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REPORT OF THE

OPERATIONAL SAFETY REVIEW TEAM

(OSART)

MISSION

TO THE

NECKARWESTHEIM

NUCLEAR POWER PLANT

GERMANY

8 to 24 October 2007

And

FOLLOW-UP VISIT

11 to 14 May 2009

DIVISION OF NUCLEAR INSTALLATION SAFETY
OPERATIONAL SAFETY REVIEW MISSION
IAEA-NSNI/OSART/07/142F

PREAMBLE

This report presents the results of the IAEA Operational Safety Review Team (OSART) review of Neckarwestheim 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.

This report also includes the results of the IAEA's OSART follow-up visit which took place 17 months later. The purpose of the follow-up visit was to determine the status of all proposals for improvement, to comment on the appropriateness of the actions taken and to make judgements on the degree of progress achieved.

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

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INTRODUCTION AND MAIN CONCLUSIONS

INTRODUCTION

At the request of the Government of Germany, an IAEA Operational Safety Review Team (OSART) of international experts visited the site of Neckarwestheim Nuclear Power Plant and concentrated its review on unit one (unit I) from 8 October to 24 October 2007. Neckarwestheim NPP unit one is a part of the Neckarwestheim site which has two (2) units with a total capacity of 2240 MWe. The nuclear power plant (NPP) is part of the Energie Baden-Württemberg Kernkraft GmbH (EnKK) Group.

The site is located in the Southwest of Germany, in the federal state or "Land" Baden-Württemberg, in the local-authority districts of Neckarwestheim and Gemmrigheim, built on the shore of the Neckar river. The NPP is situated approximately 30 km north of the city of Stuttgart and 10 km south of Heilbronn.

Neckarwestheim units I and II, which generate 840 MWe and 1400 MWe respectively, have been in operation since June 1976 and January 1989. Both Neckarwestheim units generate electricity for the three-phase public grid and for the railway company Deutsche Bahn AG. The shareholders of the operating company EnKK are EnBW Kraftwerke AG (wholly-owned subsidiary of EnBW AG), ZEAG Energie AG, Deutsche Bahn AG and Kernkraftwerk Obrigheim GmbH. EnBW Kraftwerke AG is the principle shareholder and owns more than 98% of the plant.

The purpose of the mission was to review operating practices in the areas of management organization and administration; training and qualifications; operations; maintenance; technical support (engineering); operating experience; radiation protection; chemistry and emergency planning and preparedness. In addition, an exchange of technical experience and knowledge took place between the experts and their plant counterparts on how the common goal of excellence in operational safety could be further pursued.

The Neckarwestheim OSART mission was the 142nd in the OSART programme, which began in 1982.

The OSART team for Neckarwestheim was composed of experts from Belgium; Brazil; Canada; China; Czech Republic; France; Hungary, Romania; United Kingdom, and the USA, together with the IAEA staff members and one observer from Sweden. The collective nuclear power experience of the team was approximately 280 years including the observer.

Before visiting Neckarwestheim, the team studied information provided by the IAEA and the plant to familiarize themselves with the main features of the plant and operating performance, staff organization and responsibilities, and important programmes and procedures. During the mission, the team reviewed many of the plant's programmes and procedures in depth, examined indicators of the plant's performance, observed work in progress, and held in-depth discussions with plant personnel.
Throughout the review, the exchange of information between the OSART experts and plant personnel was very open, professional and productive. Emphasis was placed on assessing the effectiveness of operational safety rather than simply the content of programmes. The conclusions of the OSART team were based on Neckarwestheim's performance compared with IAEA Safety Standards.

OSART MAIN CONCLUSIONS

The OSART team concluded that the managers of Neckarwestheim are committed to improving the operational safety and reliability of their plant. This is clearly demonstrated by the fact that since the OSART preparatory meeting in November 2006, the plant has introduced or extended several programmes contributing to improved operational safety. During this process, the plant has extensively used the OSART methodology for self assessment and the IAEA Safety Standards to benchmark their existing practices. The management of Neckarwestheim also identified useful improvements taking into account lessons learned from a previous OSART mission at Philippsburg NPP, which took place in October 2004.

The team found good areas of performance, to share with the international nuclear community including the following:

- A visual display has been created for fuel loading and unloading in the computerized operation management system to support the shift crew when monitoring sub-criticality. The purpose of this function is to assure the communication between the refueling machine operators, shift crew and the responsible people of the reactor physics section during fuel handling. This system provides Control Room Operators with a better method of monitoring refueling status than is generally seen in other NPPs.
- In the past, at the beginning of the outage, filling up the reactor cavity sometimes caused an increase of aerosol concentration within the containment building. The corrective action taken by the plant was a temporary coverage of the reactor cavity with balloon silk. Any radioactivity underneath the cover is then extracted by a suction system equipped with aerosol and iodine filters. The benefits of this process are a decrease in ambient air activity concentrations and associated contamination of the operating rooms.
- The plant commissioned, in 2006, a Safety Management System (SMS) which is based on the ISO 9001 standard. With its implementation, the plant obtains a common structured description of the main plant processes, which are shown in comprehensive flowcharts describing how the process is working, the interfaces and who has which responsibilities. Process owners make sure that the process functions as expected, using performance indicators.
- Neckarwestheim NPP has a well structured and equipped I&C components workshop, where failed or obsolete electronic assemblies can be repaired or replaced. In cases where a component is no longer available, the necessary modification is performed and the relevant documentation updated. Neckarwestheim NPP is able to provide support to all other German nuclear power plants in the repair of I&C assemblies, or to modify equipment in line with the safety qualification.
- The plant uses all sources of internal operating experience for determining reliability data for plant-specific probabilistic safety analysis (PSA). The main benefit for the plant is the improvement of the statistical dependability of the reliability data by making use of the operational experience of similar plants and the own OE. With this the plant has a current and meaningful PSA and modifications as well as change of test frequencies can be assessed.

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

- The plant should further develop, clarify and reinforce its expectations in the industrial safety programme. Without a full and effective implementation of this programme, and without strict management expectations, the plant personnel is exposed to more industrial risk with potential injuries as a direct consequence.

- The plant should consider improving the preparedness to implement precautionary urgent protective actions on-site in the case of a radiological emergency beyond the requirements by German laws. Without the establishment of precautionary urgent protective actions, the risk of deterministic health effects for emergency support teams cannot be reduced even if the probability due to the design of the plant is very low.
- The plant should consider improving the current infrastructure in the field of emergency preparedness and response to be consistent with the IAEA safety standards and guides to assure a good support for the effectiveness of emergency response activities.
- The plant should consider full implementation of a comprehensive system to report, track and trend low level events in order to have the opportunity to identify precursors to more significant events.

