies, according BAW 1-030 procedure, and they must be qualified according KTA and ISO requirements. The maintenance organisation and responsibilities are clearly defined in the Plant Personnel Organization Manual (PBO). The coordination among different maintenance sectors and groups were found good by the team, mainly due to the managers, supervisors and foremen, who are working for long time for KKP.

The Maintenance Organisation follows the Nuclear Safety Policy requirements established by the Station Management and seeks to reach the goals and objectives established by the plant on an informal procedure. The maintenance sections heads and supervisors disseminate the goal and safety culture through all the staff. There is a very comprehensive “Employee Cross Check Evaluation” that is used to evaluated personnel performance and disseminate safety aspects and cross feedback between managers, heads of sections, supervisors and staff. The organisational structure and responsibilities are clearly defined by the Plant Personnel Organisation manual (PBO). The maintenance management has a large set of maintenance indicators to measure and follow the plant’s goals, like “re-work rate”, “unplanned maintenance activities rate”, “preventive maintenance past due time rate”, “man-power effectiveness”, “corrective and preventive activities proportional rate”, “Backlog pending due spare parts unavailability” and others. However the team did not find clearly defined specific maintenance goals and an objective plan. Also the maintenance indicators are not clearly communicated and promoted among the maintenance staff. Without complete and comprehensive maintenance goals and an objective plan, it is more difficult to measure the maintenance performance and may impair the plant’s objectives and goals. This issue is discussed elsewhere in the MOA section.

Most of the maintenance managers, sector heads and supervisors are engineers and, according with the German law, the technical education must have extensive On the Job Training (OJT) in order to ensure knowledge, skills and attitude. All the workers must receive a introductory training (K1, K2 and K3) and specific maintenance training, directly applied on the workshops, based on an informal training programme, which have been prepared by maintenance managers. The maintenance department has an extensive and comprehensive Computerized “Maintenance Expertise and Personnel Qualification Control” ensuring that skills and qualifications to perform maintenance activities, keeping equipment reliability and availability are completed. This control is used to define the necessary training and education for maintenance staff as well as to ensure that maintenance activities are only done by qualified staff. The team recognizes this process as a Good Practice. Also, there is a training programme for the newest employees including on the job training directed by potential retired staff. All this information is on an integrated control system. The

Maintenance Department has 28 employees more than the official staff, in order to permit personnel qualification overlap; this subject is discussed more in the MOA section

4.2. MAINTENANCE FACILITIES AND EQUIPMENT

The maintenance facilities inside and outside the controlled area are of adequate size, cleanliness and well equipped. Adequate workshops and laboratory facilities are available to promote safe and efficient completion of the work. The electrical section has available motors, communications and switchgears and electronic workshops and the mechanical sections have a machine workshop, both inside and outside the radiation areas, with excellent installation and with most of the modern equipment available. In some of the workshops there are training facilities with adequate material. Each workshop has a foreman who is responsible for ensuring that the cleaning, equipment and facilities maintenance and consumable supplies are sufficient for the carried out activities.

The tool shops are well organized and are available on strategic points inside and outside the controlled area. All the measuring equipment and instrument are calibrated according the technical requirements, storage on adequate process and controlled by a computer system. However, the team observed that the historical review of work activities for test or measuring equipment that is later found out of calibration is not adequately performed. The control system does not ensure traceability to identify the plant equipment that was worked on using the measuring tools and test instruments that are out of calibration or out of order. Despite the fact that the plant is developing a new Work Control Computerized System (BFS) that should solve this weakness, the team recommended that improvements to the control of tools and measuring equipment should be made until the BFS system had been implemented. Some weaknesses were also observed on handling and storage chemical and flammable products. This issue is discussed further in the Chemical section of this report.

Adequate decontamination facilities are available using flushing water tanks, ultrasonic bath, glove box and lapping system. Also, there are some confined areas for field work, special handling devices for large and confined equipment and special tools like automatic machinery (CLP), snubber automatic test equipment, S/G multi-stud tensioner, reactor multi-segment stud bolts, automatic steam generator eddy current test equipment and other automatic hand tools which assist in minimizing radiation doses and contamination.

4.3. MAINTENANCE PROGRAMMES

The preventive maintenance programme follows the requirements of the maintenance manual (IHB). It is managed by a computer control system named WKAU, introduced in 1998, that automatically provides information as early and last date, man power and supports, facilities and job steps and duration. This programme contains maintenance preventive activities required by the technical specification (KTA and DIN), by the equipment manual and KKP experience and by the regulator. This programme is split in three parts, “Preventive Base Maintenance”(time of operation), “Condition Base Maintenance” (Non intrusive inspections) and “Failure Base Maintenance” (non important equipment).

Corrective maintenance is also managed by (IP) sector. For main safety related equipment malfunctions the system engineers are indicated as a FSB as required on maintenance procedures. The equipment malfunctions or failures are promptly notified by a Work Request, that is prioritised by operation and evaluated during a daily morning meeting by maintenance, operation and technical support supervisors. The prioritisation process is clearly defined and the corrective work requests are promptly planned and scheduled in compliance with the preventive programme, to be performed during normal operation, plant shutdown or scheduled outages.

The Condition Base Maintenance programme (predictive activities) contains some of the recent techniques used in the nuclear industry like vibration analysis using alert and correction reference levels, oil analysis, thermovision inspection, electrical tests and checks and temperature and noise measurement. Nevertheless it is being used only to complement the preventive base maintenance programme. The result of the non-intrusive technique tests and inspections have been used by the Technical Support Department as a tool to complement the WKP requirements and to identify causes of equipment malfunctions. The team suggests that predictive techniques could be used to increase the equipment dependability and availability, using the results of different techniques together to perform an integrated equipment trend analysis, reducing preventive interventions and optimising equipment “out of service”. Issue 4.3(1).

The in-service inspections are also controlled by a computer control system named WKP (Periodic Test Control). The programme is based on KTA and DIN requirements and is approved by the Regulator. Also the programme contains some tests required by internal and external experience. The tests required by specifications are followed and evaluated together with an Independent Inspector (TÜV), required by law, as well as by maintenance and system engineer. Some specific tests are also followed by the Association for Plant and Reactor Safety (GRS). The WKAU is a sub-system of the Computer Work Control System (IBFS). The WKP work requests are issued and then they are manually introduced in the IBFS. The Plant is developing an automatically integrated system (BFS), and is intending to implement it until 2006. The team recognizes that this improvement could minimize lost time and manpower and should improve the work control process. All the results are reported on the “WKP Protokol”, evaluated by the designated inspectors and supervisors and archived.

The plant has a comprehensive “Condition Monitoring and Aging Management System” named COMSY , complemented by a “Fatigue Monitoring System” named FAMOS, that measure and monitor equipment and system degradation on a high standard, using modern techniques. This programme is the responsibility of the System Engineer Department (S), and is discussed further in Technical Support section (TS).

4.4. PROCEDURES, RECORDS AND HISTORIES

The Maintenance Department has its own organisation and process clearly defined in the Maintenance Procedure (IHO), which is part of the Plant Manual (BHB). The maintenance process and activities are covered by administrative and technical procedures BAW`s and AAW-I`s. The BAW`s are the General Procedures that are usable by all plant departments and the AAW-I`s are the Maintenance Specific Procedures that are used by the maintenance staff. Also, there are specific procedures for maintenance surveillance tests and activities (WKP procedures) and in-service inspections (IPP procedures). All the procedures are written in German and appeared understandable and useful to the staff.

The procedures are inputted into a Computer Procedures Control System (e-doc), in order to control and make them available in an electronic form for all the plant staff. Despite the fact that the procedures have been not periodically reviewed and updated, the work control process as well as some specific procedures recently issued by Technical Support department like Operation Experience (BAW S004) and Human factor (BAW S005) evaluation, is frequently used to ensure the procedures are updated.

The maintenance records have been inputted into the IBFS system. This ensures a quick retrieval of records. After the performance of the work, all the work data, such as cause analyses when required, spare parts used, work order number, final test results, man power used are inputted into the IBFS. The maintenance engineers as well as the system engineers from Technical Support periodically review and analyse the records in order to make the necessary improvements in the maintenance programme and in plant safety performance. The in-service test and surveillance history are also inputted into the IBFS, but the physical records (WKP Protokols) must be permanently stored in the plant central vault.

4.5. CONDUCT OF MAINTENANCE WORK

The Maintenance Manager and sections heads routinely monitor, observe and assess maintenance work activities and plant conditions in order to maintain control of equipment deficiencies and ensure a high standard of performance and safety equipment operability. There is a “Responsible person for total work performance” (VDA) responsible for each maintenance activity and a senior maintenance worker (AVO) as job supervisor. Also, there is a “Working Observing Team”, consisting of maintenance and quality assurance supervisors, which survey maintenance activities based on a well-prepared checklist, that covers technical and safety aspects. The contractors follow the KKP directives and are subject to a “Pre job briefing and quality assurance check”, based on a formal system developed by the maintenance department. Nevertheless, the team observed some weaknesses in maintenance work practices and use of inadequate tools that have the potential for damaging equipment, causing personnel injury or equipment malfunction and could degrade maintenance performance. Despite the fact that the maintenance organisation has initiated actions to solve these weaknesses, the team recommended that the organization provide guidance and training to the supervisors in the identification of worker performance problems and weakness in work practices.

Maintenance jobs are performed based on technical instructions and administrative procedures included in the work packages by “Responsible person for technical clarification” (FSB). It is reviewed and approved by the system engineers, radiological protection supervisors, industrial safety supervisor and operations supervisor, who ensure the processes are up to date. Although the plant has a programme for Foreign Material Exclusion (FME), this programme was not rigorously applied for permanent FME areas as the spent fuel pool. In spite of the fact that the area has adequate segregation and posted FME warnings, workers were observed to not be using the appropriate FME standards and some inadequate materials and equipment were identified close to the spent fuel pool area. The plant has already corrected some of the weaknesses observed. The team made a recommendation for improvements in FME controls in permanently posted areas.

4.6. MATERIAL CONDITIONS

The plant material condition is excellent and follows the nuclear international nuclear industry standard. The equipment is of high quality and well maintained, ensuring equipment availability and reliability, in order to ensure plant safe operation. Despite the fact that the maintenance department does not have a formal plant field patrol, as mentioned on 4.5, all maintenance activities have a VDA and AVO, who follow all jobs in the field, observing deficiencies and keeping the plant material conditions to a very high standard. A large amount of material was found to be stored in external areas and plant buildings. In most cases these materials or components are identified, organized and secured by strap or chain or permanently fixed on the wall. However some of them are disorganized, loose and without identification, indicating that there is no systematic managing process or expectation for the control of material storage in these areas and this may lead to a low housekeeping standard. Some of these materials were found on the Auxiliary Building, annulus, Reactor Containment and Main Control Room, in the vicinity of safety related equipment and could result in equipment damage during an event (earthquake). The Team suggests that the plant should consider to develop a material storage policy to improve the requirement to keep equipment, spare parts and material stored and organized in the plant, in order to avoid impacts on the material condition and housekeeping standard. Regarding safety related equipment, the team recommends that the plant should enhance the staff’s knowledge of the plant seismic design bases, in order to avoid safety related equipment malfunctions caused by foreign material impacts during an earthquake.

4.7. WORK CONTROL

The Maintenance Planning Section (IP) prepares work packages including operational considerations, material needed and available, tools, manpower, documentation and technical instructions and all additional information to complete the work. All maintenance programme (WKAU) and in-service inspection (WKP) are integrated to the IBFS database (BASY / IBSY).

Plant work control includes the best practices used by the nuclear industry, from the discrepancy report or work request until the job report and documentation is archived. The flow chart of the system passes through all plant production departments, in order to consider operational prioritization, isolations, industrial safety precautions, radiological protection and ALARA concepts, plant configuration evaluation, regulatory and technical specification requirements, technical support and system engineer analysis and observations, work precautions or remarks for some specifics activities, work instructions and archiving.

This process is followed by FSB`s, who are responsible for technical clarification. The Work Control Process designates the person responsible for total work performance (VDA) and the technician or maintenance worker responsible for the job (AVO). KKP is developing an improved total integrated Work Control computer system (BFS), using the same data bank used on IBFS, in order to minimize lost time during planning and scheduling and optimize resources.

The planning work section (IP) used the same process to prepares work orders for the upcoming refuelling outage and forced outages.

4.8. SPARE PARTS AND MATERIALS

The procurement of safety and quality related parts as well as conventional parts are performed by a separate department (L) based on comprehensive procedures that include requirements for all documentation. For conventional parts the procurement is done under an automatically re-ordered process based on a minimum level established by the requisitioning department using their own experience and the equipment suppliers' recommendation. For safety and quality related parts the re-ordered is evaluated by system engineers before the procurement process. The spare parts and materials process is managed by SAP R3.

There are several warehouses inside and outside the plant-protected area, with adequate spare parts and storage facilities to ensure properly receipt and storage, according with the "Quality Management Manual" and the "Logistic Manual for Warehouses". All rooms are well organised, clear, ventilated and, when required, equipped with environment control system. Oils, flammable and chemical materials are stored in an adequate segregated area. The parts and material are identified, segregated, protected and controlled in order to ensure properly use, lifetime control and traceability. Nevertheless, some weaknesses on handling flammable, oils and chemical materials and spare parts storage were observed and some of them were immediately fixed. The team suggests that the plant provide guidance and training for the warehouse personnel in order to ensure proper compliance with the procedure requirements. Issue 4.8(1)

4.9. OUTAGE MANAGEMENT

The outage organization and responsibilities, as well as planning and reporting the outage results are defined in the Plant Personnel Manual. An outage coordination team is established by operation and maintenance, in order to drive the outage through the programme, to solve the interface problems and provide all the support needed to perform the activities.

Outage management is carried out using a clearly and completely defined Work flow Chart, into a MS Project database. The outage critical path is shared into 7 operational phases and each phase is split by the redundancy isolations system, safety related equipment activities, coolant and auxiliary system activities, considering compulsory activities and final check lists for each phase. This flow chart considered all main activities with the worker order numbers, the compulsory activities, surveillance activities and tests requires by specification or regulator, holding points and final check list. Also, there is a Secondary System Work Flow chart, on the same standard, directly linked with the Main Work Flow. The team recognises this Outage Work flow chart as a strength.

Outage planning follows the same process of the normal operation work control using the IFBS computer system, including operation, maintenance, technical support, radiological protection and safety aspects, and begins immediately after the last outage. Also the plant has a long outage plan for the main activities till to 2016.

After the outage, the results and lessons learned are evaluated by all plant departments and integrated in an Outage Result Report, in order to obtain feedback to prepare for the next outage.

KKP FOLLOW-UP SELF ASSESSMENT

As a result of the frank and constructive dialogue with the IAEA team, their own observations and wealth of international experience, we have identified some valuable suggestions and ideas for the Maintenance Department that will be beneficial in improving processes, the quality and results of maintenance work, but above all in raising the standard of safety. The outstanding significance of these objectives for the plant as a whole was emphasized and put into context against international standards. Permanent effort is needed to achieve these goals and maintain the standard once it is achieved.

Important focal points are:

- Pre-Job-Briefing;
- Personal protective equipment / industrial safety;
- Housekeeping;
- Storage in earthquake-relevant areas inside buildings;
- Traceability of the use of measuring and testing instruments;
- Storage of replacement parts;
- Storage of hazardous materials;
- Basic Maintenance Knowledge;
- Contractor briefings and instruction; and
- Clean-Team/assurance of foreign matter exclusion.

This has been the source of extensive action, some of which has already been fully implemented or is in progress. We have made use of the time to make our people even more sensitive to these issues and the achievement of our common goal, in which everyone can share.

STATUS AT THE OSART FOLLOW-UP VISIT

KKP has made significant progress in the area of maintenance since the 2004 OSART mission. The management team has engaged with the working staff to ensure that everyone at the site is committed to better work practices. This approach not only ensures compliance but is also beneficial in changing the sites safety culture. It is the OSART team's opinion that KKP has initiated some very good practices in the area of maintenance and they should continue to strive to be a world leader in this area.

Specific areas that should be noted are as follows. The Basic Maintenance Knowledge programme that has been developed provides a sound "bed rock" to build a high level safety culture around. The programme not only states what are good maintenance practices in the respective areas, but also states management's expectations on following these good practices.

The maintenance department has initiated programmes that ensure that proper contractor oversight is provided to its contracting staff and KKP employees. Contracting organizations are trained in a consistent and comprehensive manner, thus allowing for consistent compliance with KKP procedures and good work practices.

As noted in the report, the Maintenance Department should continue to strive to improve its material condition programme, especially in the area of the warehouse.

As stated previously, KKP has made significant progress in the area of maintenance since 2004. The management and work force continued dedication in this area will allow KKP to become an industry leader in this area.

DETAILED MAINTENANCE FINDINGS

4.1. ORGANIZATION AND FUNCTIONS

4.1. (a) Good Practice – The maintenance department has an extensive and comprehensive Computerized "Maintenance Expertise and Personnel Qualification Control" ensuring that skills and qualifications to perform maintenance activities, keeping equipment reliability and availability are completed.

This programme gathers data on all maintenance staff, including name, date of birth, qualifications, skills, experience time, law retire expectation based on date of birth, status of retirement contract, date of retirement, date when the successor should be contracted, the name of the successor, the average age of maintenance staff and years of knowledge in nuclear industry. This system allows a statistical evaluation according to the actual status and future personnel development to keep maintenance expertise.

To fulfil the requirements for keeping expertise and personnel development, a training procedure workflow was developed, considering "Individual Development" and "New Employee", which establish a matrix about job requirements and knowledge level of each technical employee in the maintenance department. This matrix is used to define the necessary training and education for maintenance staff as well as to ensure that maintenance activities are only done by qualified staff.

4.2. MAINTENANCE FACILITIES AND EQUIPMENT

4.2 (1) **Issue:** Plant procedure and policies do not ensure proper traceability and reliability for the usage of test equipment and measuring tools.

A historical review of work activities for test or measuring equipment that is later found out of calibration is not adequately performed. The control system does not ensure traceability to identify the plant equipment that was worked on using the measuring tools and test instruments that are out of calibration or out of order.

- When questioned about the last use of measuring equipment found out of order, the mechanical hot tool shop foreman answered that he does not have this control. A maintenance supervisor comments that it is possible to identify the activities performed with this tool but it would be necessary to review all the activities performed during the period;
- When questioned about this issue the foreman from the electrical shop and the foreman of the mechanical cold tool shop answered that they just supply the equipment and tools requested by the maintenance staff. They do not take care about the application or the related work order;
- Even if no deviations were found, the deficiencies in tracking in parallel tool number and activities falls shorts of good international practice.

The improper use and tracing of test equipment or measuring tools, which are out of calibration, can lead the plant to operate with equipment deviation without operators knowledge and may impact plant operation.

Recommendation: The plant should make necessary improvements on the traceability and the control for the usage of test equipment and measuring tools to control and to ensure proper use.

Plant Response / Action:

The instrument centre, which is part of the electronics workshops in the organisation chart, works to process flow chart VA 15.01 "Control of instruments and testing equipment". In general, the result was positive.

The following corrective actions have been carried out:

- Introduction of a standard concept for systematic management of all measuring instruments across the electrical, electronics and mechanical departments. The radiation measuring instruments are managed under a separate programme due to different requirements;
- Extension and alterations of the workshops to provide a separate air-conditioned test bench for mechanical instruments;
- Placing reminder notices at the tool checkout desks that only calibrated instruments are to be used, that tools and instruments must be visually inspected for good working condition and the function of torque wrenches tested;

- Integrating the requirement to use only approved instruments or tools into the contractor briefings; and
- The requirement to use tested tools only is taught in Module 4 "Good Housekeeping" of the VGB programme "Maintenance Culture - Basic Knowledge".

- Recording and clear labelling of all mechanical measuring instruments as far as used in the plant under the same management programme as for the electrical and electronic instruments. This facilitates the tracking of calibration intervals, fault statistics etc. and drafting procedures;
- Drafting the instrument-specific procedures/calibration instructions for the management, testing and tracking of instruments with reference to governance document specifications, manufacturer's instructions or station requirements;
- Traceability of instruments used in maintenance work is assured by the compulsory input field for the unique identification code of the instrument used in the new advanced computerised operations management system BFS-Nuklear. This ensures that the use instruments can be tracked and controlled in the computer. The system has been implemented successfully in December 2006.

IAEA comments:

The plant response to this item was to develop a comprehensive test equipment process that incorporates all three functional areas (Electronic, Electrical and Mechanical) within the Maintenance Department. The first step of this new process was to identify and clearly label all of the mechanical measuring equipment. All electrical and I&C equipment has been identified and clearly labeled. Approximately 75 % of all mechanical equipment have been identified and clearly labeled. It should be noted that no measuring equipment is used in the field without proper labeling. Under the new process, the Work Orders require that all information pertaining to the measuring equipment used should be directly documented on the work order. This includes the calibration report (if applicable). A review of the governing procedure found the process to be well written and robust. A second revision of the procedure (VA 15.01 done in December 2006) incorporates the New Management System (BFS – Nuklear), which allows KKP to integrate the Work Order Process with the test equipment process. During this revision KKP also includes steps that describes what the person performing the calibration should do if he finds a piece of equipment is out of calibration.

It should also be noted that the Maintenance department made significant investments in upgrading their calibration facilities. Each functional area (Electronic, Electrical and Mechanical) has a dedicated calibration room. These calibration rooms have segregated cabinets to allow for “in-coming” and “out-going” calibration equipment. These improvements in conjunction with the procedural changes described above, has heighten the level awareness for the need for traceability and the control of test equipment at the plant.

Conclusion: Issue resolved.

4.3. MAINTENANCE PROGRAMMES

4.3(1) Issue: The results of the predictive maintenance techniques are not being used together on an integrated equipment trend analysis.

The Maintenance organization contains most of the recent non-intrusive techniques used in the nuclear industry to complement preventive maintenance programmes or to support in-service inspections tests (WKP) or equipment malfunction analysis. However these techniques are not been used to optimizing Preventive Base Maintenance and maximizing equipment availability.

- The spectral vibration analyses are not being completely used on all safety related and main important equipment under an equipment trend analysis base. For example, some important equipment (Feed Water Pumps and motors - LAC 10 \ LAC 20, Condenser Pumps and Motors – LCB 10 \ LCB 20 \ LCB 30, compressors, turbine bearings and others) and some safety related equipment (Charge Pumps and motors JND and JNA 10\20, Fan and motors and others) have not been monitoring frequently and under a trend analyses base;
- Oil analysis have been carried out by Chemistry but the results are not being used on the equipment trend analysis;
- Thermovision equipment is available and has been used by the Fire Brigade. This technique is a strong tool to identify " electrical hot points" or "rotating equipment problems". This tool is not used in the predictive maintenance programme; and
- According to Technical Support, these techniques have been used only to identify primary cause of equipment malfunctions.

As confirmed by international experience, the extensive use of predictive techniques could effectively be used to detect earlier defaults and failures of safety related or important equipment and maximize equipment availability and dependability.

Suggestion: Considerations should be given to increase the use and the frequency of predictive maintenance techniques, using the results on a tendency (trend) method analysis with field collected data, in order to increase the equipment availability life time and dependability and avoid unnecessary "preventive base maintenance".

IAEA basis: NS-G-2.6

Para. 7.6: Monitoring the reliability and performance of the plant for ageing related degradation should therefore be a feature of the safety management programme, and an appropriate preventive maintenance programme should be in place.
Para. 7.7: In order to manage ageing process, the maintenance programme should include identification of degradation processes that could adversely affect plant safety and adequate and up-to-date methods for detecting and monitoring ageing process.

Plant Response / Action:

The important thing is to record existing values for trending. This is done within the processes:

- U1.2 System Monitoring – Trending and
- U16.1 Ageing Management.

Process U 1.2 System Monitoring - Trending was presented on 24th October 2005 at the heads of department meeting and given the go-ahead for implementation.

The following procedure is being implemented:
The structure of data management and the data sources are being analysed as part of the development of trend analysis for technical equipment at KKP.
The data for analysis is divided into:

- design base data;
- data for periodic surveillance testing;
- maintenance data; and
- operational data.

Department S has made up a list of existing data inventories at KKP and how they are to be managed. The purpose of the list is to give an overview of the different data archives and find ways of making it easier to locate data.

A concept was developed on the basis of SMS-process U1.2, in which trend data can be saved, updated and tracked more conveniently.
In parallel to this, KKP Department S has generated a periodic test database based on 90 periodic testing procedures, which will be used to demonstrate the evaluation. The database is finished and will be presented in Department S in September 2006.

The results of the system monitoring and trending process with the evaluation algorithms form the basis for the transition from preventive to condition-based maintenance.
This transition is being made incrementally as soon as sufficient information about the performance of individual components, component groups or systems is available.

Part 1, Chapter 9 of the Maintenance Manual deals in detail with the various diagnostic methods available, which are becoming more and more significant. Examples are vibration monitoring, intensity (Siplug) measurements, bearing temperatures etc.

IAEA comments:

The plant revised its policy (Maintenance manual), completed its programmes and developed several procedures to increase the use of result (data) of preventive maintenance, predictive maintenance, calibration data, operational data, using these results for trend method analysis. The project is comprehensive and the steps already implemented show that the approach is good. In that respect the issue is considered by the team as resolved.

The plant developed a major programme already well advanced to collect all data in a same computerized system. Operational data and calibration results will be linked to the new system. When totally implemented this programme will be a comprehensive tool to support also the plant ageing issue.

Conclusion: Issue resolved.

4.5. CONDUCT OF MAINTENANCE WORK

4.5(1) **Issue:** Some weaknesses in maintenance work practices are not identified and corrected by KKP or contractor maintenance supervisors.

a) Weaknesses in maintenance work practices:

- Presently the plant only uses 8 working hours/day of the allowable "out of service (OS)" time for Diesel Generator maintenance. Nevertheless, the team observed that during some hours during the work time, the Diesel Generator 1 and 4 was OS with no maintenance in progress;
- The switch gear was operated with the front door opened;
- Two coats were hung on Diesel Generator pressure instruments and the front RPM measurement mechanism cover was removed and the equipment was left without any protection;
- During the test of a Safety Valve, in the hot mechanical shop, some radiological protection weaknesses were observed;
- Some chemical and flammable products were stored in improper places; and
- Fresh cigarette ashes were observed in several maintenance work places.

b) Inadequate usage of tools

- Screw driver used as a handspike and used to tighten an "allen" bolts; and
- Use of open-end wrench to break the torque and release the bolts.

c) Personnel safety equipment

- Mechanical work without leather gloves;
- Lack of use of Industrial Safety Equipment required by plant policy or Work Order;
- Handling lubricants, fuel oil filters and parts without protection gloves; and
- Maintenance worker together with the TUV inspector, up on a lift machine, not using safety belts.

Use of inadequate maintenance practices could leads to personnel injury or to damage equipment. This could cause potential equipment malfunction and impair the operation of safety related and important equipment.

Recommendation: The Maintenance Organisation should provide sharp guidance and training to the KKP and contractor supervisors in order to identify weaknesses in worker practices. Also, the maintenance managers and supervisors should be actively involved in monitoring workers performance in the field to identify and correct these weaknesses.

Plant Response / Action:

Item 4.5 (1) from the OSART report was raised in the VGB working group of heads of maintenance under the heading, "Weak points in maintenance working practices" and identified as a cultural issue that needs to be debated generally. This prompted the heads of maintenance departments in German and Swiss nuclear power plants, who make up the VGB committee, to set up a joint programme with the title, "Maintenance Culture Basic Knowledge", aimed at defining, promoting and enforcing a standardised and safety based maintenance culture among their own and contractor employees.

In order to achieve the highest possible degree of acceptance among maintenance workers, the issues to be discussed were identified, selected and prioritised together with employees of the individual nuclear power stations.

The issues are:

- Foreign matter exclusion;
- Benefit and use of working documents;
- Use of load lifting equipment;
- Housekeeping;
- Working on contaminated systems;
- Use of tools;
- Handling of spare parts; and
- How to proceed when the situation deviates from plan.

Several one-week workshops have been organised in co-operation with the power station training school (Kraftwerksschule Essen), in which maintenance staff from various nuclear power plants have worked successively through these issues under appropriate instruction from the practical point of view. The results from these workshops are being worked up by order of the VGB Maintenance Heads Committee and made available to the individual power stations in the form of information cards and a poster layout. The first five issues are now fully completed, and work on the remaining topics is continuing and scheduled for completion in the course of 2006.

The information cards and posters are used in the individual locations to ensure a common understanding among their own and contractor staff, to communicate expectations regarding proper conduct and correct working practices, and thus to promote standardised safety based working methods resulting in an exemplary safety culture in maintenance working practice.

KKP internal practice was supplemented using the national and international exchange of experience. Visits to Swiss plants broadened our experience in this field.

A separate method (Contractor Briefing / QA Checklist for Contractor Work) was developed and regularly applied by Department Maintenance (I) during the 2005 outages.

It was presented at the Follow-up Steering Committee meeting on February 24th 2006, is used throughout KKP in connection with all outside contracting and has the following features:

- The contracting firm is thoroughly instructed in a briefing before the commencement of the work about KKP-specific regulations and processes, the focus of the work required and any special external conditions that may be relevant. This briefing is conducted by a staff member of the engineering section that has ordered the work with the works manager from the contracting company. The works manager then passes on the instructions to his own workmen and employees of sub-contractors, if there are any.

- During the execution of work, KKP staff from the engineering section that has ordered the work make random checks based on the "QA Checklist for Contractor Work" according to internal procedure BAW I 030. The checks are carried out during plant walk-downs during outages, short outages, campaigns. There are 25 items on the checklist, giving a "snapshot" of maintenance work. Observations are then evaluated. This method is now practised and documented uniformly across KKP and is being extended from the section management level to the departmental heads / lead engineers.

- The main objective of these checks is to establish to what extent KKP expectations are known, understood and followed at the working level (job supervisor, workers and, if appropriate, contractor personnel). The next stage is evaluation by the section staff or head and communication of the results to the works manager of the company concerned.

- Observations / facts will be communicated according to PDCA and put on the agenda for subsequent contractor safety briefings (e.g. tidiness at depots, validity of measuring instrument certification, industrial safety improvement, storage of material only in permitted marked areas within the plant, etc.).

This is backed up by other independent checks:

- contractor appraisals according to QSA 12.01.01 with the final report from QSÜ (Quality Assurance Control);
- Clean-Team inspections based on internal procedure BAW I 032 with the corresponding final report by the team leader on the outages;
- Special "workflow procedure" audits during maintenance outages; and
- Regular inspections by management staff according to internal procedure BAW S 028.

Together with the CBM consultants, systematic efforts to change mindsets with regard to industrial safety began in Autumn 2005. They were launched with a series of presentations for managers as part of the monthly meeting of department and section heads. The topics were legal principles, managerial responsibility, obligations in connection with selection, instruction and supervision and examples of recent court rulings. This was followed by half-day workshops run by the Group's central department of industrial safety for the maintenance department's workshop managers, FSB and lead engineers within the context of a series of seminars for young maintenance workers.

In spring 2006, the Maintenance Department was chosen as a KKP pilot project to continue the hazard assessments for the permanent workplaces for workshop staff. This hazard assessment was developed in each case by selected experts from CBM together with the workshop managers and staff using the relevant workplaces. A participative approach was used. The results for all the fixed workplaces for IM and IE are now available. The threat analysis is continuing on schedule for all departments and sections.

The corporate goal set for KKP was to reduce the number of reportable industrial accidents by 20 % in 2006. This goal was broken down to the workshop managers as part of their agreed goals. In addition, more people were appointed to the Health and Safety Committee (ASA) and trained for this work at courses run by the Employers' Liability Insurers.

The issue of reducing accidents was put on the agenda for the contractor briefings during power operation and KKP1 and KKP2 outages. To this end, some of the industrial safety experts from the contractor companies came to KKP for internal briefings in support of their works managers before the outage began. In major projects involving more than 50 people, one employee was released from other duties to act as the safety expert. This issue is also an item on the QA checklist for contractor work according to BAW I 030 under the heading "PPE/Accident Prevention/Fall Protection", indicating that the current positive development in accident figures is the result of systematic effort.

IAEA comments:

In developing the resolution to the issue, KKP management first solicited the input from the individuals performing the work. This solicitation of the workforce seems to have increased the ownership of the processes that were put in place to strengthen the work practices at the station. An example of this can be seen in the development of the “Basic Maintenance Knowledge” material. To increase the ownership of this material, KKP had discussions with those who were actually performing the work. During these discussions the issues were prioritize by the workforce to ensure that the most important issues were addressed first. Based on the results of the prioritization, several one-week workshops were held, in which maintenance staffs from various nuclear plants (in Germany and Switzerland) discussed and developed appropriate instructions to assist in strengthening the work practices at each station. Currently there are 5 information cards that discuss management expectations and examples of good practices in areas such as Foreign Material Exclusion programme (FME). These information cards are consistent and are in use at all nuclear stations in Germany and Switzerland. Over the next year, the number of topics contained within the Basic Maintenance Knowledge package is expected to increase.

KKP has also increased their oversight and guidance provided to the contract personnel used at site. All contract personnel are required to read and understand a “KKP orientation package” which includes procedures and KKP management expectations for the work performed on site. In conjunction with these “orientation” packages, KKP personnel complete a detailed check list for all of the work performed on site. An independent review of the performance of the contract organizations are performed by Quality Assurance Control, which reviews a subsection of all contractors’ performance on an annual basis.

This increased attention of maintenance work practices has increased the level of focus by KKP management in this area.

Conclusion: Issue resolved.

4.5(2) **Issue:** A Foreign Material Exclusion (FME) process is not followed properly and consistently applied on permanent FME posted areas.

Although the plant has a programme for Foreign Material Exclusion (FME), this programme was observed focusing plant equipment and not be consistently applied in permanent area such as close to the spent fuel pool.