The overall impression of the OSART team is that the plant showed many attributes associated with a strong safety culture. Neckarwestheim has had good performance results over the past years having the last scram in 2003 (four years before the start of the mission). The team observed evidence that plant attention to good material conditions, housekeeping and cleanliness is visible throughout the plant and this indicates a strong commitment by the plant management. The plant safety related structures, systems and components are well maintained and tested and this has resulted in superior equipment performance and plant availability. The OSART team, in its joint search for improvement, interacted with personnel who were open, honest, technically competent and qualified. The team noticed that special and adequate attention was paid to fire equipment and exercises. Good team work is well established at the plant.

A strong safety culture is evident in many ways; however the team found some areas where improvements are on-going and need to be sustained and fully implemented. For example the “plant management presence in the field” programme, during normal operation, could to be further promoted, allowing the plant managers to encourage, coach and reinforce safe practices and management expectations toward employees at Neckarwestheim.

Neckarwestheim NPP management expressed a determination to address the areas identified for improvement and indicated a willingness to accept a follow-up visit in about eighteen months. The regulatory body from the state level supports the plant decision.

NECKARWESTHEIM FOLLOW-UP MAIN CONCLUSIONS (Self Assessment)

At the request of the Government of Germany, an IAEA Operational Safety Review Team (OSART) of international experts visited the site of Neckarwestheim Nuclear Power Plant and reviewed unit one (unit I) from October 08 to October 24, 2007. Following our principle of continuous improvement, the preparation process was just as important as the mission itself. Preparation was undertaken as a project, in which people who would be 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 provided a comprehensive view.

Comparison with the OSART Guidelines, undertaken with the support of experts from other nuclear power stations followed up by discussion to identify and implement corrective action and intensive engagement with the problems of other team members, enabled us to compare our performance with that of other nuclear plants and to improve our operational safety in advance to the OSART mission.

We have rigorously maintained this approach throughout preparation for the follow-up visit and actively involved the other nuclear power stations in our corporate group (KKP and KWO). The follow-up project at GKN has been supported by technical experts and management staff from KKP and KWO. Similarly, KPP had had the support of our experience in their preparations for their OSART follow-up in 2006. Members of our staff are involved in IAEA missions and the preparation of new IAEA documents and conduct benchmark visits in other NPPs abroad (e.g. GB, US and Canada), bringing experience back to our plants. Their well-defined duties are validated by the OSART results and our corrective action programme, and we consider this an important step in the process of continuous improvement.

The results of OSART missions in our plant and in others 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 recommendations and nine suggestions advanced by the OSART team have all been assessed with a view to implementation and presented to the local GKN OSART Steering Committee for decisions. They were assessed and prioritized individually so that they could be co-ordinated with other on-going activities in the plant.

Along with the actions resulting from OSART, other major projects ongoing at this time include the introduction of the indicator-based safety management system, the condition-based preparation and performance of the annual maintenance outages, particularly the long outage for unit I. In order to accept decisions and changes, individuals must be aware of and appreciate the underlying reasoning and purpose. The OSART follow-up mission therefore offers us the opportunity of seeing our estimation of the relevance and progress of individual actions appraised through the eyes of the IAEA team.

We have supplemented our set of procedures in order to impart all relevant expectations to the operators. This has led to enhanced monitoring and surveillance of the plant processes. Similarly, the corrective actions in the fields of radiation protection and chemistry have been helpful in providing clear rules and procedures for the individuals involved.

OSART FOLLOW-UP MAIN CONCLUSIONS

Neckarwestheim NPP achieved very good results during this follow-up mission. There is clear evidence that NPP management has gained significant benefit from the OSART process. The results from the previous OSART Follow-up on the Philippsburg NPP were fully utilized during the preparation for the mission.

The team received full cooperation from the Neckarwestheim NPP management and staff and were impressed with the actions taken to analyze and resolve the findings of the original mission. The plant thoroughly analyzed all the OSART suggestions and the recommendation and developed appropriate corrective action plans. The willingness and motivation of plant management to use benchmarking, consider new ideas and implement a comprehensive safety improvement programme was evident and 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 in a much broader manner than the original intent of the recommendation and suggestions. In addition, several of the safety improvements were implemented across the EnKK fleet. This is considered to be very important by the team and confirmation that EnBW acknowledged the OSART recommendation and suggestions as very significant to the improvement of operational safety.

Neckarwestheim NPP performed investigations and assessments on how to resolve the industrial safety recommendation. A multidisciplinary working group was set up to discuss in depth industrial safety and has developed a comprehensive action plan. The action plan is broadly covering three basic areas; Man – Technology – Organization interfaces. The action plan is assessed and updated regularly, distributed to appropriate managers and is accessible to all employees via the internal intranet system. This issue was evaluated as being resolved.

The plant addressed two issues related to operation. Clarification is now given in the revision to the procedure with respect to control room operations staff, including Shift Supervisors, regarding their required frequency of panel walkdowns in the Main Control Room and specifically what they should review. Also, requirements are in place regarding the reporting of industrial safety deficiencies, for field operators to identify and report such deficiencies. A pre-job briefing is now conducted, if required by work supervisors, shift supervisors or if it is a non-routine activity or presents a potential danger for either the plant or job safety. These briefings include a portion concerning debriefing (post-job briefs). The plant has initiated a policy of 'as few documents on site as possible'. Those documents which constitute 'operator aids' are now well-controlled within a system developed by the plant which ensures that all remaining operator aids are valid and relevant. Individuals are given the responsibility and ownership for operator aids within their specified jurisdiction and they are charged with controlling such aids. All departments at GKN have been informed about the new stamping arrangement and that BAW-185 is valid for all departments.

During the OSART mission, one suggestion was made in the area of Technical Support. The plant has developed a quarterly system health report. The report contains essential data and an overall assessment of the status for each system. The report has proven to be a useful tool for the management to get a comprehensive overview of the status of the plant. The plant has performed a comprehensive study to identify data to trend and has strengthened the vibration supervision with on-line measurements on relevant pumps and motors.

In the Operating Experience area two suggestions were reviewed. The plant revised the management expectations in order to focus more on the operating experience feedback process and the no-blame policy. Deadlines to perform basic analyses or in-depth analyses are now written into the OE procedures and tracked by indicators. Regarding the issue of LLE, a new procedure describes the trending concept. The plant uses four sources: field walk downs of managers, technical fault reports, LLE identified in the Chemistry section (the plant considered Chemistry section as a pilot before full implementation of LLE for all other sections), and LLE concerning industrial safety identified in the Construction section within the framework of a special action plan.

In the area of Radiation Protection, the plant has undertaken a number of initiatives to address the issue. The induction training video has been totally revamped. Further training sessions have been undertaken, for plant and contractor staff. A rapid-response foot contamination monitor (Kadet) was developed by the plant staff. This monitor detects low levels of gamma radiation in a short counting time and was successfully used during the last plant outage. A new procedure has been developed to designate and delineate contamination controlled zones. Hand and foot monitors have been placed in strategic locations. Plans are also in place, with a projected timescale of completion by 2009, to install a fixed contamination monitor in the truck airlock.

The plant is using a powerful central database to control all chemicals, auxiliaries and consumable materials. The database contains all safety datasheets and necessary information from the manufacturer. In addition operating procedures for handling these substances are part of the database. The appropriate storage and labeling of hazardous substances was confirmed during comprehensive plant tours. The plant conducted many training activities to familiarize the staff and contractors about the hazardous substances management system and revised procedures. The plant also has implemented two hardware modifications to fully resolve the OSART issue.

In the area of Emergency Planning and Preparedness two suggestions were made during the OSART mission. To cover events with a very low probability of occurrence that could lead to the release of radioactivity the plant has added a new section to the Emergency Procedure Manual. The new section provides guidance and rules for operational intervention levels with general measures as well as radiation protection and dosimetry measures. This guidance is rather complex and the team encourages the plant to review the categorization and, at the same time, reconsider their position to have the assembly point inside a building instead of outdoors. A comprehensive online dose-rate measurement system has been installed and the system provides a good overview of the radiological situation around the site should a radiological accident occur. The plant has also relocated the emergency response staff.

The original OSART team in October 2007 developed one recommendation and nine suggestions to further improve operational safety of the plant. As of the date of the follow-up mission, some 18 months after the OSART mission, 80% of issues were fully resolved and 20% were progressing satisfactorily.

There was not one issue which was considered as having insufficient progress. These results are excellent.

The team was given total access to all information and personnel at Neckarwestheim NPP. The team was allowed to independently verify all information that was considered relevant to its review. In addition, the team concluded that the managers and staff were open and frank in their discussions on all issues. This open discussion made a huge contribution to the success of the review and the quality of the report.

1. MANAGEMENT, ORGANIZATION AND ADMINISTRATION

1.1 ORGANIZATION AND ADMINISTRATION

The organizational structure of the three sites Neckarwestheim, Philippsburg and Obrigheim is undergoing an organizational change within the framework of the EnKK merging process. The first step is nominating a joint manager board with Technical Directors for each site. The final objective is to promote a unified organizational structure and standards for the two operating sites, Philippsburg Nuclear Power Plant and Neckarwestheim Nuclear Power Plant. EnKK has under its authority the third site, Obrigheim Nuclear Power Plant, which is undergoing decommissioning. The merging process started in 2004 with the establishment of EnKK-wide responsible Commercial and Human Resource Sections. The merging process is considered to be completed for these sections. This first part of the merging process was on the plant own responsibility and therefore not subjected to state regulatory approval. The second part of the merging process will address the technical organizational structures with cross-functional tasks and will need approval from the state regulator. The plant currently is implementing some of the preliminary steps like discussions with the work council and selection of new managers. The merging process is a major organizational change where some functions will change or will be reorganized.

Currently managers are in the plant performing the function of section heads while they are still maintaining the shift supervisor operator license. They are also process owners of several safety management system (SMS) processes.

The organizational structure is described in the Personnel Organization Procedure (PBO). This document contains the job descriptions of all managers and department and section heads including the shift supervisors and states the managers' main responsibilities. The PBO is approved by the state regulator (UM). However, apart from a general statement about safe operation, the managers' job descriptions do not contain an expectation for nurturing safety culture, promoting and enforcing safe attitude and professional behaviors. At the plant level, another document (G+K Business and Competence Assignment) describes, in more detail, the responsibilities of all staff (structured in organizational, technical and economic responsibilities). These job descriptions do not contain references or expectations for safety. The plant states that these expectations of the management regarding safe attitude and professional behavior are described in the MARKER endorsed by EnKK top management. A booklet and an electronic documentation system e-Doc promote plant expectations. The team noticed that the PBO is currently under revision to include the description of the organization after the merging process.

The plant defined the objective that human resources need to be available at all times, both in terms of quantity and quality. Minimum numbers for required personnel are described in a document (PBO) which is approved by the state regulator. For each manager, department head and section head a short term and a long term succession plan exists. The plan for human resources is updated annually or at any time when organizational changes so require.

Indicators have been devised which closely monitor personnel number fluctuations and un-availabilities due to medical leave and also they monitor any overtime worked by staff. In general, the values of the indicators are in the range of a stable organization.

Personnel age structure and the replacement interval are also closely monitored so new recruits are made to preserve organization know-how.

In order to stimulate and utilize employees' initiatives, the plant developed an Idea Management System. Suggested ideas are analyzed by an assessing group. If the idea is found beneficial it will be considered for implementation and the initiator of the idea is rewarded. In 2007, twenty three ideas for improvement had been submitted.

A Management Review Meeting is conducted every year, where plant management, Heads of Department and assigned personnel discuss plant and company issues and the status of the objectives and goals that result from the Safety Management System. There are also weekly meetings where plant management discuss and establish actions based on plant safety issues.

Technically, the scope of external staff services is clearly defined in the policy document, BAW-195, which considers all requirements of the state regulatory authority. A process of contractors' management procedure U17.1 (process description procedure) is part of the Safety Management System. For each service contract there are liaison persons on both sides. Periodic review meetings between departments and the contractors' representatives are held to evaluate the effectiveness of the provided services. In support of the effectiveness assessment, the plant developed an audit process used by each technical department which supervises contractors.

In general, the plant is satisfied with contractors' performance and quality of services. During the discussions and the field tour it was visible that the plant has the same expectations from the contractors as from its personnel. Also the conditions provided by the plant and contractors are similar.