- Several pieces of equipment and parts covering by yellow plastic and packaging were found on the spent fuel pool elevation. Some of them were fixed by tapes or ropes and others were loose;
- There is a spot light covered by transparent plastic near the spent fuel pool monitoring camera;
- A small plastic fasting belt was observed near the fence of the spent fuel pool;
- An iron nail, plastic and paper dirt were observed in a floor cable penetration;
- Two maintenance workers were inside of the spent fuel pool posted area, with a pencil in their pockets, with badges hanging out and one of them with helmet. To go in FME area, the maintenance supervisor asked the team to close all pockets and use a yellow piece of tape to fasten the zipper. The workers were not following this procedure;
- Some small pieces of plastic and paper were found close to the manipulator crane rails; and
- There is a lot of plastic, paper and silver tape on the manipulator crane and on the floor.

Improper FME implementation in permanent FME posted areas could lead to equipment damage and may cause safety consequences.

Recommendation: The plant should make necessary improvements in the FME process in order to consider permanent FME posted areas and meet IAEA safety standards and good international practices.

Plant Response / Action:

In 2005, German and Swiss plants shared experiences in a fact-finding process for action at KKP. The result is that VGB is preparing a campaign of "Basic Maintenance Knowledge", which includes foreign matter exclusion (Module 1).

Based on the exchange of experience, the existing specifications according to operational procedure BAW I 032 are deemed to be sufficient for purpose. The important thing is that station and contractor staff need to be informed in good time about the existing requirements and expectations, and to enforce compliance with them.

Specific precautions against foreign material exclusion (FME) from open systems have been in place at KKP for many years. The Maintenance Manual makes the job supervisor (AvO) responsible for FME. This is also communicated during briefings of contractor works managers and documented. Metal covers, bolted connections or fabric flange covers are obtainable from the tools counter in various sizes.

In 2003, extra final checks for FME in safety related systems were introduced during outages. They are conducted by the Clean Team independently of the job supervisor (AvO).

Depending on the extent of the activities and the unit concerned, the "Clean Team" is made up of about 6 - 10 employees. As well as carrying out the final checks before closing safety systems, the "Clean Team" has other monitoring functions. These include monitoring compliance with internal regulations, requirements for the use of personal protection equipment, industrial and plant safety instructions and housekeeping in work areas.

Every inspection is accompanied by the relevant documentation in the work order in the integrated operations management system. After the outage, the individual reports are analysed and evaluated. Conspicuous deviations, problems or irregularities pointing to particular contractors or jobs are summarised in the final report with possible optimisation measures, including the allocation of responsibility for implementing corrective action.

The Clean Team has proved its worth over the past three years and has become a recognised institution within KKP. See Report of Experience from the 2005 outage KKP 2 (Nr. 211-08-2005)

Special notices have been posted in the vicinity of the 21.5 m level in the reactor building, where the fuel pool is located. They urge workmen to take the utmost care with regard to FME in this sensitive area of the power plant and show photographs to remind all employees of expectations when entering this zone (dress code: no hard hats, pockets zipped up, no unsecured tools, masking tape over zippers).

In addition, other walk-downs are carried out throughout the plant by external personnel, including unannounced inspections to check the efficiency of the station's own monitoring and actions:

- VGB –SBS (DNV and station staff);
- Scientech;
- Regulatory Focus of the local regulator;
- Ketag walkdowns (Independent Technical expert); and
- Audit by EnKK focusing on contractor management during 2006 outage.

IAEA comments:

KKP has made significant steps in this area. The first thing that the management team did was to involve the maintenance workers in determining how to increase the focus on Foreign Material Exclusion programme (FME). Through this process the maintenance department developed a Basic Maintenance Knowledge module that discussed FME. This module not only discussed good practices but also discussed the management expectations in this area.

KKP also introduced an additional "barriers" to exclude foreign material for safety related systems. During outages, a Clean Team performs independent checks for foreign material when maintenance or modifications are performed on safety related systems. One of the additional benefits of having this dedicated team is that other workers at KKP see the high level of management commitment to FME.

All members of the OSART team commented on the high housekeeping standards that were seen through the plant during their respective plant tours. Specific attention was given to the 21.5 m level area in the reactor building (fuel pool area). This area was also found to be well maintained and workers within the area appear to be following good work practices to minimize foreign material from entering any of the plant systems.

Conclusion: Issue resolved.

4.6. MATERIAL CONDITIONS

4.6(1) Issue: Lack of management of material storage control could affects the Material Condition and Housekeeping standard and in specific cases could impair the operation of safety related equipment during a seismic event.

External areas and Auxiliary Buildings:

- Some pallets with parts and iron plates were stored in front of the warehouse (around the street) without identification and around the safety coolant pumps building (1UQB);
- Cooling Water Intake Building (UPC);
- There are spare parts, some circulation oil equipment, wheeled carts and tools, inside of the Cooling Water Intake Building;
- Turbine Building (UMA);
- Tools and spare cabinets, work benches and wheeled carts are stored around the Turbine building;
- Some gas connections hoses were found near two hydrogen pressure cylinders;
- A section of a tube was found on a metal structure on the turbo-generator elevation; and
- A cleaning machine was released without identification, near the generator sealing oil pumps and heat exchangers;

Regarding Safety Related Equipment:

- Reactor Containment (UJA), Containment Annulus (UJB) and Nuclear Auxiliary Buildings (UKA):
- In the containment building there are pallets, scaffolding, wheeled carts, parts and non attached work benches, on the spent fuel pool elevation;
- There are wheeled carts, cabinets, a weld machine, forklift, some boxes, pallets, crane rails, mobile exhausters, loose and most of then with no identification, close to the “Charge Pumps and High Pressure Injection Pump”;
- There were tables with PC’s and a bench near the personal lock entrance; and
- There was a table loose with a ash-heap on it and an aluminium ladder behind the main control panel on the Main Control Room.

A large amount of material was found improperly stored in the external areas and plant Buildings. In most cases this material is identified, organized and secured by strap or chain or permanently fixed on the wall. However some of them are disorganized, loose and without identification, indicating that there is no strongly managed process or expectation for the control of material storage in these areas, leading to a low housekeeping and material condition standard commitment.

Some of these materials were found in the Auxiliary building, annulus, Reactor Containment and Main Control Room, close to safety related equipment and could lead to important or safety related equipment damage during an event (earthquake);

Recommendation: The plant should improve the staff knowledge with plant seismic design bases, in order to avoid equipment malfunctions caused by improper material storage impacts during an earthquake.

Plant Response / Action:

As part of the "Basic Knowledge Maintenance" project, Module 4 "Housekeeping" the information cards and posters were used at KKP to assure a common understanding among the station's own and contractor staff. Expectations with regard to correct behaviour and working practices were communicated in a practical manner, thus ensuring a standardised and safety orientated procedure and thus an exemplary safety culture in maintenance. Particular emphasis was placed on tidying up the workplace after completion of the job and leaving the plant clean and tidy.

In parallel to the action within the project "Storage of Mobile Equipment in Safety Relevant Buildings" and the drafting of internal procedure BAW S 156, training content and courses were planned and implemented to teach the subject matter and results of the project and internal procedure BAW S 156 itself.

The subjects for training are:

- Forms of earthquakes with relevance for plant design base;
- Earthquake design for the relevant installations; and
- Principles of storage in earthquake sensitive areas.

Training courses have been given on six dates so far.

Employees from all departments took part in the training. A repeat of the training sessions is scheduled within the 2007 programme. Contractor staff is informed by the technical departments concerned as part of the contractor safety briefing.

IAEA comments:

The training information package that was provided to the KKP plant staff with respect to seismic events was reviewed. The material was found to provide a good foundation on basic concepts of seismic events as it pertains to the KKP plant.

KKP also developed a Basic Maintenance Knowledge module (Module 4) which discussed management expectations and good practices in the area of “Good Housekeeping”. This Module discussed the good housing practices that should be implemented during and after any maintenance activity. The module also included management expectations of the use of proper tools and materials at the workplace.

Conclusion: Issue resolved.

Suggestion: The plant should consider to develop a material storage policy and programme to improve the requirement to keep equipment, spare parts and material stored and organized in the plant, in order to avoid impacts on the material condition and housekeeping standard.

Plant Response / Action:

Section KKP-SZ established and executed a project, in which

- a basis was developed for the assessment of the situation in the plant and the execution of corrective action;
- tours of inspection were carried out to observe the situation in the field and define corrective action;
- spaces where storage is permitted in KKP 2 were visibly marked;
- stored equipment was secured;
- departments IM/IE/US have moved equipment in KKP 2 from areas where storage was not permitted; and
- the respective areas and the corrective actions were documented in the building plans.

This was the basis for drafting operational procedure S 156 "Plan of Storage Spaces for Mobile Equipment in Safety Relevant Buildings", which is now complete and was released on 8th May 2006 for implementation.

IAEA comments:

Procedure BAW S 156 was developed to document the process to ensure that all portable equipment in the plant was thoroughly evaluated and that proper mechanical devices were attached to these pieces of equipment to ensure that they would not damage safety related equipment during a seismic event. KKP also dedicated “lay down” areas (marked in yellow tape), that could be used as equipment storage areas. These areas were determined to be safe areas in which equipment would not have any negative impact on safety related equipment during a seismic event.

A plant tour was conducted to review the applications for this new process. All portable equipment reviewed was found to be adequately labelled and secured to permanent structures.

Conclusion: Issue resolved.

4.8. SPARES PARTS AND MATERIALS

4.8(1) Issue: The plant does not provide the necessary guidance for the warehouse personnel to ensure proper compliance with the procedural requirements in order to deal with handling flammable and chemical materials and spare parts storage.

- In the warehouse, some freshly received parts are stored in the same room as the released parts. (Limit switches, bolts, studs, hydraulic shock absorbers – 19354, Switch Gears – 34273, Electric Control units – 34309);
- The person responsible for receipt inspection and for implementing the storage process has his working place inside of the receiving area and materials warehouse. Some parts waiting for inspection or documentation release are too close to his post (Measurements transducers – YB12T61A007, Iskamatic modulo for motors – YB31T030 and others);
- Some spare parts designated as "received" are stored without the receipt tags or official identification (Rubber Welt without released tag and hand written identification – ID00R010030, Ceramic Gaskets without released tags – ID00R050080, ID00R050060, ID00R050150);
- Roller bearing storage processes do not following supplier recommendations and the best industry practices. The process in place to periodically inspect and maintain spare parts has not been used for bearings in storage. Some bearings are stored for long time with package opened or violated. (446295D – SKF manufactured on 1980, 054207 – SKF manufactured on 1984, 2128952 SKF manufactured on 1991, 51213 - SKF manufactured on 1987);
- Some other facts regarding handling of flammable and chemical products are considered in to the Chemistry area.

The improper handling of flammable and chemical materials or the use of inappropriate spare parts may cause personnel injury or affect the operability of safety related equipment.

Suggestion: The plant should consider providing clear guidance for the warehouse personnel to ensure proper compliance with the procedure requirements in order to deal with handling flammable and chemical materials. Regarding adequate maintenance of stored spare part, the plant should re-consider the procedures for the process of testing and maintaining spare parts.

IAEA Basis:

NS-G-2.6: Para. 8.30: A separate and secure quarantine area should be provided for temporary retention of stocks not cleared for final storage and issue.
More detailed information on storage could be found in 50-C/ SG-Q13 para. 406-419

- relief valves, motors and other equipment are stored on their bases,
- machined surfaces are protected,
- parts, materials and equipment are repackaged, or protective caps reinstalled to seal items on which previous packaging or protective caps have deteriorated, or been damaged or lost while in storage…
- equipment internals are protected from the ingress of foreign materials, and
- There is suitable segregation of safety related and non-safety related components.

Para 412: Preventive maintenance of items held in storage should be performed on items such as large pumps and motors, including periodically checking energized heaters, periodically changing desiccants, rotating shafts on pumps and motors, changing oil on rotating equipment, and other maintenance requirements specified by the vendor.

Plant Response / Action:

In response to this suggestion, KKP revisited the processes/procedures for goods reception into the stores and the issue of goods from stores. These procedures provide for different areas for different flows of goods. A separate area exists for outgoing goods by analogy with incoming goods. In the goods reception area, incoming material is unpacked and inspected. Accepted material is labelled and moved to the warehouse area. Material is not allowed to be issued directly from the incoming goods area.

The quality management manual contains two processes for incoming and outgoing goods. They form the basis for process U12.2, stores organisation:

- Process VA 12.02 for goods reception checks in the SETs; and
- Process VA 13.01 for outgoing goods.

VA 12.02 specifies, among other things, that individual materials are marked with the appropriate clearance labels after reception checking and approval by the quality control staff. Consequently, goods not labelled with the appropriate marking are blocked and may only be issued for use under the conditions stated in the process procedure. The release label makes the status unambiguous.

The same applies to goods that have already been accepted into the stores, from which the label may have come unstuck or got lost. By analogy with newly delivered goods, any such material will be deemed not to have been cleared and will not be issued for use until it has been properly checked and cleared by the quality control staff.

Reception of spare parts into stores:

Instructions to stores staff for storing and handling ball bearings consist of signs in the storage area telling them:

- how the ball bearings are to be stored;
- how they are to be taken out of the stores;
- what kind of packaging to use; and
- when ball bearings are to be scrapped.

Acceptance into and removal from warehouse of hazardous materials in the chemicals store in UST building.

Work procedure L 0024 governs the acceptance and issue of hazardous materials in the chemicals store in UST building.

In addition, a written operational procedure for each individual material is posted at the corresponding position in the store, describing how to handle the particular hazardous substance. The operational procedures are currently undergoing review and updating.

In the annual refresher training on the accident prevention regulations (UVV), one of the recurring subjects is the correct handling of hazardous materials. In addition, a revision course is given every two years by section UC.

IAEA comments:

Large effort was made to respond to the issue developed by the OSART team. The warehouse is better organized and areas are marked. Nevertheless separate and secured areas were not in place to ensure that equipment in the receiving area, that needs technical or QA controls, cannot be mixed with equipment already qualified for storage.

Labelling for equipment to be stored is adequate and well applied.

The warehouse is well organized, housekeeping and cleanliness is very good.

Packaging is correct, storage is done properly.

The ingress of foreign materials programme is not fully done in a consistent manner in the storage area for pipes, valves and electrical equipment such as motors for valves, valves, piping, tubing, etc… The plant management should still re-enforce its expectation in this area and look for more consistency in the application of the programme.

Conclusion: Satisfactory progress to date.

5. TECHNICAL SUPPORT

5.1 ORGANIZATION AND FUNCTIONS

The Technical Support area is comprised of six (6) technical areas. The 5 of the sections reviewed in the Systems Engineering (S) department were: Nuclear Systems (SN), Conventional Systems (SK), Electrical System (SE), Cross Section Electrical (SQ), and General Service System Engineering (SZ). The Physics (UP) section of the Surveillance department (U) was also reviewed.

Note: In this report, for simplicity the term System Engineer will be used for any engineer that was reviewed, including the physics area.

Staffing levels was found to be sufficient. KKP is able to attract new graduates from Universities into the System Engineering Department. It is estimated that over 25% of the engineering staff have from 0 to 5 years experience.

KKP has a strong commitment to Knowledge Management. KKP has a policy to have a 2-year period in which new staff is teamed with an individual who is leaving the company. These two years allows the new individual to acquire the design basis knowledge for the particular system/equipment that he/she will be responsible for. Although this may not be possible for all organizations, it is viewed as a positive attribute. Based on the interviews preformed, the team recognizes that the System Engineering (S) department has an adequate level of experience to perform its required duties. To supplement this knowledge, (S) has invested in such programmes as Condition Oriented Aging Plant Life Monitoring System (COSMY) and Aging Management Programme. Both of these programmes were judged as Good Practices and a description of these programmes can be found in the Good Practice section of this report.

Engineering [(S)+(U)] does not currently have any department goals, objectives or performance indicators. This was identified as a weakness by KKP before the start of the OSART mission and Engineering is currently scheduled to train on the new objectives in November of 2004.

Qualification of contractors is covered by regulation KTA 1401. All system engineers that were interviewed in this area demonstrated a good understanding of this procedure.

The System Engineering training processes and practices were reviewed. The training and qualification of each engineer is reviewed each year with their respective section head, during their personnel performance meeting. Responsibilities, levels of authority and career plans are also reviewed at this time. The team also interviewed engineers from the Cross Section Engineering (SQ), who were formally trained in project management process. The engineers that were interviewed demonstrated a strong understanding of project management techniques.

Plant management is committed to engineering activities. This can be seen in the amount of funding that [(S)+(U)] receives to investigate engineering issues. An example of this level of commitment can be seen in the work that was done to determine the fracture mechanism for the cooling water line in KKP1 that was found in 2002.

Based on interviews with KKP staff, the team recognized that there was good interaction between Senior Plant Management and Engineering [(S)+(U)]. They commented that each month all section heads and directors meet to discuss nuclear safety issues. This meeting is called the "Working Circle for Safety Questions", and the meeting attendees include department directors and section heads.)

5.2 SURVEILLANCE PROGRAMME

The team reviewed the preventive maintenance and periodic test programme. These two activities are governed by the Maintenance Handbook and the Handbook for tests on safety related components respectively. VA 11.06 describes the workflow for all periodic test procedures. Both programmes looked robust and complete. Physical work that is required to be performed for these tests is administratively controlled through the KKP work control process. This ensures that all testing is sufficiently organized.

Based on interviews with the system engineers, the review team recognized that the engineering staff had good understanding of their administrative procedures. It is suggested that the actual acceptance criteria value be included on the acceptance sign-off sheet to prevent any human error.