The plant has in general a good relationship with the state regulator that displays it's authority in a professional manner. The relationship is formalized in various plant documents. There are several meetings a year between the state regulator and the plant management. During these meetings the main topics are the plant issues, event reports, modifications backlog and results from plant inspection tours.
In addition to the primary responsibilities in the domain of safe operation, the plant is required to provide a daily report on plant status to the state regulator, even if there is no on-going safety issue.

All procedures like operating, maintenance and in service inspection procedures on safety related systems, need to be reviewed by the technical experts reporting to the state regulator. This is required, even if there are no safety implications. The average duration for the approval of procedure change is between one to eight months. Due to the difficulties to approve procedures and due to the need to issue some changes on short notice, the plant developed a parallel revision process. These processes are the red print hand written modification process for operating procedures and the temporary shift instructions (SAW). SAW are used to transfer operational information to the shift when the operating procedures cannot be timely revised or approved by the regulator. The plant could go further in the work with the state regulator or technical experts to improve the timing of revision and approval process.

Corporate and plant make efforts to maintain a trust relationship with the public. EnBW opened a public relation center located in Karlsruhe. The nuclear company (EnKK) has also a public relation office located in Philippsburg Nuclear Power Plant. The plant itself has an information center open to the public. About five to ten times a year, the plant organizes cultural events (art exhibitions) with public participation or presentations with information of public interest like nuclear energy policy. A summer fest was organized for the inauguration of the interim fuel storage facility with about 2500 people from the nearby communities. Twice a year, meetings are organized with the public representatives where the plant management presents the major objectives at the company level. The plant distributes also brochures and an information line is available for the mayors of the near-by communities. This is considered to be a positive relation of the plant with the public.

The plant has an Internal Safety Committee gathering department heads, plant managers from the two units and the Technical Director. The chair person of the meeting is the Nuclear Safety Officer. The meetings are held quarterly and are focused on plant safety issues, radiation protection issues, event analysis and external operating events. At the beginning of a meeting observed by the team, the OSART experts noted that two recent events were discussed, one cylinder damaged on one of the diesels and a loss of 0.4 kV bus due to a defective breaker. This meeting was focused on appropriate safety aspects. The content of the presentations was technical and focused on the particular problem with description of different curves on component parameters, drawing sections through complicated devices showing how they work, etc.

The plant has a formal process to address organizational changes. The process is part of the Safety Management System. It is one of the leadership processes and it also contains a comprehensive flowchart. The process was recently implemented and the plant has the intention to apply it to the current merging process of the two operating sites. The process complies with the IAEA safety standards and the content of the document INSAG 18 on organizational changes.

1.2 MANAGEMENT ACTIVITIES

The plant has a SMS-process for defining goals and objectives both from top-down and bottom-up. On the basis of EnKK guidelines, the objectives are issued from the corporate level for the whole company, and afterwards they are analyzed and defined at the site level. These goals and objectives promote the attributes for safe and efficient operation for the year to come.

Another process is developed at department level where the most specific department goals and objectives are established on the basis of the site goals.

Once plant objectives are defined, a brochure is published and then it is disseminated to every staff member. Each individual has a discussion with his line supervisor who ensures the objectives are understood by the employees. At the same time, some specific additional objectives are established for the individual. Some surveys have been performed to assess personnel commitment to plant goals and, in general, the results indicate that the personnel interviewed support the plant goals. The implementation status of the goals and objectives is reviewed during an annual management review meeting. The results are analyzed for the current year and new objectives defined for the next.

In general plant personnel display a professional behavior and attitude showing respect for their responsibilities and the tasks they are required to perform. The plant has developed a programme to enhance human performance behavior. A working group was established to promote the human performance programme in the plant. The EnKK management issued a booklet (Marker) to promote the expectations on professional behaviors such as good communication, team work and a guide for decision making. There is a plan to further improve human performance and to commit the supervisors and managers to enforce positive behaviors.

The team attended some pre-job briefings. A form, which shows how to perform observations, is used by the managers. However, the observation form does not yet cover attitudes and behaviors. Regarding the completed forms the team observed that only few issues were noted and the actions taken only addressed the individual case and not the problem as such.

During field tours, the team noted some instances when personnel performance needs improvements and there was not always evidence that the supervisors corrected behaviors on the spot. The human performance programme should describe (1) expectations for safe performance and quality performance at the job site and (2) how the managers and supervisors observe, coach and reinforce the management expectations. Although there is a human performance programme, the team noted some inconsistencies. A task observation process to correct weak practices is not yet fully defined, the team encourages the plant to go further in that direction.

1.3 MANAGEMENT OF SAFETY

During the OSART review, the team identified several positive features of safety culture at the plant:

The plant has a strong and effective team which indicates that management is supportive of maintaining a team that focuses primarily on safety. Technical staff, engineering support and management at Neckarwestheim were observed to be frequently interacting on all levels of the organization with respect to safety aspects. It is extremely important that this interaction takes place to ensure that any relevant safety aspects are communicated and addressed within the entire organization. The OSART team observed that team work was effective at Neckarwestheim.

All personnel interviewed by the team were observed to be open, honest, technically competent and qualified – an organization requires such employees to ensure a safe working environment and to ensure continuity of safe operation.

The plant safety related equipment at Neckarwestheim was observed to be well maintained and tested. This has resulted in superior equipment performance and availability which is visible through the system of performance indicators developed at the plant.

The material condition, housekeeping and cleanliness throughout the plant are at a very high level and indicate a strong commitment by the management team in this area. It indicates an organization that has a focus on safe practices.

Numerous fire mitigation initiatives have been undertaken at the plant resulting in a professional personnel attitude towards fire safety. The quality of firefighters' action was demonstrated as efficient when the team observed an unplanned drill.

However, a survey of safety culture aspects, which the team undertook, revealed some indications of safety culture that could benefit from further improvement and these includes:

- Significant benefit can be gained from capturing data on events which are below the reporting threshold required by the state regulator. The reporting, analysis and trending of such low level events, including near misses and human performance events, could be further enhanced. This topic is further developed in OE area chapter 6.
- The presence, in the field, of plant management can be improved as this is considered important as it contributes to encouraging, coaching and reinforcing safe practices and management expectations in the work areas.

The safety culture self assessment programme is running at the plant level; the programme is based on a guideline for safety culture developed in the German NPPs (independent from the company - VGB). There are twenty generic subject areas used for the safety culture self assessments. The future plan is to focus more in the area of staff behavior. Assessments were conducted in 2002, 2004 and 2007.

In 2006, the plant commissioned a Safety Management System (SMS) based on the DIN ISO 9001 standard. The initiative started after a German event in 2001. The concept is to get common structured plant processes and define performance indicators and an owner for each process. The process owners monitor the process health status. The processes are separated in three categories: leadership, core and support processes. In total, there are around 70 processes. For each process, a comprehensive flowchart describes process functions and the responsibilities associated with it. All this is supported by a computer programme. The team considers this to be a good practice developed in the MOA area.

For each process, performance indicators were established and a sophisticated computer programme was designed to monitor them. The programme is not yet fully developed. When the performance of a process is not as expected, then actions, responsible persons and target dates are established to remedy the situation.

The performance indicators are not always fully relevant for the purpose they should serve. In some cases it was observed that they are used rather for statistics than as drivers for plant improvement. For example, it is known by the plant that the current fire detectors often raise fault alarms to the main control room. The indicator used is to present the evolution of all fire alarms (announced and non announced alarms) during the last 3-4 years, which shows that the number of alarms is around 150-200 per year. While the problem has been known since commissioning, the plant has been collecting data for statistical purposes rather than taking action to improve the existing fire detection system.

The plant approach to decision making is a practice using a form, which is based on a decision making process used by the aviation industry (FORDEC = Facts, Options, Risks, Decision, Execution, Check). This form is in place to assist the participants in meetings organized in the response to an event.

The organization is willing to further improve safe operation and is using several tools to enhance it. Benchmarks are conducted with other German plants. There are internal audits and an action tracking data base.

1.4 QUALITY ASSURANCE PROGRAMME

The plant quality assurance programme covers the whole range of the activities at the power plant. The quality assurance policy and principles are described in the quality management manual (QMH). Clear responsibilities are established for the implementation of the quality management policies. The main responsibility for QMH policy implementation is assigned to the department and section heads. Departments like electrical and mechanical engineering have developed additional quality programmes to support the plant quality management programme.

External assessments of the quality management programme are conducted through the OSART, WANO Peer Reviews, national peer review system, association of (mainly) German NPPs (VGB-SBS) and by experts on behalf of the state regulatory authority. This is considered by the team to be in accordance with IAEA standards.

1.5 INDUSTRIAL SAFETY PROGRAMME

The plant has an industrial safety programme that covers plant staff and contractors. The legal bases of the programme are the Occupational Safety Act and the Working Conditions Framework Act. The Plant has to comply with the requirements of the Employers Liability Insurance Association (ELIA). The ELIA specifies that an industrial safety event is considered reportable only if the event renders the injured person unavailable for work for more than three days. Events are always reported by the respective employer. The indicator in the first nine months of 2007 is five events for plant personnel. The internal target for the plant is to investigate any events that render the injured person (including contractors) unavailable for work for more than one day. The result after nine months in 2007 is thirty one events that meet the one day threshold. Three of these events happened during the OSART mission and it was not evident to the team that the actions taken by the plant will prevent this kind of events in the future. Twenty five of the thirty one events involved contractors while sixteen were due to stumbling and falling on tripping hazards and nine were cuts and contusions. For each event the plant performs an analysis within the scope of the event report. In the first nine months of this year, no common cause analysis was performed. The plant representative states that if more events are recorded in the same category, then the basis analysis will be performed. However, after discussion with plant management, the team noted a sufficient number of events in the same category that could require a common cause analysis.

Plant personnel are classified in two categories: the workers and administrative staff. Only the first category receives a minimum of one formal brief a year on industrial safety issues by the supervisor. The team encourages the plant to increase the focus on industrial safety aspects for all sorts of employees.

There is a schedule and a check list for managers to go routinely in the field and check various aspects in the plant including personnel protective equipment. Some check lists were observed by the team and it was noticed that in a few instances personnel has no correct behavior in wearing the appropriate safety equipment. The team also made some field observations revealing that industrial safety deficiencies concerning personnel were not always observed and corrected by plant staff. The team considers that plant industrial performance programme has some room for improvement and the team has developed a recommendation in the industrial safety area.

1.6 DOCUMENT AND RECORDS MANAGEMENT

The plant has a well established documentation record system. This is established by the German nuclear-engineering code of practice and licensing and state regulatory procedures. These regulations require that the plant maintain records basically for all safety documentation. There are three groups of documentation records: operations, quality and licensing documents. The safety archives (Central Documentation Office) are well maintained, documents are easily retrievable. Fire detectors are in place and are periodically tested. The fire brigade receives annual refresher training on extinguishing techniques in the archive rooms.

The plant has also implemented an electronic documentation system known as e-Doc. All plant documents are available in electronic form. The system is user friendly and documents are easily retrievable.

NECKARWESTHEIM FOLLOW-UP SELF-ASSESSMENT

The recommendation of the OSART team in the area of industrial safety was seriously adopted by the plant management. The subject has been processed as a comprehensive project with high priority. The objective is to implement the subject of industrial safety as a fixed part of the daily routine for both workers and managers and to achieve a significant increase in awareness and acceptance to industrial safety. The actions taken for this purpose cover clear formulation of management expectations, revision of rules and procedures, training of employees, and monitoring effectiveness. A number of various technical improvements have also been implemented.

The main influencing factors for a successful industrial-safety concept are the mental attitude (mindset) of employees and managers with regard to this subject and the awareness they have of themselves and their own work standards. Consequently, we do not expect a direct and rapid reduction of the number of industrial-safety events down to an excellence level. In the light of this conclusion we are planning a long-term programme of continuous improvement in which we will use the services of acknowledged experts.

In this context the team encouraged us to do further improvements in task observation. So we started with a managers-workshop to create a concept for “managers in the field”.
The good practice for our Safety-Management-System encouraged us for further developments. In April 2009 we got the certification for an Integrated Management-System based on the standards ISO 9001:2008 / ISO 14001:2004 / OHSAS 18001:2007.

STATUS AT FOLLOW-UP OSART VISIT

In the review area of Management, Organization and Administration there was one recommendation developed during the 2007 OSART mission. The Neckarwestheim NPP performed investigations and assessments on how to resolve this recommendation. A multidisciplinary working group was set up to discuss in depth industrial safety and has developed a comprehensive action plan. The action plan is broadly covering three basic areas; Man – Technology – Organization interfaces. The action plan is divided to ten main groups of corrective measures. These groups are subdivided into an additional 63 corrective actions. The action plan is assessed and updated regularly, distributed to appropriate managers and is accessible to all employees via the internal intranet system. The scope of this action plan is broader than the original intent of the OSART issue.