System Engineers provided visible evidence, of the tracking, trending and analysis test information for their respective systems. All systems engineers that were interviewed had a sufficient amount of trending data available for their respective system. The team found that the important information that was received during the test was trended by the System Engineer.

The system engineers were found to be alert and proactive. The following is an example that supports this statement. In this example, the system engineer was trending an unexpected level of heat energy being input into Pressurizer Relief Tank. The system engineer realized that this was a deviation from the way that piece of equipment should be operating and took the correct steps to resolve the issue.

All test procedures were found to have a sufficient level of review. In the majority of tests, an Independent Expert (assigned by the regulator) is involved in development of the test procedure/work order and the evaluation of the test results. Regulatory authorities are notified of a special test based on the criteria that is in place in the work order process.

5.3 OPERATIONAL EXPERIENCE FEEDBACK (OEF) SYSTEM

The operational experience feedback system at Philippsburg 2 NPP is based on the reporting of events and other shortcomings, their screening, investigation and taking corrective actions. Processes and working practices are described in the procedures. The corresponding departments and sections coordinate and implement the evaluation results of experience from operation, maintenance, trend monitoring as well as internal and industry events and official bodies.

Internal events such as deviations, failures, damages and other irregularities are entered into the IBFS database. Equipment reliability is trended based on the IBFS data and equipment test results on a superior level.

The plant has a voluntary reporting system since 1996, which is dedicated to report personnel errors to a man factor analyst. Recently the voluntary reporting system was stressed again to the plant staff. However, the number of voluntary reports, as compared to international standards, is very low. Some of the interviewed personnel were not aware of the voluntary reporting system.

The near miss programme has not been specified yet at the plant.

Results of event analysis and external information are discussed during meetings of the Safety Committee, which approves corrective actions needed to prevent repetition or occurrence of events. Composition and responsibilities of the Safety Committee should be described in more detail within the procedure.

Statistical review of the operational experience feedback process is periodically done. These reviews, however, do not include recommendations for further improvement based on comparisons to adverse trends, thresholds, targets and other benchmarks. The large amount of information contained in the IBFS database, industrial safety database, and information from event analysis are evaluated separately, but they are not evaluated in common manner to trend human performance problems.

Criteria for low-level events have not been established yet. Trending of events considered as low-level is not being done on a regular basis.

The information accumulated in the OEF databases provides a good basis for evaluation of corrective actions effectiveness to eliminate recurrent events. Application of processes such as evaluation of corrective action effectiveness, prioritization, control of corrective action implementation (corrective actions taken based on internal analysis of events) should be developed further.

External operational experience feedback includes thorough screening of events from the nuclear industry, dissemination of this information to relevant departments, evaluation for applicability and developing corrective actions to prevent reoccurrence if required. The following sources are actively screened for applicability: VGB reports, WANO reports, FANP evaluations, GRS-WLN, GRS/BfS reports, GRS quarterly reports (in these reports the IRS reports are included), GRS annual foreign reports. However, WANO SER and SOER recommendations are only reviewed for technical applicability. These recommendations could be reviewed further to include lessons learned into personnel work practices and plant processes.

Regarding personnel work practices, the procedure does not provide personnel with key questions to openly discuss in pre-job briefings, such as familiarity with the task, critical steps of the task, human factors issues, defenses in place to help prevent errors, previous lessons learned while doing similar works etc. Interviewed personnel differed in explanation of the pre-job briefing meaning.

Best practices in the world include use of lessons learned from previous events in work preparation and pre-job briefings to increase awareness of personnel on potential human related risks. This practice is not described in procedures. As a result, personnel may not apply use of lessons learned from previous events in pre-job briefings.

Without an effective near misses programme, trending of low-level events and human performance problems, process of evaluation of corrective action implementation and their effectiveness, and benchmarking of operational experience feedback practices a chance to avoid occurrence of events or their repetition could be lost. The mission believes that the improvements, that are necessary to the corrective action programme, require the attention of the management team as a whole. Therefore the recommendation has been included in the Management, Organization and Administration section (see 1.2. for details).

The team observed a strength in the area of learning from experiences following an outage. The whole staff is encouraged to report problems, including human performance related, experienced during the annual outage. Since the whole staff can participate in the post-outage debriefing, this increases their awareness of the experienced problems and they have prompt feedback, how problems reported by them are solved.

5.4 PLANT MODIFICATION SYSTEM

Modifications are classified into four categories A through D to reflect their level of safety significance. Responsibilities and individuals that are needed to authorize the modifications are well understood.

All installation activities associated with the modification are well documented and understood. The inspection requirements for all safety significant modifications are developed and then discussed with the independent authority.

However, there is no Temporary Modification procedure within the engineering [(S)+(U)]. Operations Working Procedure B2 07 governs temporary modifications. Operations do review the list every month to ensure that Temporary Modifications are kept to a minimum. From the review of the procedure, the team recognizes that the procedure contained a sufficient level of control (e.g., minimization of temp. mods. and reduction of time that the temp. mods are in place.) to ensure that temporary modifications were not in place for an extended period of time. Never the less, it is recommended that KKP investigate if this Temporary Modification procedure should be made into a procedure that is similar to the Engineering Modification procedure. It is also suggested that these modifications be clearly identified as Temporary Modification. The intention of both of these suggestions is to ensure that Temporary Modifications receive the same level of review as a permanent modification. More discuss of this issue can be found in the issues section of this report.

All modifications reviewed received a high level of engineering review. The Independent Expert reviews all safety significant modifications. However, the team does suggest KKP review the amount of challenge these modifications received with respect to Nuclear Safety. Based on international practices, it is suggested that all modifications to be reviewed by a Nuclear Safety Committee, that interrogates the modification to ensure that there is no negative impact on nuclear safety. The equivalent to a “Nuclear Safety Committee” for KKP is the Modification Committee. This committee meets every two weeks to review proposed and active modifications. It is suggested that KKP determine if this committee has the correct level of expertise to interrogate the nuclear safety aspects of the modification and the committee clearly understands that the members should be reviewing the nuclear safety significance of the modifications. (See the issue section for more information.)

The team did ensure that the appropriate level of training was completed for those effected by the modification, before the modification is released. In the modifications reviewed, all operations shifts are trained and qualified prior to the modification being released.

5.5 REACTOR ENGINEERING

The Reactor Engineering organization within KKP is the Physics (UP) section. The section was found to be highly trained and motivated. All personnel were found to have university technical degrees and received additional specific training while at KKP.

The majority of tasks within the Physics section are contained in procedure U 518 (General Plan for Refueling). This procedure describes the responsibilities not only of KKP but also the responsibilities of the supplier organizations, the Independent Expert and the regulator.

The Physics section was found to be very proactive. An example of this was the work that the section has done in evaluating outside operating experience to determine if KKP had similar issues in the area of rector physics.

The Physics section has been very proactive in developing additional computer software that will assist in the reactivity management of the core. The action goes beyond what is required by regulation, to ensure that the operation of the reactor is safe. An example of this can be seen with the development of the CAPHAS programme. This computer programme calculates the theoretical K-eff during proposed fuel assembly movements, to ensure that there is sufficient negative reactivity in the core during fuel movement. This programme also has an algorithm that ensures that grip strap to grid strap interaction between fuel assemblies is minimized, thus minimizing the potential for fuel damage.

5.6 FUEL HANDLING

It should be noted that foreign material control in the fuel handling area is covered in the Maintenance Section of this report.

The team determined that KKP has sufficient control of heavy loads in containment. These heavy loads are controlled by procedure S 101. Interviews with personnel in this area indicate that this procedure was comprehensive and robust. New fuel assemblies are checked using procedure QSA 12.03.01. This procedure requires the checking of the shipping container, seals, fuel and documentation to ensure that they are all satisfactory.

Procedure U 505 describes the administrative control that is used to minimize the possibility of fires and floods in the storage areas. Entry into the storage room is restricted to ensure limited access into the room.

The team did determine that there might be a weakness with respect to the limited knowledge of reactivity management by the individuals responsible for fuel movement. A human factor suggestion was made to KKP to increase the level of independence of the verifier during fuel movements.

It should be noted that KKP has incorporated an additional barrier into the refueling machine to prevent improper fuel movements. Prior to the start of the outage, the core loading pattern is loaded into the refueling machines computer. This computer programme will follow the core loading and prevents loading steps that are incorrect or out of sequence. This “electronic interlock” should stop a majority of wrong fuel assembly movements.

5.7 COMPUTER APPLICATIONS IMPORTANT TO SAFETY

KKP have undertaken two major modifications in the information technology area. The first is the GRETA project, which will replace the process computers by 2005. The second is the READIG project, which will replace the equipment, used for reactor control, limitations systems and LVD measuring channels with TELEPERM-XS. The team found the project managers of these programmes competent in the aspects of project management.

The team recognizes that KKP ensures that all third party software is sufficiently reviewed prior to release of the software to the plant. All third party software used at the KKP is controlled for release by an EnBW corporate function.

Procedure VA 11.02 describes the process for controlling changes at the plant. All safety related computer programme changes are also processed through the plant modification process.

As stated above, the KKP staff reviews any safety related calculation that is performed by external vendors. In some areas, such as Physics, the section maintains independent computer programmes that allow KKP to check the calculations. This practice should assist in identifying any errors in vendor software.

KKP FOLLOW-UP SELF ASSESSMENT

During the OSART Mission, the Technical Support area was reviewed with regard to technical competence and organisational functions. "Technical Support" as practised at KKP was measured against international practice and standards.

Open and constructive dialogue with the OSART reviewers during the presentations gave us valuable hints for further improvements in actual cases.

We have now examined these hints and integrated them to a high degree into our internal regulations and work practices e.g. the procedure for initiating and tracking temporary modifications or the training units for reactivity checking during fuel handling.

The technical support in nuclear power plants is constantly developing all over the world. In addition to the specific subjects discussed, we also gained a comprehensive view of these developments. As a result, further thrust was added after the OSART Mission to our self-critical re-think and optimisation of the processes and practices in use at KKP.

The measures derived and implemented directly from the OSART Mission, and having our attention focused on international developments in technical support have made a lasting contribution to the optimisation of KKP's safety status.

STATUS AT THE FOLLOW-UP VISIT

In 2004, the OSART team found that KKP had a strong commitment to engineering. The two areas of weakness that were found were in the areas of control and review of Temporary Modifications and limited reactivity management knowledge and experience for those personnel directly involved in fuel movement operations.
These two weakness areas were reviewed and found to now meet IAEA standards.
During the review of the Temporary Modification process, significant improvements have been made to ensure that all modifications receive a through nuclear safety review. One of improvements is that KKP now requires that the Safety Issues Committee reviews all complex nuclear safety related modifications. This new requirement ensures that these modifications, receive a board and through review from the KKP respective experts. Steps have also been put in place to ensure that Temporary Modifications receive the same level of review as permanent modifications.

In the area of Criticality Safety, Engineering has developed a comprehensive training programme to increase the knowledge of those involved with nuclear fuel movement. The training course is provided before every outage and incorporates recent refuelling Operating Events (OEs) at other nuclear plants since the last outage. This was found to be a good practice.

In summary, the Engineering Department has sufficiently addressed the one issue and one suggestion that were identified in the 2004 OSART mission.

DETAILED TECHNICAL SUPPORT FINDINGS

5.2. SURVEILLANCE PROGRAMME

5.2(a) **Good Practice**: KKP Engineering has implemented a holistic approach for the aging management of their equipment.

Aging management is an area that all nuclear power plants have to deal with. KKP have developed specific aging management reports for critical components. These reports contain information on the current state of the equipment and are updated periodically. The reports contain such items as, testing and inspection results for that period, operational transients that component may have experienced, and other relevant information.

These reports are then discussed with a group of component engineers in the respective areas (NDT, systems, fatigue, radiation damage..) within KKP to determine how the current information impacts the condition of the component. They then determine if any thing should be changed with respect to that component (e.g., more NDT testing) to ensure that the component will meet its intended design function.

Another benefit of this report is that it contains all of the historical information for that component. This is a very valuable tool in preserving the knowledge base for the plant.

5.2(b) **Good Practice:** To preserve the knowledge of the components and piping of the plant, KKP has developed a computer data base that describes all piping and related component information for all safety related systems.

To develop this database, KKP initiated a programme to verify their documentation was in line with what was physically installed in the plant. This verified information was then loaded into a computer database for easy retrieval.

The objective of this programme is to have faster access to the current design basis of the plant, when carrying out maintenance and introducing modifications. The database provides the engineers with status of piping systems and their connections (including geometry, material composition and related calculations.) This ensures that engineering has the correct information on what is current design basis of the equipment installed in the plant.

This programme, combined with similar programmes such as the pipe flange database, allows KKP to have a strong understanding of the components in the plant. Evidence of this strong understanding can be seen in the material condition of the plant (e.g. limit amount of plant leakage and no evidence of use of temporary sealant to stop leakage).

An additional benefit is that this programme provides a good source of information for less experienced engineers. This provides KKP with a good knowledge management tool in maintaining its knowledge of the plant.

5.4. PLANT MODIFICATION SYSTEM

5.4 (1) Issue: All changes to the plant (modifications) are not prepared and reviewed in a consistent manner.

At KKP the plant Modification Committee reviews all modifications, but not Temporary Modifications. Focus of the committee is to ensure that the personnel performing the modification are qualified. The committee does not focus on questioning the nuclear safety aspects of the modification.

Temporary modifications are controlled by Operations and are not processed using the modification procedure. The review team also found a temporary modification that was not controlled by Operations.

In all modifications (reviewed) at KKP2, there was not sufficient review of the nuclear safety aspects of the modification by a group of individuals with sufficient knowledge of the design/licensing basis of the plant and who were also not directly involved in the modification.

Additional weaknesses that were identified in the modification process are:

"Changes to the design bases that received sufficient engineering review, but did not go through the modification process".

- Modification to change the maximum temperature allowed for the Ultimate Heat Sink (river) from 27 deg. C to 29 deg. C.

"Temporary modifications that did go through the temporary modification process but the modification package did not seem to be complete."

- During the review of the temporary modification that allows KKP to obtain radiological samples from the turbine building wastewater, only equipment drawings and schematics were found. No drawings for the temporary structure that contains this equipment was found No markings were found on the temporary structure that would identify the structure as a temporary modification;

Temporary modifications that were reviewed by implementing organisation, but did not go through the modification process:

- Modification that install a temporary covering over ("balloon") over the reactor cavity. This modification was performed by the Radiation Protection department and did not go through the modification process.

Modifications to KKP should receive the same level of review as the original design to ensure that after the modification is completed, the plant operates as designed. Improper review of modifications could lead to a modification that has a negative safety impact on the station.

Recommendation: KKP should ensure that all changes to the plant are prepared and reviewed in a manner consistent with international standards. Aspects of this process should include, but not limited to, a review of the nuclear safety aspects of the modification. The review of the nuclear aspects of the modification should include a review by individuals with sufficient knowledge of the design/licensing basis of the plant and these individuals should not be directly involved in the modification (i.e., Nuclear Safety Committee).

IAEA Basis:

IAEA Safety Guide (NS-G-2.3) states: 7.12 “A commissioning report… should be approved by the plant management and/or the plant safety committee and/or the commissioning committee and/or the regulatory body as appropriate.”

INSAG-18: 21. “For major changes, and those with significant potential to affect safety, boards of directors and executive management need to satisfy themselves that the safety implications of changes have been fully a satisfactorily addressed.”

IAEA Safety Standard NS-G-2.3 states: “The procedure for obtaining approval to implement a temporary modification should be the same as that for a permanent modification.”

IAEA Safety Guide (NS-G-2.3) states: Temporary modifications should be clearly identified at the point of the application and at any relevant control position.

Plant Response / Action:

Modification procedure

The duties of the Modification Group have been redefined to focus more clearly on nuclear safety checking and the possibility of delegating some work to the Internal Nuclear Safety Committee deploying a testing team. The Modification procedure in the Operating Manual and internal procedure BAW U001, "Plant Modification Procedure", have been supplemented in this context.

The Modification Group will determine what safety related aspects must be considered and who will review them, starting in the early stage of the approval procedure for the proposed modification.

Temporary Modifications

Temporary modifications are those which, for reasons of urgency, have to be entered into the control room documentation (according to control room procedures WSO) and/or the plant before the official modification procedure is processed according to the written rules (ÄO) and operational procedure BAW U 001. Temporary modifications are time limited. Modifications pre-defined in written operational procedures, such as simulations of LPRM signals or limit value simulations needed for periodic testing are not covered by the term.

In principle, temporary modifications undergo the same stages of examination as permanent modifications. However, the process is substantially speeded up so that it can be completed in a short time.

Modifications in written internal regulations follow process U9.3 for control room documentation management. The following operational procedures (BAW) from the B1 and B2 departments govern the introduction of red entries in the control room documentation (definition of scope according to the control room and shift procedures WSO):

- BAW S 002: "Document handling; signature rules";
- BAW U 001: "Plant Modification Procedure";
- BAW B 004: "Format specifications for the revision of Operating Manual chapters";
- AAW B2 0001: "Checking, replacement and filing of work documents by the Operations Office BB2";
- AAW B2 0005: "Amendment and updating of the Operating Manual (editorial guide)";
- AAW B1 031: "Place for filing Operations documents such as:
  - Operating Manual including system operating instructions, functional flowcharts, system diagrams, fire safety plans and electrical circuit diagrams".