The plant has achieved very good progress in all the main groups of corrective measures. The team considered this issue resolved. However industrial safety improvement is a long standing process and the plant should continue its effort for further enhancements.

DETAILED MANAGEMENT, ORGANIZATION AND ADMINISTRATION FINDINGS

1.2 (a) Good Practice: Safety Management System Concept

The plant has commissioned in 2006 a Safety Management System (SMS) which is based on ISO 9001 standard.

The initiative started after a German event in 2001. The concept is to divide plant processes. For each process there have been defined performance indicators and an owner is responsible to monitor the process. The processes are separated in three categories: leadership processes, core processes and support processes. In total there are around 70 processes. For each process, there are common structured descriptions, which are shown in comprehensive flowcharts. These flowcharts describe how the process is working, the interfaces and the distribution of responsibilities. Process owners make sure that the process functions as expected, using performance indicators. All is supported by a sophisticated computer programme.

With the implementation of this concept the plant obtains:

– a standardized structure of the main plant processes,
– ensure the processes work appropriately at the cross functional interfaces, and
– by monitoring the processes, early decline can be detected.

1.5 INDUSTRIAL SAFETY PROGRAMME

1.5 (1) Issue: Industrial Safety

The plant has not fully developed, clarified and reinforced its expectations in the industrial safety programme.

Although the plant has an industrial safety programme, the team observed a number of inconsistencies:

- OSART team escort observed someone not wearing safety shoes, pointed this out to the individual but did not direct the person to leave the area to obtain proper shoes.
- The plant registered 31 industrial safety events in the first nine month of 2007, out of which more than 25 are with contractors. The plant did not develop any specific plan to decrease the number of event occurrences. Since the start of the OSART mission, three industrial safety events happened in the plant and the team did not see sufficient management reaction.
- Only one root cause analysis was performed on one particular more serious industrial safety event, but not on the aggregate aspect of the industrial safety events to evaluate potential common causes.
- Person in reactor building not wearing safety hat and plant supervisor not taking any action to correct the non compliance with plant safety rules.
- Eye washers are available close to the Diesel battery room; however the working procedures do not specify to add any protective personnel safety equipment such as portable shower.
- In some places in the plant the passages are low and the personnel need to crouch so they do not hit the ceiling. However, there is not always a signpost to warn of the existing hazard. The plant personnel stated that wearing a safety hat is enough.
- The movie presenting the basic training in Industrial Safety at Neckarwestheim NPP revealed several working practices that need to be corrected (e.g. performing mechanical work without gloves).
- During a field tour it was noted that only three out of eleven people entering the residual heat removal pump area were in compliance with the ear protection safety rules. The present plant supervisors did not take expected actions to correct the non compliance with plant industrial safety rules even though there were signposts indicating the requirement to wear ear protection.
- In the steam safety valves rooms several cat walks were observed not having safety chains.

Without a fully and effectively implemented and reinforced industrial safety programme, the plant personnel can be put at risk for injuries.

Recommendation: The plant should further develop, clarify and reinforce its expectations in the industrial safety programme.

IAEA Basis:

NS-G-2.4

6.56. An industrial safety programme should be established and implemented to ensure that all risks to personnel involved in plant activities, in particular, those activities that are safety related, are kept ALARA. An industrial safety programme should be established for all personnel, suppliers and visitors, and should refer to the industrial safety rules and practices that are to be adopted. The programme should include arrangements for the planning, organization, monitoring and review of the preventive and protective measures. The operating organization should provide support, guidance and assistance for plant personnel in the area of industrial safety.

DS347: Draft of safety standards: Conduct of operations

7.35. The operations manager should analyse trends in the occurrence of accidents relating to unsafe industrial safety habits in his department and should take actions to reduce the number of industrial safety events. The operations manager should also analyse trends in the violation of industrial safety in his department to be aware of the direct and root causes of such violations.

Plant response/action:

1. Organizational boundary conditions

In order to further improve industrial safety and health protection at the GKN site and throughout EnKK, a working group that was set up at the start of 2008 has held a number of meetings to discuss in depth questions relating to industrial safety and has developed an appropriate measures plan.
The working group (AG) is a panel 15 strong and is made up of our safety engineers from the two plants GKN and KKP, our plant physician, a representative cross-section of people from the departments and an external specialist for industrial safety. The working group is chaired by a head of department.
The actions proposed by the working group were approved and cleared for implementation by a steering committee consisting of the technical Director and the heads of department.

2. Action plan

The action plan takes into account the M-T-O approach (Man – Technology - Organization interfaces) and has 10 main points with the following objectives:

1. To formulate management's expectations regarding industrial safety in a small number of generally accessible and clearly structured documents
2. To improve the mental attitude of managers and workers to industrial safety
3. To enhance employee motivation for industrial safety by incentives and rewards
4. To reinforce and intensify information about and actions concerning industrial safety
5. To improve substantive information on selecting and wearing personal protective equipment (PPE)

6. To identify and implement technical optimizations in the plant
7. To improve communication about industrial safety and the training of partner companies/contractors with regard to behavioural rules and expectations (contractor management)
8. To systematically analyze and evaluate industrial safety events at work and entries in the first-aid logs
9. To perform industrial-safety training for managers and employees and conduct an exchange of experience with other plants
10. To monitor the efficiency of the actions instigated

Several individual measures were defined for each of these focal points. All optimization measures are stated in a list and their implementation is continuously tracked by management.

3. Implementation status

The investigation and evaluation of the industrial safety events are now conducted on a more structured basis and are carried out more effectively in order to identify root causes and to prevent recurrences.
Improving industrial safety has been incorporated as a point of special attention in our annual goals and is communicated through the employee brochure entitled "Our goals for 2008". This aspect, moreover, has been included as a new item in the EnKK corporate guidelines.
The following is an extract from the action list initiated in 2008 and those planned for 2009, structured in accordance with our H-E-O approach:

Human performance/behavior:

- Specific behavioural rules have been formulated for managers and employees and communicated by supervisors in briefings.
- More frequent posting of information relating to industrial safety on our Intranet to sustain the awareness of our employees for the importance of this issue.
- Advice on and the exchange of information concerning the use and correct selection of personal protective equipment have been intensified.
- In a first phase of a written employee survey we have gathered information on the personal attitudes of our employees to industrial safety. A second phase in 2009 will evaluate the results and assess the effect achieved by measures implemented in the interim.
- An 'industrial safety Olympics' competition embracing all three EnKK plants will be held in 2010.
- Optimization of the MARKER brochure for professional human performance in industrial survey matters.