Modifications in the plant

If it is necessary to introduce Temporary modifications in the plant, the "Temporary modification" form is filled in and presented in the Modification Group.
After approval by the Modifications Group, the modification is introduced into the plant using a work order under the terms of the Maintenance Procedures. Section SZ is in charge of managing the Temporary modification numbering.

If it is necessary to introduce a modification in the plant immediately, the Temporary Modification form is filled in and given advance clearance by the shift supervisor. The Temporary Modification form is presented in the Modification Group on the next working day. The Group can be convened immediately after the morning meeting.

The Modification Group evaluates the Temporary modification in terms of its safety relevance and safety requirements. If necessary, further technical expertise is called in. A time limit is assigned to the Temporary modification by defining the date when it must be taken down again. This is the final date by which a decision must be taken as to whether the Temporary modification is to remain in place in the plant. If that is the case, a modification procedure must be initiated within the Modifikation procedure in the Operating Manual and internal procedure BAW U 001.

The monitoring of Temporary modifications for overstepping time limits, decisions on remaining in situ and further action (initiation of a modification procedure) takes place at the regular Modification group meetings.

Irrespective of this, regular checks are made as part of the shift routine by the sections BS1 and BS2 to verify whether existing Temporary modifications are still in time.
IAEA comments:

KKP has incorporated the implementation of Temporary Modifications (TMs) into their modification process. This process is governed by procedure U 001 “Modification Process” and has been submitted to the Independent Reviewer for approval in September 2006. The procedure was found to be complete and robust.

As part of the TM process, KKP has included procedural steps for the review of complex safety related modifications by the Safety Issues Committee. To support the increased amount of modifications to be reviewed the Safety Issues Committee now meets every 6 weeks. The technical competence and experience level of the Safety Issues Committee is commensurate with the level of complexity of the modifications being reviewed.

Based on the information reviewed, the new process that has been submitted to the regulatory authority, meets all IAEA standards and guideline requirements.

Conclusion: Satisfactory progress to date.

5.5 REACTOR ENGINEERING

5.5 (a) Good Practice: KKP have taken additional steps (beyond regulatory requirements) to ensure proper reactivity management and minimize fuel damage during fuel movement.

KKP engineering has developed a programme called CAPHAS that allows them to calculate the theoretical K-eff of the core during each fuel move. This allows them to analyze the proposed loading pattern to see if they can maximize the level of safety with respect to reactivity management.

This programme currently calculates the theoretical K-eff, but UP plans to incorporate the ability to measure actual physics data, during the fuel movement to calculate a real time K-eff while the fuel is being moved. This will provide an additional barrier in the effort to prevent an improper reactivity manipulation.

KKP have also developed a sub-routine in this programme that minimizes possible grid damage from two fuel assemblies interacting during fuel movement, by only allowing fuel to be lowered or raised when the proper configuration of the surrounding fuel assemblies is obtained.

5.6. FUEL HANDLING

5.6(1) **Issue:** Limited reactivity management knowledge/experience for personnel directly involved in fuel movement.

KKP procedures only require that maintenance personnel be directly involved in fuel movement. All other personnel that are formally trained in reactivity management are not in direct/continuous control of the fuel movement.

It should however be noted that the refueling machine is programmed prior to the start of the outage with the core-loading pattern. This additional "electronic interlock" should prevent the majority of refueling bridge mispositions.

Reactivity manipulation is one of the most important actions that a nuclear plant operator does at his/her respective plant; therefore, a high amount of attention should be placed on this activity.

Suggestion: KKP should review the procedures for this reactivity manipulation (fuel movement) to ensure that the proper numbers of personnel trained in reactivity management are in direct/continuous control of all reactivity manipulations.

IAEA basis:

IAEA Safety Guide (NS-G-2.5)**:** 4.19 "An authorized person should be in charge throughout the entire refueling process".

Plant Response / Action:

The IAEA Safety Guide provides that an individual must be designated as responsible for the entire process of fuel handling. This is assured by the maintenance procedures in the Operating manual. .

The issue of knowledge and training among these particular employee groups is taken up for both units in work procedure AAW UP 5014 "Training of Fuel Handling Personnel".

Training courses have been given by UP since 2005 for the group of people concerned.
Those who have been addressed so far are the job supervisors (AvO) in the field and the refuelling machine operators. B1/B2 personnel will also be included in future. The training content includes: aspects of reactivity management including design base and abnormal events, surveillance measures, and regulations to assure sub-criticality during fuel handling.

These requirements were implemented for the first time in connection with the next outage at KKP1, starting from 2005.

IAEA comments:

To address this suggestion, KKP embarked on the development of a comprehensive training programme for the individuals that are involved in the fuel movement and related tasks. The one half day training consists of a review the nuclear physics fundamentals that govern criticality safety and preventive measures that KKP has put in place to ensure the criticality events do not occur. This training is provided to fuel handling personnel before each refueling outage.

It should also be noted that recent industry operating events that relate to criticality are also reviewed. For example, the refueling loading error event that occurred at Dampierre Nuclear Power Plant was also reviewed. This was determined to be a good practice and should be continued within the training programme.

The OSART team also reviewed KKP's further improvements in the area of Criticality Safety. Since 2004, KKP has performed Criticality Sensitivity studies for possible core loading errors that could occur during each refueling campaign each outage. This type of analysis allows the Reactor Physics personnel to determine the level of safety margin through the entire refueling campaign. This was also view as a good practice.

Conclusion: Issue resolved.

6. RADIATION PROTECTION

6.1 ORGANIZATION AND FUNCTIONS

The responsibilities for radiation protection in the plant are based on statutory and official regulation. The Radiation Protection Ordinance defines the following functional levels.

The Technical Director of the EnBW Kraftwerke AG is the Radiation Protection Supervisor for the Kernkraftwerk Philippsburg (KKP) and he delegates those duties to a deputy called Radiation Protection Executive – the manager of the KKP. The Radiation Protection Procedure defines the responsibilities of the Radiation Protection Commissioners (RPC).

The RPC from RP section can stop the performance of any task if it violates any RP rules.

RP performance indicators are established such as collective dose for the coming year, for the outage and for individual dose. They are part of the company goals. The number and the system of performance indicators of the plant have been discussed in conjunction with the authority and an enlarged system will be established following the OSART mission. The existing indicators are analysed annually.

ALARA principles are defined and understood. An optimisation practice has been established in the radiation protection activities, and it is applied as stipulated per the German guideline (IWRS II guideline). By comparison with international practices (WANO indicators) an excellent level of collective and individual doses have been achieved in the last years. However the team observed some deviation from the best international practices. A suggestion was developed on that topic. No ALARA working group or council/committee is present at the site. This group should have some guidelines for responsibilities, schedule of meetings and members; hence some ALARA practices have not been implemented.

Radiological events are reported in a timely manner and analyzed periodically in the outage and annual reports. In any case of radiological event, special analysis and report as required in the plant’s Manual are performed and sent to the Regulatory Body. This task is carried out by a designated group which starts the incident assessment when a ‘trouble ticket’ appears with the outgoing Radiation Work Permit(RWP). The ‘Trouble ticket’ starts the process of developing the discrepancy report.

Daily briefings deal with any operational issues; the RP programme is reviewed internally and also externally - monthly within the EnBW and twice a year with the VGB (Association of large German power plant operators).

The RP section is completely independent of the operational and maintenance department. The head of section has to report directly to the Technical Director in radiation protection matters, as stipulated in the German Radiation Protection Ordinance.

The budget of the RP section is sufficient and covering all aspects and needs of the group. It is discussed yearly within the management and finally accepted by the Technical Director.

The RP group is taking part in the development of Federal standards via the VGB organization. Within the VGB there is a Operational Radiation Protection Working Group, where all German NPPs are represented by a Radiation protection commissioner of the plant. The close contact of this group with the regulatory bodies allows open discussions concerning radiation protection standards already during their development process. KKP's radiation protection indicators and limits are set by the manager of the RP section.

All regulations on radiation protection matters are prepared by the RP section itself, discussed and accepted within the plant.

The RP area is closely monitored by the supervisory authority and their independent experts. Collective dose calculations for the following year and outage have to be reported and are checked by the regulator, the same as for outage reports or reports on high dose tasks.

Contracts are signed only with licensed external companies. Contractors are monitored and controlled as if they were KKP employees.

Before starting to perform his duties the RP worker has to pass training on-the-job combined with theoretical training (external training facilities). This phase lasts at least 2 to 3 years. For special duties even much longer experience is necessary.

The human resources are influenced by a change of generation. The more experienced staff members working since the commissioning of the plant are now planning to retire within a quite short period of time, supported by an early retirement programme. That means a loss of knowledge and specialized 'know-how' which may jeopardize the safe operation of the plant, including the radiation protection activities. There is a need of early employment of staff to work parallel with the people anticipated for retirement to gather a sufficient amount of knowledge to take over the jobs. The management of the plant has developed a plan to ensure that they maintain an appropriate level of experienced workers. A strength on that topic is developed in the MOA area of this report.

Special and continued training in the RP area is given appropriate attention to the relevant jobs. All nuclear workers in Category A are annually checked by the medical service to ensure they meet the requirements for working in RCA. Workers in Cat. B are checked before first entry and afterwards only on the demand of the doctor.

An ambulance service on-site KKP is available day and night. Procedures for first aid in case of overexposure or contamination are available and staff members are trained in these procedures.

6.2 RADIATION WORK CONTROL

Radiation work authorization is clearly stated in the RP regulations. All works in the RCA are planned well in advance as followed:

- General planning of all work;
- Detailed planning based on work card of each working group separately, including prescription of all measurements, protective clothing, additional measures; and
- Check of planned activities just before starting the work.

In addition to the general training work preparing instructions are given to the foremen (AVO). All protective measures prescribed in the radiation work permit have to be signed by AVO. Special instructions are given to the AVO and his team before the commencement of work starts.

The Radiation Work Permit (RWP) system is a computer-based system. The RWP procedure is partly described in the Radiation Protection Manual, in detail described in the Maintenance Manual. An additional Work Instruction (AAW) gives detailed information about the particular radiation protection measures.

For unusual hazards (incorporation, high exposure, airborne activity, high dose rate) alarm limits are set and special provisions are given partly in the Radiation Protection Manual, and partly in the Alarm Manual.

The work permit procedure is structured in such a way that the radiation protection section gets information on all maintenance related activities or operation on early stage. Besides the automatically created information by the Trouble tickets, involvement is ensured by close contacts with the specialist from the maintenance planning and system engineering departments and sections. Thus radiation protection aspects and measures can be taken into account and are incorporated into the planning procedure. This ensures the effectiveness of RP measures.

The layout and access to the RCA is in compliance with the IAEA Guidelines. Most areas are classified as clean areas. When the dose rate is higher than 3mSv/h the room is classified as exclusion area and access is permitted only under surveillance of the RP technician. Categorization of the areas is observed in compliance with the RP Procedure. On the boundaries the contaminated and non-contaminated areas adequate manual and automatic personnel contamination monitors are available. Small number of contaminated tools is stored according to the rules in the RCA. Where and when it is appropriate, special provisions as postings, labeling, shielding are implemented to keep individual doses ALARA. An additional on-line air activity monitoring is used for risky tasks (metal treatment) and appropriate required protection means used.

There is no robust leak reduction programme procedure or in the plant. The minimization of leaks is integrated or dealt within the operational and maintenance procedures.

The portal monitors at the exits of the RCA measure simultaneously beta and gamma contamination. In this way if some internal contamination exists the worker is immediately sent to Whole Body Counting and the dose assessment is much more accurate. The team in that specific strength developed a good practice.

A measurement chamber for tools and small items is also available to ensure that they are not contaminated when taken out of the RCA.

6.3. RADIATION DOSE CONTROL

The objective of the radiation protection is to protect the personnel and the environment. All procedures and guidelines in the KKP plant are in compliance with the Radiation Protection Ordinance which follows the EU Council Directive 96/29/EURATOM. Every person working in the RCA must wear at least two dosimeters: electronic one with alarm levels and accumulative one issued and evaluated by authorized measuring agency. Workers of the contractor must in addition wear their company dosimeters. Personnel doses of the plant employees and contractors are monitored and tracked via PERSEUS dosimetry system. This database has the required redundancy and capacity.

Control of extremities, (Finger rings) and Albedo dosimeters are available and used when appropriate.

Implementation of the ALARA principle has been accepted from a long time and practiced by the plant employees. In addition, especially during outages, specific arrangements are undertaken to reduce exposure and individual doses, including respiration protective measures and aerosol activity control.

A well-established programme for internal contamination dose assessment exists in the plant. Two facilities are available to measure the internal activity of the body. One ‘Quicky’ vertical counter is used for ‘screening’ everybody before entering the RCA and when leaving the plant. A whole body counter with two germanium detectors is also available. Assessments of the effective dose are according to the ICRP-60. For selected workers ‘in vitro’ (Urine) measurements are performed in the Research Centre of Karlsruhe.

6.4 RADIATION PROTECTION INSTRUMENTATION, PROTECTIVE CLOTHING, AND FACILITIES

The plant has a sufficient amount and diversity of radiation protection instrumentation and facilities to survey the RCA. The metrology of the equipment is performed by an independent technical inspection agency (TüV), and periodical testing by qualified persons of the particular section, supervised by TüV experts. The correct calibration sources are available and stored properly. One technician from the RP section is appointed and responsible for maintaining and controlling all calibration sources.

Portable and fixed dose rate and contamination measurement instrumentation are checked every three months. Individual dosimeters are calibrated and tested according to requirements of ICRP and ICRU.

Adequate control of effluent release paths exists. There is provision for monitoring and assessing the gaseous and aerosol effluents during normal operation and during accident conditions. Even in case of beyond design-based accident (core melt) the monitoring of emissions is performed in a controlled manner via filter and washer to avoid breach of containment. Nevertheless the team noticed some deviations from the regulation KTA 1503 of such type of monitoring. Measuring points for iodine 131 and aerosols emissions in case of for designed-based and beyond-designed based accidents are not available. The plant is aware of the problem and the needed instrumentation is already ordered. The installation is expected next year.

The plant has effective decontamination and cleaning facilities. The number of the lockers and protective clothes is kept sufficient.

The laundry is well equipped. Control of the decontamination process is performed and overalls having contamination above the set threshold are separated.

6.5. RADIOACTIVE WASTE, MANAGEMENT AND DISCHARGES

A concept to minimize the radioactive waste (RW) exists in the plant. All materials entering into and leaving the RCA are monitored. Packing material is not allowed to be brought into the RCA. The prerequisite for successful volume reduction is the specific separation and collection of the RW at the point where it is generated. Residual materials from the controlled area are collected, segregated, decontaminated if necessary, and measured in traceable manner before released from the RCA. The implemented free release practice is economically justified as an amount of 70 to 80 tons per year is free released and doesn't need to be treated as radioactive waste but can be recycled.

A process exists to separate contaminated and non-contaminated lead. Waste of radioactive contaminated lead from the mobile shielding is melted in a special device installed on site. This process separates the contamination. The clean lead is formed into new shielding elements. The team recognizes this as a strength.

The classification of radioactive waste is adequate. The management of the radioactive waste programme is fully implemented. An interim storage exists on site. Two RW data base systems are implemented in the plant thus allowing the complete tracking of RW. The plant has enough free volume on site until the decision to license a final disposal site is made. Since the unit was commissioned combustible radiation wastes from KKP have been incinerated in Studsvik, Sweden.

All measurements of emissions (exhaust air and discharged water) are reported on monthly and yearly basis. Liquid effluents are sampled twice, once with on-line instruments and once manually by laboratory staff. If both results are acceptable the water is approved for discharge. This process should ensure no violation of authorized limits. Records about quantity and content are kept in a database. All data are used as input to the software when assessing the dose to the critical group of the population.

The plant has a well-established environmental monitoring programme. All path of possible contamination are monitored and separately analysed. Conservative calculations indicate that the dose exposure from the effluents to the adults is less than 0.15% and for children less than 0.23% of the permissible dose level for the population.

The radiometric instrumentation is state -of- the-art and properly calibrated.

6.6. RADIATION PROTECTION SUPPORT DURING EMERGENCIES

The plant has adequate equipment and procedures to be used in case of activation of the emergency plan. High range radiation monitors along with portable instrumentation are available. The facilities in the Emergency Centre are sufficient and well maintained. The staff from the surveillance division is in charge of the radiological data and initial assessment of the radiological consequences around the plant. A software named' "Pluto" is used to modeling the plume track according the real meteorological conditions and work out the doses in the assumed radius.

All responsibilities of the RP staff are described in the Alarm Manual. Emergency training and special drills for radiation protection personnel are scheduled periodically inside the department.

Feedback and corrective improvements are provided for future actions.

KKP FOLLOW-UP SELF ASSESSMENT

The preparation and execution of the OSART Mission was a major challenge with substantial learning curves for the radiation protection organisation and its staff.

A very intensive exchange of ideas took place with the reviewer on the topic of ALARA, which gave us new insight into the international way of looking at it. In consequence, we have adopted many more ALARA ways of thinking into our operational practices.

The most important item in this context is certainly the establishment of the ALARA Committee as a communication body on radiation protection between the corporate and plant management and the radiation protection officer.

Practices have also been reconsidered and optimized in terms of implementing "Dose Constraints“.

STATUS AT OSART FOLLOW UP VISIT

The team was impressed with KKP actions to resolve the suggestion offered by the original OSART team. Radiation protection team used very comprehensive and systematic approach to analyze the issue and develop correct corrective actions. IAEA Safety standards and German regulations were used very comprehensively during this process. The solutions adopted by KKP have positive influence to the other German plants.

The KKP ALARA Committee was established in May 2005. The function of ALARA committee is described in a process (part of the process Radiation protection organization) with detailed flow chart. Members of the committee are nominated by the plant manager, schedule is established (twice a year) and discussion and results are recorded. The typical topics of the meeting are e.g. results of RP, outage preparation/evaluation, operating experience, long term activities related to RP, experience of RP officers and interdisciplinary cooperation.

The projected dose budget for outages and specific maintenance tasks were elaborated and are closely monitored by RP team. KKP is using these results for detailed exposure analyses of specific maintenance activities and is successful in reduction of individual and collective dose.

The dose constraint approach was formally implemented and enhanced. Results are very good and KKP is able to not exceed very strict corporate goals. Radiation protection training for RP level 2 was improved taking IAEA and WANO recommendations into consideration. General employee training and training for externals was improved as well.

The chemistry laboratory manual was revised and additional radiation protection measures were implemented and communicated to the staff.

Labelling of very low radioactive waste containers was improved and it was confirmed by plant tour.

DETAILED RADIATION PROTECTION FINDINGS

6.1 ORGANIZATION AND FUNCTIONS

6.1(1) **Issue**: The implementation of the ALARA principle is missing some of the attributes found at the best international plants:

- There is no ALARA working group or council /committee. Usually/normally such committees have guidelines or rules for the responsibilities, schedule of meetings and members;
- No projected dose budget for main specific maintenance tasks is elaborated for describing the outage. Without this no detailed exposure analysis of each main specific maintenance activity could be performed;
- The dose constraint approach is formally not implemented although the authority is requiring minimization instead of ALARA;
- There is no formal procedure to require preparation of a dose budget for unplanned outages, although it is done above certain expected collective dose for the task;
- The training in RP - level 2 is missing some practical ALARA hints and measures as in the ALARA training materials prepared and provided by the IAEA;
- In the chemistry laboratory the technician works with water samples without gloves. The operation procedure of the chemistry section is not dealing with all RP measures during sampling and chemical analyses; and
- There were some missing labels and some unreadable labels were found on site for storage of very low radioactive waste.

Not having systematically implemented ALARA principles could cause the plant to miss some opportunities to limit the collective and individual dose.

Suggestion: The plant should consider reviewing and applying the IAEA standards and best International ALARA practices.

Plant Response / Action:

1. ALARA Committee

The KKP ALARA Committee was established in May 2005 and meets twice a year at the invitation of the Station Manager and Radiation Protection Commissioner. One meeting is held during the preparation for outages and the other at the end of the year. All radiation protection commissioners and department heads plus representatives of the GKN and KWO plants are invited.

Important radiological protection planning and projects are presented and discussed with evaluations and reports on any weak points. Open items are tracked. The meetings are noted done.

2. Dose budgets are established for special outage activities.

- Estimated annual collective dose for each power generating unit: collective doses for major activities are estimated then followed up during the actual work.
- Implementation of the new version of the IWRS II guideline: collective dose of 25 mSv, individual dose of 6 mSv and "unfavourable radiological conditions" as threshold values for detailed estimates and radiation protection planning.
- Daily updates during the outage meetings about the exposure status of collective dose for the outage and special activities (if appropriate).
- Analysis of work flows and dose budgets as part of the tracking process, also with special reference to the IWRS II guideline.
- Evaluation of dose aspects also as part of the post-outage review.

3. Dose Constraints

The following dose constraints exist:

- Annual corporate goals for individual dose; separate goals for station and contractor personnel;
- Annual collective dose for each unit based on known work activities at the beginning of the year;
- Daily exposure limits programmed into the dosimeter (500 / 1000 µSv), adaptable if necessary; and
- Additional regulatory indicator annual: individual dose of 5 mSv.

4. Specification of dose budgets for unplanned outages

This recommendation is not being implemented, because our experience shows it to be almost impracticable.

- In case of unplanned outages, the priority for all available resources is concentrated on actively surveillance activities.
- The planning period is too short for realistic planning.
- The scope of activities changes as knowledge of the situation evolves; there is generally no stable basis for planning.

5. ALARA items in level 2 training

A concept developed by US and FP has been incorporated into the level 2 radiation protection training.

6. Contamination prevention measures in the radiochemistry laboratories

A laboratory procedure has been drafted by UC to include protective measures against contamination and incorporation plus alarm raising measures in contamination events.

7. Container labelling

The labelling of radioactive material containers deposited in the monitored area is clearly specified in a work procedure by the USA.

IAEA comments:

The KKP ALARA Committee was established in May 2005. The plant manager (Radiation Protection Supervisor) is chairing the meeting and there are about 15 participants from different parts of the plant organization and other plants of EnBW. The function of ALARA committee is described in a process (part of the process Radiation Protection Organization) with detailed flow chart. Members of the committee are nominated by the plant manager, schedule is established (twice a year) and discussion and results are recorded. The typical topics of the meeting are e.g. results of RP, outage preparation/evaluation, operating experience, long term activities related to RP, experience of RP officers and interdisciplinary cooperation. KKP RP staff very appreciates the activities of ALARA committee and they believe that it is a good support for radiation protection.

The projected dose budget for outages and specific maintenance tasks were elaborated and are closely monitored by the RP team. KKP is using these results for detailed exposure analyses of specific maintenance activities and is successful in reduction of individual and collective dose.

The dose constraint approach was formally implemented and enhanced. This concept is used respectively for the planning and executing of tasks. Results are very good and KKP is able to not exceed very strict corporate goals e.g. annual corporate goal for individual dose for plant staff is less than 4mSv and less than 10 mSv for contractor staff. There are also additional dose constraints applied by KKP.

Radiation protection training for RP level 2 was improved taking IAEA and WANO recommendations into consideration. General employee training and training for externals was improved as well and it was demonstrated during the OSART team training.

The chemistry laboratory manual was revised and additional radiation protection measures were implemented and communicated to the staff. Plant tour confirmed good implementation of RP measures.

Labelling of very low radioactive waste containers was improved and it was confirmed by plant tour. No missing or unreadable labels were found on site for storage of containers. In addition pictures and detailed list of items loaded into the container are available.

Conclusion: Issue resolved.

6.2. RADIATION DOSE CONTROL

6.2(a) Good practice: The portal monitors at the exit of the radiation protection area are able to measure simultaneously beta and gamma contamination. The total body surface including hands, head, and feet are measured by 14 beta gas flow proportional counters. Directly behind the beta counters additional two large area gamma plastic-scintillation detectors are positioned in the breast area (left and right side). As they are only gamma sensitive, they are able to detect incorporated gamma activity if any. The detection limit is about 1000 Bq (against Co-60, 3 sigma error) regarding measurement time of 10 seconds. In this way if some internal contamination exists the worker is immediately sent to WBC and the dose assessment is much more accurate.

7. CHEMISTRY

The Chemistry Section is staffed with experienced and competent personnel who contribute to safe operation. Personnel show a major commitment to their duties. Deputies for leading functions are defined.

7.1 ORGANIZATION AND FUNCTIONS

The Chemistry Section organization is committed to perform effective chemistry control of the plant. Each of five laboratories is led by a responsible engineer who reports to the Chemistry Section Head.

The Chemistry Section Head reports to the Head of the Surveillance Department. This Department consists of four sections: Chemistry, Physics, Radiation Protection and General Monitoring.

Job specifications, responsibilities and authorities are clearly defined and understood for all position in the Chemistry Section. Job descriptions are written for each individual and include a description of the duties and required education. The job description is presented to the employee by the supervisor and signed by both parties.

Documentation is kept inside the Chemistry Section for a minimum of five years. Data is easily retrievable.

The Chemistry Section takes an active role in plant condition improvements and there applications. Several successful approved internal plant modifications have been applied in this area. This is recognized as an active contribution of the Chemistry Section to increase the reliability and operational capability of the plant.

Good communication exists inside the Chemistry Section as well as between the Chemistry Section and other plant groups. Responsibilities and activities, which must be conducted with the other groups, are defined and properly understood. Although the communication protocols are good between departments, they are not covered by a procedure.
The Chemistry Data acquisition system is accessible to Operations and to other Departments.

An effective response system is applied to chemical parameter variations, and the Chemistry Section is involved in problem resolution.

The Qualification and experience level of the Chemistry personnel is high. For new personnel, a “dual” education system is applied. After approximately three years of “on-the-job” training, an official examination is conducted. If apprentices are successful, they can be hired at KKP or any other Power Plant. Because of this very personal approach to staff training, a single programme for personal training and retraining was not been developed.

Training is conducted on an individual basis. It is based on the qualifications and experience of the specific individual. Training Records are kept inside the Chemistry Section and show excellent feedback between supervisors and staff. However, there is no formal written evaluation of each employee on an annual basis. The station is encouraged to develop such a programme to help improve staff performance and reduce the risk of human error.

7.2 CHEMISTRY CONTROL IN PLANT SYSTEMS

Excellent plant material condition is the overriding goal of the Chemistry Section. The Chemistry Control programme required to attain this goal is well managed. High quality data is produced by several laboratories to assure that primary, secondary and auxiliary systems are in optimal chemistry conditions. Operating and Working Procedures cover the overall chemistry programme.

Good working relations, proper understanding of the importance of good chemistry control and appropriate support from all Departments at the station was observed.

The water chemistry control programme is well established. Applied chemistry regimes are suitable for the systems to which they apply. Specifications for each system along with appropriate documentation and flow diagrams were available.

The primary system chemistry is well managed. Parameters are properly monitored and redundant methods are available. By maintaining a high and stable pH value in the primary system, corrosion and radioactive build-up is minimized. A suitable increase in the measurement frequency for chemistry and radiochemistry parameters is applied whenever operational changes or power reductions occur. Shutdown and start-up procedures are clearly defined and assure appropriate control of chemical parameters.

The Chemistry Department has developed an electrochemical membrane technique to control the lithium -7 concentration in the primary coolant. The Team evaluated this new development has a good practice.

High All Volatile Treatment (HAVT) is applied for secondary side water conditioning. To suppress local flow-accelerated corrosion of the carbon steel heater tubes of the Moisture Separator Reheaters, (MSRs), oxygen addition was introduced into the reheating steam line upstream of the Moisture Separators. A more stable protective oxide layer has been formed by the oxygen containing steam condensate. In the recirculating water of the steam generators reducing conditions are still maintained in order to minimize local corrosion.

After several years of operation, the steam generator tubes are in good condition. Eddy current inspections have confirmed this situation and tube degradation is very low. Visual inspections of the boilers show only small amount of a thin soft sludge inside the low flow area of the Steam Generators. Sludge lancing is not routinely performed. The Team believes that these findings, regarding the excellent state of the steam generators, should be confirmed by carrying out HORT during some future power reduction and cooling process.

It is also been noted that no wet or dry lay up is performed when Steam Generators are drained. This practice should be reviewed by the station.

The secondary side addition systems and preparation tanks are kept in good condition with adequate containment built around the tanks to prevent any spills of these hazardous chemicals.

A condensate polishing system is used during start-up conditions for removing mechanical impurities from the secondary cycle.
Emergency cooling and auxiliary systems chemistry are controlled properly. Records are keeping in laboratory logbooks.

Ground water is used for de-mineralized water preparation. Before treatment, iron and manganese are removed by coagulation process and filtration.

The central chemical storage area is spacious, clean and well maintained. There is an adequate supply of safety equipment present for the chemicals being stored. Staff working in this area has been trained in the safe handling of chemicals.

During station tours however, some deficiencies were noted in the storage of chemicals, specifically in the workshops and also within the plant. Some improvements are required when people not specifically trained in the handling of chemicals use such materials within the plant. Accordingly a recommendation to station management has been provided in this area.

7.3 CHEMICAL SURVEILLANCE PROGRAMME

The Chemistry Section executes the analysis programme to satisfy the Technical and Chemical specifications of the plant. Procedures, schedules and methods of analysis are clearly defined. Sampling is defined and conducted by a daily schedule. Records of all analysis conducted are maintained in the laboratory.

Standards used in the laboratory have a defined shelf life and are prepared from traceable standards. Certificates for calibration standards for radiochemistry measurement are available in the laboratory. Laboratory instruments are calibrated at the correct frequency using the above standards and records are kept.

Sufficient laboratory equipment is available and diverse methods are also available in the event of equipment unavailability.

Work practices within the laboratory from a safety perspective could be improved. The mission noted that staff often failed to use protective gloves when handling liquid samples. This is not consistent with international practice.

During the execution of analysis, any deviations from system specification are immediately reported to the Head of Section or to his deputy. Corrective actions are taken immediately.

A strong QA/QC programme has been established. The KKP Laboratories are currently going through the process of accreditation for ISO 17025. While the approach of the laboratories QA/QC programme is slightly different to that in the international community all of the basic elements are covered. Once ISO 17025 is obtained, the majority of these differences will be removed.
The mission has identified some opportunities for improvement in the QA process and this forms a suggestion to apply to the station.

7.4 CHEMISTRY OPERATIONAL HISTORY

Responsibilities for reporting and assessment are clearly defined and implemented. Routine reports produced include:

- Monthly reports to WANO and VGB;
- Monthly report to station management; and
- Annual input to the station Management Review.

All main parameters are trended, evaluated and reported. Records are available and easily retrievable.

KKP FOLLOW-UP SELF-ASSESSMENT

KKP used the time in preparation for the OSART follow-up mission for intensive optimisation of the written operational procedures, especially the Chemistry section's departmental regulations. The actual review was of great benefit to the plant as an exchange of experience. In this context, the discussion with different cultural circles, from Eastern European Slovenia to Far Eastern Pakistan, was particularly valuable.

The result prompted KKP plant to resume participation in round robin experiments for chemical parameters in cooling loop water run by the Department of Chemistry at Sarria University in Barcelona, Spain, in which several other German nuclear power stations take part alongside the Spanish operators.

To optimize KKP quality assurance in respect of measurements for chemical analysis, the chemistry department enhanced its existing Laboratory Information and Management System with an advanced quality assurance module. In addition, the use of control charts will be extended in 2007 to cover all important instruments.

With regard to the labelling of bottles and other containers containing toxic substances or materials that constitute a hazard to environment, a computerized "Sticker system" has been introduced. All relevant areas have been equipped with so-called "label printers". The internal procedure BAW U205 now prescribes proper labelling for all such containers. Any containers without labels will be withdrawn.

In summary, the OSART review has been beneficial for the Chemistry section.

STATUS AT OSART FOLLOW UP VISIT

The management of chemical and hazardous material outside the chemistry department was subject to large improvement. Labeling, distribution and collecting of small quantity of chemical is now well managed under clear procedures. Training was performed and new equipment (fire cabinets) was installed in warehouse and maintenance shops.
The OSART team tours the laboratories, the turbine building, the storage areas for chemicals and the oil storage rooms and did not find any discrepancies in the management of small quantity of chemicals. The process of goods receiving was analyzed in depth and improved with significant effect on field.
Revision of quality assurance and quality control programmes were made at KKP after the OSART mission. More accurate chemistry standards are used for the calibration of chemistry equipment. Quality Control (QC) forms are developed to collect, track, trend and analyze data

results of calibration. A computerized system is in progress of development to be effective in 2007.The plant restarts the inter-comparison programme on calibration of chemistry equipment with a foreign company.

DETAILED CHEMISTRY FINDINGS

7.2 (a) **Good Practice**: Chemistry Control of the ^{7}Li in Plant Systems by membrane electrolysis

The Chemistry Department has developed an electrochemical membrane technique to control the lithium concentration in the primary coolant.

During a fuel cycle about 1,5 kg ^{7}Li are added and about 9 kg of ^{7}Li are extracted. This means, that 7.5 kg ^{7}Li are generated in total from boron burn out.

In PWR of former lines, ion exchange resins are used to reduce the ^{7}Li-concentration and $^{7}LiOH$ is injected to increase its concentration respectively. The ^{7}Li that has been extracted gets lost with the resins and has to be dumped as radioactive waste, which is very expensive. One calculates about 2 m^3 of waste resins per cycle.

Membrane techniques like membrane electrolysis are not yet implemented in power plant construction. The method uses the property of electrically charged particles, the ions, to migrate in an electric field.

Efficiency of the developed technique was demonstrated with a pilot. The work is documented and recorded.

This procedure makes it possible to remove $^{7}LiOH$ selectively out of the primary coolant and to concentrate it up to 10 g/kg. In this form it can be stored until it is needed in the next cycle. Radioactive cesium, that is also concentrated together with the lithium, can be removed with a new Cs-selective, inorganic ion exchanger. The dosage of ^{7}Li can simply be realised by reversing the polarity of the two electrodes. The ^{7}Li then migrates back into the primary coolant. Since ^{7}Li-removal and ^{7}Li-dosage are now continuous processes, no sudden changes in pH value occur.