Organization:

- All managers have been instructed to place particular emphasis on safety at work in the staff appraisal interviews, which are conducted at least once a year.
- If an industrial safety event occurs, the head of section will contact the incident victim personally if possible, clarify the situation for the subsequent post-event analysis, and report on the sequence of events leading to the incident in the next morning meeting.

- During outage preparation the safety engineer and the heads of section conduct one-to-one meetings to discuss special hazards that might arise and define measures for industrial safety
- Training measures have been conducted for contractor staff and expectations with regard to industrial safety were clearly communicated.
- In order to exchange experience and to familiarize themselves with “good practices”, our safety engineers visited EDF-St. Laurent NPP, took part in a VGB conference on "Industrial safety and health protection in power plants" and joined EDF safety engineers in an exchange of ideas on aspects of industrial safety.
- Improvements have been made to characteristic scenes in the level 1 induction training video on work practices, industrial safety and fire prevention and protection for all internal and external workers. Further improvements will be incorporated into a new video that is being made jointly with KKP NPP to promote the inter-plant exchange of experience.
- An Industrial Safety Manual for EnKK has been compiled within the framework of the introduction of an integrated management system in 2009.

Engineering

- All potential tripping hazards in our main passageways and escape routes were listed and are being assessed by an evaluation committee with regard to the need for optimization and approved for alterations as necessary.
- A second handrail has been fitted to upgrade much-frequented stairways.
- A systematic assessment of the offices to assess the correctness of the layout of computer workplaces is planned for 2009.

4. Industrial safety events

There were 16 industrial safety events in our two units in 2008.
This figure is down 56 % on 2007 (37 industrial safety events).

The measures implemented to date show that we further improve the personal attitudes of our managers, our employees and our partner companies to the importance of industrial safety.
We will continue to reinforce these measures by way of a long-term and comprehensive improvement programme.

IAEA Comments:

The Neckarwestheim NPP performed investigations and assessments on how to resolve the OSART recommendation. A multidisciplinary working group was set up to discuss in depth industrial safety and has developed a comprehensive action plan. The action plan is broadly covering three basic areas; Man – Technology – Organization interfaces. The action plan is divided to ten main groups of corrective measures. These groups are subdivided into an additional 63 corrective actions. The ten main groups of corrective measures are as follows:

1. Management expectation goals
2. Improvement of mental attitude of managers and workers
3. Motivation, praise and criticism, incentive plans
4. Information to all employees
5. Use of personal industrial safety protection equipment
6. Hardware improvements to reduce the risk of injury
7. Management of contractors
8. Analysis of industrial safety events/operating experience feedback
9. Training improvements
10. Control of effectiveness of above measures

All corrective actions contain responsible department/persons, completion date and status of completion. The action plan is assessed and updated regularly, distributed to appropriate managers and is accessible to all employees via the internal intranet system. The scope of this action plan is broader than the original intent of the OSART issue.

The plant has achieved good progress in all main groups of corrective measures. Management expectations are well developed and broadly communicated to the staff and contractors. The industrial safety guide is an integral part of the Integrated Management System. The plant is producing an annual booklet "Our goals for the year" including industrial safety goals and a booklet "MARKER for professional behavior", again including industrial safety. This information is distributed to all employees, "MARKER" including contractors.

Industrial safety is discussed in every appraisal interview and managers are heavily involved in the industrial safety issues, including comprehensive walk downs, industrial events investigation and discussions during several types of management meetings. Several initiatives and competitions have been developed to promote good industrial safety. There are EnKK Olympics for industrial safety on top of these initiatives. The plant achieved much better use of industrial safety protection equipment and this was confirmed during comprehensive plant tours.

Many hardware modifications have been implemented and this was again confirmed during the comprehensive plant tours. Several activities have been carried out to improve industrial safety of contractors. The results have showed very good progress, however this area remains as a challenge also for the future. Very important improvements have been done in the area of industrial events investigation and operating experience feedback. All events are analyzed for immediate corrective actions and then a root cause methodology is applied to analyze events and develop appropriate corrective actions to eliminate root causes and to avoid repetition of events. In addition the plant has improved the training programme for all employees including contractors. New movies were developed for initial training in the areas of industrial safety, plant access, fire protection and radiation safety.

Conclusion: Issue resolved.

2. TRAINING AND QUALIFICATIONS

2.1. TRAINING POLICY AND ORGANIZATION

A systematic approach to training is used at Neckarwestheim nuclear power plant (NPP) to maintain and improve programmes relating to initial and continuing training for plant personnel. Job tasks are established by state regulatory requirements, job descriptions and employee business and competence plans (G&K). Learning objectives are established and maintained. Classroom material is structured to ensure learning objectives are met. Training Section ZA owns a continual assessment process that supports maintenance and improvement of training programmes through the use of multiple inputs to a programme needs analysis. These inputs include plant modifications, student feedback, instructor comments, plant and industry events, and supervisory observations.

Policies and programmes clearly define training requirements for plant personnel. Programmes are aligned with all state and national legal requirements and maintained in a manner consistent with a systematic approach to training.

Personnel involved in plant operations are trained in the basics of all disciplines affecting operation, including radiation protection and nuclear safety. Senior plant management, including plant managers, department heads and control room personnel have job related educational backgrounds in engineering, reactor physics or nuclear technology and receive continuing training in technical operation of the plant.

Instructors solicit student feedback following completion of course modules. Training management evaluates and acts on the comments to resolve student concerns and improve training programmes. Supervisors and managers observe simulator training. These observations are supported by a checklist of key activity expectations, such as proper use of procedures, communication and good team interaction. In contrast, qualitative criteria are not established for instructor skills in classroom settings. Historically, the training organization has not focused on instructional skills as much as they have on ensuring the technical expertise of instructors in their subject areas. Training management recognized this as an area where performance could be improved. As a result, in January 2007, Neckarwestheim NPP enhanced instructor qualification through programme requirements for eight days of instructor training in proper instructional techniques. However, the team encourages the plant to propose additional improvements in the definition of their training expectations.