With pole inversion this procedure is predestined to load following operations.

By implementation of the described procedure it would be possible to extend the service time of the coolant polishing system by several years. Every year it may be possible to save about 2 m^3 of wasted resins from the mixed bed filter that is installed in front of the boron recycle evaporator and the ^{7}Li-removal filter. Furthermore less additional ^{7}Li would need to be bought. Thus, it may be possible to economise on this operation.

By replacing the cation selective membrane by anion selective membrane electrolysis could be used to control the concentration of boric acid in the primary coolant. Some preliminary experiments have already been performed successfully.

Radioactive activation- and fission products can also be removed, so this technique will replace the coolant polishing system.

7.2. QUALITY CONTROL OF OPERATIONAL CHEMICALS AND OTHER SUBSTANCES

7.2(1) Issue: Some chemicals which are used outside the chemistry department are not properly labeled and controlled.

- Some unmarked bottles and containers believed to contain oil were found in workshops, near diesel generators and around the plant;
- Some other containers are also not labeled. Content of the container is unknown and the user must be tracked.
- Some containers remains in some areas without periodic control;
- Some flammable and chemical products are stored without Operating and Safety Specification protocol as required by the procedure (PA2901338 – RIVOLTA SKD, PA0964523 – PERMATEX SEALING, PA1301117 – LOCTITE SUPER GLUE, PA2803001 – PETROLEUM, PA2802939 – SOLVENT, PA7800988 – Hazardous product);
- Weakness on oil storage and handling (improperly use of the same measuring bottle for several kinds of oils, sawdust on the barrel PA280318.1, some oil barrels without Operating and Safety Specification protocol);
- Flammable, oil and powder chemical products are stored in the warehouse and this premise is not equipped with emergency shower; and
- Barrels of a corrosive chemical were stored on the third shelf, about 4 meters above the floor. If the barrel fell from the shelf, the contents would spread throughout the warehouse.

Unlabelled chemicals, hazardous materials could be mixed leading to unexpected chemical reactions, or they could be used in the wrong application. Spills resulting from poor storage could result in injury or environmental release.

Recommendation: Effective labeling and control of chemicals and other hazardous materials outside chemistry department should be implemented and a responsible person defined.

IAEA basis: DS 388 Draft document to develop a safety guide on “Chemistry control in the operation of nuclear power plants”. This draft is, at the time of the follow-up visit, accepted by the Commission in charge of evaluating the progress of IAEA document development.

Para 3.5: Chemistry programme should ensure the management of hazardous chemicals and availability of material safety data sheets.

Para 5.30: Industrial safety (storage of flammable solvents and hazardous materials, safety showers, personnel protective equipment, as well as first aid kits, etc.) and radiological safety should be ensured.

Plant Response / Action:

The specifications of the Hazardous Materials Ordinance and thus the rules for handling hazardous materials are implemented at KKP in operational procedure (BAW U 205) Handling of Hazardous Materials.

Internal procedure (U 205) is currently undergoing revision in Chemistry Department (U) in accordance with the Hazardous Materials Procedure in the Operating manual (Result of the report from the review performed by the Consulting Business Management (CBM) company. The points raised in this recommendation are covered in this work. In particular, it regulates the responsibility for handling and labelling hazardous substances after they have been dispensed from stores.

There are facilities in the warehouse area for smaller quantities to be decanted from larger containers, so that the person needing the material is not left with a large amount of lubricant left over after completion of work, which he then has to store safely in the plant or possibly dispose of uneconomically.

In this context, the technical sections have been provided with label printers (7 in 2006 and more in the future), with which authorised employees can print out special stickers to label the containers used in decanting or sample vials.

The following precautions have been taken in Department I:

- Procurement of more hazmat fire protective cabinets for storing oils and lubricants in plant rooms.
- When the contract is signed with the contractor, The U 205 "Handling Hazardous Substances" procedure is handed out to the works manager of every contractor firm.
- The text of Module 4 of the Basic Knowledge Maintenance Culture Project, " Housekeeping", - developed by VGB for all German utilities - includes the instruction not to take more hazardous material than required for the day's work. Pedagogical booklet is disseminated to improve knowledge in that area.
- Workers in the field and shops are aware that these "chemicals/working materials" are to be locked up safely in special cabinets when they break off or finish work.
- These materials are also stored in special cabinets for hazardous materials in the main stores. The staffs who issue tools dispense only the small quantities needed.
- Oil drums and lubricant canisters are in general kept in suitable containers that are large enough to collect any spillage of contents. The stored quantities are kept to a minimum. Oil binders are easily retrievable and readable. There are no ignition sources in the vicinity.

The issue of chemical/service materials storage is an item for attention during inspection tours. Additional portable emergency showers are being installed in the storeroom corridors in the warehouse area (UST).

IAEA comments:

The plant has successfully addressed the recommendation provided by the OSART team. All hazardous chemicals are clearly labelled and chemicals are distributed in small amount or adequate quantity for the needed application and in suitable labelled containers. Procedures were revised.

Tour of the laboratories, the chemical storage areas, of the distribution point of chemicals in warehouse, and in the turbine building showed that this new programme is well known and well applied in the field.

Conclusion: Issue resolved.

7.3. CHEMICAL SURVEILLANCE PROGRAMME

7.3(1) Issue: Although the plant has a very strong Laboratory QA/QC programme, some improvements are available in the nuclear industry to make the results more easily transparent and comparable to other international standards.

- Many of instruments have the possibility to trend the standard measurements, and compare them to the goal value. The plant does not systematically use this possibility;
- Some control chart graphs are performed with standards which the concentration is higher than the concentration of the plant samples;
- Inter-comparison testing programme is not done on a regular basis by the laboratory.

Without a transparent QA/QC system deviations cannot easily be recognized.

Suggestion: The Plant should consider revising its QA/QC Programme by supplementing with a higher frequency of using standards and quality control chart development. Additional inter-comparison with other authorized organizations could improve the reliability of chemistry results.

IAEA basis: DS 388 Draft document to develop a safety guide on “Chemistry control in the operation of nuclear power plants”. This draft is, at the time of the follow-up visit, accepted by the Commission in charge of evaluating the progress of IAEA document development.

Para 3.35: Chemistry programme should ensure that in time reactions – is able - to correct any deviations from normal operational status such as a small deficiency, weak trends or quick transients of chemistry parameters.

Para 5.13: Plant must have implemented QA system which ensures…timely calibrations developed either on the bases of equipment manufacturers’ recommendations and plant experience or using standards solutions.

Para 5.25: Calibration points should be chosen in such a way to overlap measuring range.

Para 5.36: Adequacy and accuracy of procedures should be checked regularly by intra- or inter-laboratory tests, to identify analytical interferences, improper calibrations, analytical techniques and instrument operation.

Plant Response / Action:

- The control charts either present or available in the device software at measuring points are already used systematically, for instance in nuclide specific gamma spectrometry and liquid scintillation spectrometry. In addition, control charts are kept manually for most devices.
- The concentrations of control standard solutions are checked and adjusted, if necessary, to the measured concentrations in the plant, if this is reasonable from the analytical point of view.

- The water laboratory UC2(W) and the radiochemical laboratories UC2(R) used to take part in round robin experiments run by the University of Barcelona in the past (most recently in 2001). Contact with Barcelona University is currently being built up again with the intention of renewing regular participation in round robin experiments.
- The radiochemistry labs of both units and environmental monitoring laboratory have been regular participants for many years in round robin experiments run by the Federal Office of Radiological Protection (BfS) for measuring radioactivity in effluent and exhaust gas samples (pollution monitoring).
- The water chemistry laboratory also takes part in round robins in the field of radiological environmental monitoring.
- The goods reception laboratory UC2 (WE) takes part regularly in the FAM (Fachausschuß Mineralöl - petroleum expert committee) round robin experiment.
- The installation of a new computerised laboratory information and management system is in progress. This is expected to make the required quality assurance measures more systematic.

IAEA comments:

The plant developed a specific data form for many instruments to collect, track, trend and analyze the standard measurements, and compare them to the goal value. The document is timely verified by line management.
Chemistry measurement equipment is now checked regularly by inter-laboratory tests, to identify analytical interferences, improper calibrations, to improve analytical techniques and instrument operation.

Conclusion: Issue resolved.

8. EMERGENCY PLANNING AND PREPAREDNESS

8.1. EMERGENCY ORGANIZATION AND FUNCTIONS

The emergency preparedness provisions in German nuclear power stations are aimed at preventing any effects on the environment following serious incidents or, if this is not possible, to reduce any such effects. This includes, on the one hand, measures within the nuclear power station itself (internal plant emergency protection). On the other hand, there are also contingency measures for the surroundings, i.e. in a radius of up to 25 km.

Disaster control is the responsibility of the individual federal states and is planned by the corresponding state authority and coordinated with the power station operator.

Due to the location of KKP in the northern part of the state of Baden-Wurttemberg, responsibility lies with the state authorities of the regional council in Karlsruhe (RPK) and the supervision and services department (ADD) in Trier (due to the close vicinity to the neighboring state Rhineland Palatinate).

The legal framework for disaster control is based on the Atomic Energy Act as well as the radiation protection regulations and the disaster control legislation of the state of Baden-Wurttemberg. In addition, various other directives and recommendations apply, in particular the general recommendations drawn up by the Radiation Protection Commission (SSK) for application throughout Germany for disaster control in the vicinity of nuclear facilities. Other provisions for the protection of the population outside disaster control zones are contained in the radiation protection provisions law.

8.2. EMERGENCY PLANS

The operation procedure "Emergency preparedness manual" (BAW U 601) describes the emergency organization of KKP including the composition and tasks for the Emergency Preparedness Group and the emergency units. In addition, each unit has drawn up emergency measures for selected events that exceed the design data in the emergency manual (NHB).

The general recommendation for disaster control in the vicinity of nuclear facilities differentiates between a precautionary alarm and a disaster alarm. It is up to the head of the disaster control authority or his representative to consider the recommendation, and so to decide whether a precautionary alarm or a disaster alarm is triggered.

The KKP issues a recommendation to trigger a precautionary alarm or disaster alarm when the stipulated conditions apply. These are as follows:

- A precautionary alarm is triggered if an incident in the nuclear facility has not had any or only a slight effect on the environment compared to the criteria for triggering a disaster alarm. Criteria for the precautionary alarm are; a possible effective dose in the environment between 5 mSv and 50 mSv or thyroid dose between 150 mSv and 250 mSv.

- A disaster alarm is triggered if, as a result of an accident in the nuclear facility, a harmful emission of radioactive substances in the environment has been ascertained or is threatened. The criteria for the disaster alarm are: effective dose in the environment larger than 50 mSv or a thyroid dose larger than 250 mSv.

In addition, according to the Baden-Wurttemberg disaster control laws, the regional council in Karlsruhe must be informed about incidents that entail the use of active safety devices in order to manage the incident (e.g. loss of coolant incidents, outside effects) under at least one of the three following additional conditions:

- It is not possible to assess the status of the facility;
- The emissions behavior cannot be assessed;
- It is not possible to detect with an adequate degree of reliability that the incident can be managed without exceeding the approved annual limit values for the emission of radioactive substances through the air into the environment.

8.3. EMERGENCY PROCEDURES

When an incident occurs, the situation is examined according to the BHB incident guidelines to see whether protection objectives are at risk. If this is the case, then emergency measures are taken according to the emergency manual (NHB). The aim is to restore the plant parameters as quickly as possible to acceptable levels or to limit the effects from compromised protection objectives to an unavoidable level. The emergency measures distinguish between preventive and mitigative measures. Emergency measures can draw on resources both inside and outside the power station.

In an emergency, the following organizations are available for providing contractually warranted advice or technical support.

- Framatome Advanced Nuclear Power (FANP) at Erlangen;
- Kerntechnischer Hilfsdienst (KHG) (Nuclear Assistance Service) near Karlsruhe.

In addition, in an emergency KKP can request expert staff, mobile radiation protection equipment and other aids from the neighbouring nuclear power stations in Biblis, Neckarwestheim and Obrigheim.

Furthermore, technical, medical and organizational assistance is also available from Karlsruhe Research Centre and from the local fire brigades and other emergency services.

In an emergency KKP must notify the following external organizations and guarantee the necessary flow of information:

- Karlsruhe regional council (RPK);
- Trier supervision and services department (ADD);
- Regulator;
- Police stations; and
  Other authorities and organizations such as TUV, Gesellschaft fur Anlagen und Reaktorsicherheit (GRS- Association for Plant and Reactor Safety), Landesanstalt fur Umweltschutz (LfU- State Environmental Protection Agency), Ministerium fur Umwelt und Forsten in Mainz (MUF- Ministry for the Environment and Forests).

These organisations can also provide KKP with support and advice in an emergency.

As soon as an emergency has become known, the activities necessary to combat the emergency begin without delay. The shift supervisor receives the notification, takes immediate measures and issues the alarm according to the Alarm Procedures (manual, AO). He also informs the emergency personnel, the heads of operation (LdA), the unit on-call team and, if necessary, the responsible KKP managers.

The LdA arranges for the Emergency Preparedness Group to be convened and informs the head of the emergency units. Presently the Emergency Preparedness Group is composed of 11 members, the number of the emergency units is 8.

The members of the Emergency Preparedness Group and the heads of the emergency unit decide whether additional persons need to be convened to manage the emergency. They arrange for the necessary staff to be informed.

In the event of a disaster at KKP, disaster control committees are set up at Karlsruhe regional council (RPK) and Trier supervision and services department (ADD). KKP sends expert liaison officers to Karlsruhe regional council and to the expert advice unit at the MUF (Ministry for the Environment and Forestry) in Mainz that advises the ADD in Trier.

The disaster control authorities are responsible for deciding which measures are to be taken to protect the population. The key measures here are:

- Warning the population, e.g. through:
  - sirens, loudspeaker warnings by the police and fire brigade;
  - announcements on radio, television and video text;
- Informing the population about correct behaviour, e.g.
  - stay indoors;
  - keep doors and windows closed;
  - traffic restrictions;
- Issuing and instructing people to take iodide tablets;
- Evacuation.

Recently, Germany introduced a new procedure to distribute potassium iodide (KI) tablets for populations near nuclear power plants.

- Within 5km of nuclear power plant, public can get KI tablets in pharmacy shop with no cost;
- Between 5km to 10km from the plant, there is a possibility public can get KI tablet depending on State regulator policy;
- Within 5km to 25km of nuclear power plant, each municipality will be responsible to make the KI tablets reservation in own district;
- From 25km to 100km of nuclear power plant, the disaster control authorities take responsibility. The KI tablets are stored in seven national depository of KI tablets.

8.4. EMERGENCY RESPONSE FACILITIES

In case of emergency, the Emergency Preparedness Group can use the central emergency management room in the basement of administration building 3. It is provided with extensive communication equipment, documents and information. There are many items of emergency equipment at and around the KKP facilities.

There is an alternative emergency management room in the department of fire department house of Philippsburg.

8.5. EMERGENCY EQUIPMENT AND RESOURCES

KKP has a total of 58 emergency cabinets at various points of the facility equipped with the following minimum equipment:

> 1 stretcher, 1 first-aid kit, 1 compressed air rescue unit (escape unit) with respirator, 1 rescue rope, 1 safety belt, 4 pairs of rubber gloves, 1 battery spotlight, 2 compressed air respirators with mask. Some of these cabinets also have additional emergency equipment. They are located in the emergency power supply and switchgear building of KKP2 and in the USUS and switchgear building of KKP1.

The computer code for diffusion analysis named "Pluto" is used to calculate the dose to the population for a release of activity from KKP. The Surveillance Emergency unit of Emergency Preparedness Group would perform this calculation. The team recognised this as a good way of emergency response.

- Pluto is well programmed to calculate all relevant doses;
- Input to programme is easy and interface with shift supervisor is clear to get release activities;
- Calculation time is less than 10 seconds; and
- Hand calculation is possible if computer is not in use.

8.6. TRAINING, DRILLS AND EXERCISES

The personnel working in the nuclear power station (KKP and external companies) are informed during the information session before starting employment and then at yearly intervals about the alarms and their meanings as well as the correct behaviour in various alarm situations. The instruction session covers the main provisions of the alarm procedures pertaining to the staff.

Drills are held to ensure that everyone is prepared to take the right measures in an emergency. These drills include:

- Practice drill: The alarm drills are held once a month to check functions and to check the intercom system. All persons present on the power station premises are informed before the alarm is triggered and told about the alarm sounds;
- Alarm drill/Emergency Preparedness Group drill: At irregular intervals alarms are triggered for drills of several different kinds (radiation protection, fire protection, first aid, emergency protection); and
- Disaster control drill: KKP participates in the disaster control drills held by the responsible authorities.

The emergency protection equipment is checked regularly to ensure that it is ready for operation and in functional condition. Records are kept of the checks. The responsible shift personnel are trained on the simulator to be able to cope with emergency situations.

While there is a competent emergency response team, some weaknesses in the programme for emergency exercises and functioning of the emergency teams were identified. These include the off-site drill frequencies, the use of a manual notification system, the number of people participating in drills and administrative burdens placed on some managers during drills. The team offered a recommendation in this area.

8.7. LIAISON WITH PUBLIC AND MEDIA

A brochure on nuclear emergency measures is distributed to the 100,000 households within 10km by KKP. This is based on the German Atomic Law since year 1998. A new version of brochure was distributed in year 2003 to show the public what should be done in case of nuclear emergency.

KKP has started a programme called "Power Plant Talk (KKP Kraftwerkgespraech)" in 2001. Under this programme, every three months there is communication with the local population at KKP Information Center in the evening. Participation involves about 80-100 people, and includes near plant site mayors, local representatives, and police officers. The team recognised this as a good conduct.

- Frequency of meeting is every three months;
- Participation of many local stakeholders around plant;
- Each meeting guest speaker of interest to local population is invited and make presentation;
- Evening meetings make for easy of participation of many people and a relaxed atmosphere is created;
- Plant manager will inform participants of plant status and specific information of interest to local population.

KKP FOLLOW-UP SELF-ASSESSMENT

Implementation of the recommendations from the KKP OSART Mission 2004 raised intensive cross-functional discussions concerning the organisation of emergency preparedness at KKP, especially crisis management team organisation. The implementation of the new crisis management team structure was preceded by detailed analyses and debate about the tasks and responsibilities of individual departments during a crisis. The issues were:

- manning of teams within the departments and organisational units;
- co-ordination of tasks during a crisis;
- the who and how of internal and external communication procedures; and
- implementation in written operational procedures.

The discussion itself and the need for co-ordination arising from it over a period of several months indirectly made the management of KKP more aware of crisis management team work. The subsequent systematic presentation and employee training of the new structure for the crisis management team organisation was equally fruitful.

The overall result has been a reduction of tension in crisis management team work, which was felt when crisis management team exercises are held.

STATUS AT OSART FOLLOW UP VISIT

The KKP has spent much effort in analyzing and resolving the recommendation and suggestion offered by the original OSART team. A systematic approach was applied to resolve the issue which led to significant progress and comprehensive activities, some of them aimed much broader and also in a longer-term perspective. One recommendation was resolved and one suggestion is progressing satisfactorily to date.
KKP developed a process of emergency planning and preparedness including flowchart. The authorities and responsibilities were clearly identified. The new organization structure is very clear, simple without undue overlapping and with better communication possibilities. The new structure has several advantages e.g. less number of the crisis management team members, the team builds up quickly and starts acting, the team is clearly structured into three cells, meetings are more effective and information management is better. The new structure has been tested during spring on site exercise. The feedback form members of the crisis management team and observers were very positive.

The KKP analysed plant’s notification system and established clear objectives for a new Digital Alarm and Communication server (DACS). DACS has been successfully developed during the years 2005and 2006 with following features:

Notification, warning, alarm, conferring over a large area, reaches members rapidly using existing telephone infrastructure and public terrestrial and mobile networks. DACS has been successfully tested using test group comprises 30 volunteers from KKP and contractors. Full implementation of DACS requires design modification of MCR and such modification shall be approved by regulatory authority. The design modification will be submitted to the regulatory authority in December this year and implemented after receiving permission from the regulatory authority.

8.6. TRAINING, DRILLS AND EXERCISES

8.6(1) **Issue:** While there is a competent emergency response team, some weaknesses in the programme for emergency exercises and functioning of the emergency teams were identified.

The telephone calling system used to notify emergency staff is operated manually through a scheme of sequential calls. This system could be slow or difficult to complete. There exist two steps of emergency calling:

  - Step 1: The shift supervisor of the non-affected unit starts alarming the members of the emergency preparedness group and the heads of the emergency unit.
  - Step 2: The emergency preparedness group and the heads of emergency unit decide whether additional persons need to be convened to manage the emergency.

- Although the plant plans to modify the management structure of the emergency response team, the present arrangement may place a too large administrative burden on some positions.
- The number of people participating in exercises is less than on other plants around the world.
- The number of off-site exercises was only two in 10 years. Most other plants in the world perform these exercises more frequently.

More efficient communication practices and more frequent exercises will improve emergency response.

Recommendation: The plant should improve the emergency exercise practice and frequency, especially concerning off-site exercises.

Plant Response / Action:

Both the composition and allocation of roles in the KKP Crisis Management Team have been reorganised.

Human resources

The number of Crisis Management Team members has been reduced from twelve to ten. The decision making authority remains with the Head of Operation (LdA). Three Crisis Management Team members make up each of three "cells", whose role is to support the Head of Operation (LdA). The composition of technical department and crisis management functions in the cells is as follows:

- Leadership cell (Team leadership and information management), comprising the "Team Leader", "Assistant Team Leader" and "Minute Keeper"
- Internal cell (internal matters) with representation from the technical departments "Operations", "Maintenance" and "System Engineering".
- External cell (external matters and radiology) in which the technical departments "Surveillance", "Communications" and "Regulatory Reporting" are represented.

In addition to the departmental response units supporting the members of the Crisis Management Team, organisational units were set up for "Technical Support" and "Safety" functions. The Safety Engineer is no longer a member of the Crisis Management Team but leads the "Safety" organisational unit.

The former Crisis Management Team member "Logistics" is no longer part of the Team. The duties of this department are fulfilled by the "Logistics" response unit, which is headed in the event by the "Maintenance" member of the Crisis Management Team.

Distribution of Functions

In order to relieve the burden on the Head of Operation (LdA), the Team Leader chairs the Crisis Management Team meetings. The decision making authority rests with the Head of Operation (LdA) of the power generating unit concerned.
The duty of external communication has been lifted from the "Surveillance" department.
Contact with external response organisations is made by the "System Engineering" Crisis Team member.

The expected improvements in Crisis Management resulting from the new organisation are:

- structured meetings (tracking of instructions, breaks)
- a targeted flow of communications with decision making
- earlier readiness / response capability of the Crisis Management Team (as soon as one representative of a "cell" is present, the cell can go into action, i.e. new members of the Crisis Management Team are integrated into the work faster.

The new Crisis Management Team organisation has been introduced incrementally, in the context of

- several training courses for Crisis Team members, the leading shift crew members and new KKP employees; and
- inspections in the field and departmental/ section training courses, Crisis Team exercises for KKP1 and KKP2, and workshops in which Crisis Team exercises were used to train the Team and its first and second reserves.

Feedback from Crisis Management Team members has been generally positive. Communication during the Crisis Management Team meetings was optimised by the cell structure. Information management was centralised by means of technical modifications in the Crisis Team command centre. External communication has been improved by installing a new telephone system in the telecommunications room of the Crisis Management Centre.
The new Crisis Management Team organisation was mapped in process K 9.3 “Crisis and Emergency Management” and has been in place since 23rd March 2006. The frequency of emergency drills, especially with regard to exercises in association with off-site organisations, will be increased in future.
Under the provisions of the "Disaster Response and Management Act" (Gesetz über den Katastrophenschutz (Landeskatastrophenschutzgesetz - LKatSG), KKP has the obligation to take part in exercises when required to do so by the authority responsible for crisis control to the extent defined by the authority. The emergency authorities are required to conduct regular

exercises under the authority's standard command and involving KKP for the purpose of preparedness.
This means that the definition and frequency of off-site emergency preparedness exercises is a matter for the responsible emergency preparedness authorities.

Under the provisions of the "Framework of Recommendations for Disaster Control in the Vicinity of Nuclear Installations" (Rahmenempfehlungen für den Katastrophenschutz in der Umgebung kerntechnischer Anlagen) special emergency preparedness plans are established for the surroundings of nuclear power plants requiring compliance with some essential principles, e.g. alarms, identification of the situation (radiological, environmental measurements etc.), notification and warnings to the public, traffic restrictions, staying indoors, distribution of iodine tablets, evacuation, decontamination, medical assistance and care. In addition to the authority preparedness planning, KKP is required by the Radiation Protection Ordinance to establish precautionary and preparedness action plans of its own, which are set out in the alarm procedures contained in the Operating Manual BHB and the Emergency Preparedness Manual. Planning and execution of emergency exercises at KKP is governed by the latter documents (on-site emergency preparedness) on the basis of the "Recommendations for the Planning of Emergency Preparedness Actions by the Operators of Nuclear Power Plants" (Empfehlungen zur Planung von Notfallschutzmaßnahmen durch Betreiber von Kernkraftwerken).

At the beginning of 2006, the Ministry of the Environment for Baden-Württemberg, in consultation with other independent external experts, carried out a regulatory review focused on the "Planning and Execution of Emergency Preparedness Exercises by the Operator". We do not have the results of this review yet.

IAEA comments:

The recommendation offered by the OSART team was thoroughly analyzed and well addressed by the KKP. A process of emergency planning and preparedness was developed including detailed flowchart. The authorities and responsibilities are clearly identified. The new organization structure is very clear, simple without undue overlapping and with better communication possibilities. Head of Operation is decision maker supported by three basic groups/cells: Leadership & information management, including chairman of the crisis management team, chairman assistant and minutes keeper, External affairs and radiation protection including nuclear safety engineer, surveillance and public relations, Internal affairs including operation, maintenance and system engineer. The crisis management team is further supported by operation units and organization units. The new structure has several advantages e.g. less number of the crisis management team, the team builds up quickly and starts acting, the team is clearly structured into three cells, meetings are more effective and information management is better. The new structure was approved in March this year and has been tested during spring on site exercise. The feedback from members of the crisis management team and observers were very positive. KKP is performing 2 on-site exercises per year, one for unit 1, second for unit 2. The rules for frequency of off- site exercises were discussed with the regulatory authorities and they decided that changes are not necessary.

Conclusion: Issue resolved.

Suggestion: The plant should improve the notification system.

Plant response/Action:

Following the implementation of the new Crisis Management Team organisation, the notification of Team members was automated. The first stage reflects the existing procedure for raising the Team. In addition, a digital alarm and communication server (DACS) was installed.

IAEA comments:

The KKP analysed plant's notification system and established clear objectives for a new Digital Alarm and Communication Server (DACS). These objectives included automation of warning system, speeding up the alarm processes, economy of personnel resources, automated and qualified record keeping and use of modern technology. DACS has been successfully developed during the years 2005 and 2006 with following features:

Notification, warning, alarm, conferring over a large area, reaches members rapidly using existing telephone infrastructure and public terrestrial and mobile networks. DACS was successfully tested using test group consisting of 30 volunteers from KKP and contractors. Full implementation of DACS requires design modification of MCR and such modification shall be approved by regulatory authority. The design modification will be submitted to the regulatory authority in December this year and implemented after receiving permission from the regulatory authority.

Conclusion: Satisfactory progress to date.

SUMMARY OF STATUS OF RECOMMENDATIONS AND SUGGESTIONS OF THE FOLLOW-UP OSART MISSION TO PHILIPPSBURG NPP 6 -10 NOVEMBER 2006

	RESOLVED	SATISFACTORY PROGRESS	INSUFFICIENT PROGRESS	WITH-DRAWN	TOTAL
Management, Organization & Administration	R 2 S 1	R 4			R 6 S 1
Training & Qualification	R 1 S 1				R 1 S 1
Operations	R 1 S 1	R 1			R 2 S 1
Maintenance	R 4 S 2	S 1			R 4 S 3
Technical Support Including Operating Experience feedback	S 1	R 1			R 1 S 1
Radiation Protection	S 1				S 1
Chemistry	R 1 S 1				R 1 S 1
Emergency Planning and Preparedness	R 1	S 1			R 1 S 1
TOTAL R (%) TOTAL S (%)	R 10 62,5 S 8 80	R 6 37,5 S 2 20			R 16 S 10
TOTAL (%)	R+S 18 69,2	R+S 8 30,8			R+S 26 100

DEFINITIONS

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.

DEFINITIONS - FOLLOW-UP VISIT

Issue resolved - Recommendation

All necessary actions have been taken to deal with the root causes of the issue rather than to just eliminate the examples identified by the team. Management review has been carried out to ensure that actions taken have eliminated the issue. Actions have also been taken to check that it does not recur. Alternatively, the issue is no longer valid due to, for example, changes in the plant organization.

Satisfactory progress to date - Recommendation

Actions have been taken, including root cause determination, which lead to a high level of confidence that the issue will be resolved in a reasonable time frame. These actions might include budget commitments, staffing, document preparation, increased or modified training, equipment purchase etc. This category implies that the recommendation could not reasonably have been resolved prior to the follow up visit, either due to its complexity or the need for long term actions to resolve it. This category also includes recommendations which have been resolved using temporary or informal methods, or when their resolution has only recently taken place and its effectiveness has not been fully assessed.

Insufficient progress to date - Recommendation

Actions taken or planned do not lead to the conclusion that the issue will be resolved in a reasonable time frame. This category includes recommendations on which no action has been taken, unless this recommendation has been withdrawn.

Withdrawn - Recommendation

The recommendation is not appropriate due, for example, to poor or incorrect definition of the original finding or its having minimal impact on safety.

Issue resolved - Suggestion

Consideration of the suggestion has been sufficiently thorough. Action plans for improvement have been fully implemented or the plant has rejected the suggestion for reasons acceptable to the follow-up team.

Satisfactory progress to date - Suggestion

Consideration of the suggestion has been sufficiently thorough. Action plans for improvement have been developed but not yet fully implemented.

Insufficient progress to date - Suggestion

Consideration of the suggestion has not been sufficiently thorough. Additional consideration of the suggestion or the strengthening of improvement plans is necessary, as described in the IAEA comment.

Withdrawn - Suggestion

The suggestion is not appropriate due, for example, to poor or incorrect definition of the original suggestion or its having minimal impact on safety.

LIST OF IAEA REFERENCES (BASIS)

Safety Standards

Safety Series No.110; The Safety of Nuclear Installations (Safety Fundamentals)

Safety Series No.115; International Basic Safety Standards for Protection Against Ionizing Radiation and for the Safety of Radiation Sources

Safety Series No.120; Radiation Protection and the Safety of Radiation Sources: (Safety Fundamentals**)**

NS-R-1; Safety of Nuclear Power Plants: Design (Safety Requirements)

NS-R-2; Safety of Nuclear Power Plants: Operation (Safety Requirements)

NS-G-1.1; Software for Computer Based Systems Important to Safety in Nuclear Power Plants (Safety Guide)

NS-G-2.1; Fire Safety in the Operation of Nuclear Power Plans (Safety Guide)

NS-G-2.2; Operational Limits and Conditions and Operating Procedures for Nuclear Power Plants (Safety Guide)

NS-G-2.3; Modifications to Nuclear Power Plants (Safety Guide)

NS-G-2.4; The Operating Organization for Nuclear Power Plants (Safety Guide)

NS-G-2.5; Core Management and Fuel Handling for Nuclear Power Plants (Safety Guide)

NS-G-2.6; Maintenance, Surveillance and In-service Inspection in Nuclear Power Plants (Safety Guide)

NS-G-2.7; Radiation Protection and Radioactive Waste Management in the Operation of Nuclear Power Plants (Safety Guide)

NS-G-2.8; Recruitment, Qualification and Training of Personnel for Nuclear Power Plants (Safety Guide)

NS-G-2.9; Commissioning for Nuclear Power Plants (Safety Guide)

NS-G-2-10; Periodic Safety Review of Nuclear Power Plants (Safety Guide)

50-C/SG-Q; Quality Assurance for Safety in Nuclear Power Plants and other Nuclear Installations (Code and Safety Guides Q1-Q14)

RS-G-1.1; Occupational Radiation Protection (Safety Guide)

RS-G-1.2; Assessment of Occupational Exposure Due to Intakes of Radionuclides (Safety Guide)

RS-G-1.3; Assessment of Occupational Exposure Due to External Sources of Radiation (Safety Guide)

RS-G-1.4; Building Competence in Radiation Protection and the Safe Use of Radiation Sources (Safety Guide)

GS-R-2; Preparedness and Response for a Nuclear or Radiological Emergency (Safety Requirements)

INSAG, Safety Report Series

INSAG-4; Safety Culture

INSAG-10; Defence in Depth in Nuclear Safety

INSAG-12; Basic Safety Principles for Nuclear Power Plants, 75-INSAG-3 Rev.1

INSAG-13; Management of Operational Safety in Nuclear Power Plants

INSAG-14; Safe Management of the Operating Lifetimes of Nuclear Power Plants

INSAG-15; Key Practical Issues In Strengthening Safety Culture

INSAG-16; Maintaining Knowledge, Training and Infrastructure for Research and Development in Nuclear Safety

INSAG-17; Independence in Regulatory Decision Making

INSAG-18; Managing Change in the Nuclear Industry: The Effects on Safety

INSAG-19; Maintaining the Design Integrity of Nuclear Installations Throughout Their Operating Life

Safety Report Series No.11; Developing Safety Culture in Nuclear Activities Practical Suggestions to Assist Progress

Safety Report Series No.21; Optimization of Radiation Protection in the Control of Occupational Exposure

TECDOCs and IAEA Services Series

TECDOC-489; Safety Aspects of Water Chemistry in Light Water Reactors

TECDOC-744; OSART Guidelines 1994 Edition

TECDOC-1329; Safety culture in nuclear installations - Guidance for use in the enhancement of safety culture

TECDOC-955; Generic Assessment Procedures for Determining Protective Actions during a Reactor Accident

EPR-METHOD-2003; Method for developing arrangements for response to a nuclear or radiological emergency, (Updating IAEA-TECDOC-953)

EPR-ENATOM-2002; Emergency Notification and Assistance Technical Operations Manual

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