Personnel qualification is assessed as part of all plant initial training programmes. At Neckarwestheim NPP, apprenticeship and mentoring are emphasized in all disciplines. Trainees are guided and coached by experienced personnel through their qualification process.

Control room operational personnel participate in a lengthy training process with frequent observation and oversight by management personnel. A panel of experts assesses trainee knowledge at completion of the programme. Following the end of the formal scheduled training, these trainees then continue their training as apprentices under fully qualified control room personnel for a minimum of 6 months to a year, depending on future job position. Certified master technicians (mechanic, electrical and control technicians) mentor apprentices, ensuring they are fully capable prior to authorizing them for independent work.

Line and training managers are fully engaged in oversight of individual qualifications.

The NPP parent organization (EnBW) plans to realign some training functions for their two operating nuclear plants (Philippsburg and Neckarwestheim) in the near future under a single department. The team recognizes this as potentially beneficial toward improving training at both sites.

Training attendance is good and easily verified through a centralized database tracking system. Training records fully document each individual's training history. Training history files are maintained on each plant employee. Individuals and their supervisors can assess their training history through an on-line training management system. Individual qualification records are linked within this system to the work planning process such that work planners are notified if they attempt to schedule work to be performed by individuals whose qualification has lapsed. The team developed a good practice in this area.

The plant's training manual establishes clear lines of responsibility for content and implementation of training programmes. In some cases, responsibility for administration of training programmes (mechanical, electrical, automation, chemistry, radiation protection and technical support) is divided between the central services training section and the line discipline. Central services training section interacts closely with these groups, making all arrangements to provide the requested training services and controlling course documentation for tracking and trending purposes.

Training and personnel development are fully accepted by management as necessary and valuable to the organization. Support for training by plant management is clearly evident. Training records indicate site personnel in all disciplines receive a significant amount of structured training. The amount of training conducted exceeds minimum requirements in every training programme. Much of the training is provided by expert external service organizations, such as Kraftwerks-Simulator-GmbH and Gesellschaft für Simulatorschulung mbH (KSG and GfS) in Essen, Germany.

Neckarwestheim NPP seeks high quality providers for training services. For example, specialized equipment operator training is conducted by an individual with many years experience and qualified by the related industry organization to issue equipment operator licenses. The long term relationship with the KSG/GfS full scope simulator training company is another good example of Neckarwestheim NPPs use of high quality external training providers.

External training services are used extensively at Neckarwestheim NPP with good result. Supervisors are generally engaged in the process to respond when training services do not meet their expectations. Supervisors take responsibility for training of their personnel and it is evident that they communicate with these personnel about all aspects of their jobs, including training.

Solicitation of training feedback is not required by the organization for courses taught off-site by external training service providers. Any trainee feedback in these cases is solicited by the external organization only and its review and use may differ among service providers. The team encourages the plant to consider enhancement of processes to ensure feedback is consistently received and addressed for all documented training of Neckarwestheim NPP personnel on-site and off-site by part-time, full-time and external instructors.

2.2. TRAINING FACILITIES, EQUIPMENT AND MATERIAL

Classroom facilities at the plant are generally very good. Human factors have been taken into consideration in the layout, lighting, seating and ventilation of classrooms. A wide variety of training aids are used. Most classrooms are set up with computers and projectors for electronic presentations as well as transparency machines and erasable boards.

The simulator for Neckarwestheim NPP Unit I is plant specific and adequately replicates actual plant design. It is adequate to support abnormal events, accidents and accidents beyond the design basis. Instructors control and monitor simulation progress in a control area toward the back of the simulator. Configuration control is maintained by KSG/GfS in close cooperation with Neckarwestheim NPP Central Services Training Section. Simulator software modifications are generally completed twice per year and structured to support plant needs. A clear prioritization system is established and implemented for the simulator deficiency report work process control. The Unit I simulator has a low number of open deficiency reports. Simulator instructors spend two weeks annually on-site at Neckarwestheim NPP to maintain good familiarity with the plant.

KSG maintains an operating scale model of a nuclear plant heat transfer cycle, called the "glass model". This training tool is very well designed. It uses electric heaters in a simulated reactor and primary loop to demonstrate pressurizer and reactor level response during a loss of coolant accident. The model provides an excellent and unique opportunity for students to visualize the various phases of a loss of coolant accident, including steam generator reflux, thermal stratification and system pressure response to hot versus cold leg injection.

The organization of materials used for training varies widely from group to group and also within groups due to the distributed nature of training at Neckarwestheim NPP. Much of the training is conducted by external service providers. Expectations for material quality are generally upheld through the use of established and proven providers. A culture of openness exists where trainees speak up if and when training materials should be improved.

2.3. QUALITY OF THE TRAINING PROGRAMMES

Training evaluation is continuously used to enhance existing programmes. Central services training section tracks and trends student feedback as just one of many methods to ensure effective use of evaluation input.

2.4. TRAINING PROGRAMMES FOR CONTROL ROOM OPERATORS AND SHIFT SUPERVISORS

The training programmes for Control Room Operators and Shift Supervisors at the plant exceed the requirements of the German regulatory authorities and programme content is similar to that of operator training programmes in other countries. Operators are adequately trained to perform their duties.

Shift Supervisors enter the initial programme as graduates of third level institutes such as a university. The qualification process lasts a minimum of four years. Students participate in a three year period of formal instruction, self-study and on-shift practical training, culminating in an oral examination by a five person team of experts (consisting of regulatory and plant personnel). After successful completion of the final examination board, the future Shift Supervisor spends the following year improving skills in an apprenticeship role on the shift crew (six months training in the reactor operator role and six months training in the Shift Supervisor role).

Deputy Shift Supervisors require a background as a master craftsman or technician. Reactor operators require a background as a skilled craftsman. The deputy Shift Supervisor and reactor operator initial training is very similar to that of Shift Supervisors.

Simulator training drills and exercises are adequate to train and maintain operator knowledge and skills. A close relationship exists between the simulation training company and the plant departments for training and operations. Plant training management maintains close oversight of the simulator training.

On-shift training is structured by the training section and frequently audited by supervision to verify adequate trainee progress.

Control room operational staff continuing training includes two weeks of simulator training per year. Classroom continuing training consists of topics selected jointly by operations and training section management for the three year continuing training schedule. Current events training and modification training are often conducted just prior to having a shift crew assume responsibility for the plant, in order to be as responsive as possible to this training need. Operators receive continuing training on the "glass model" once every five years.

2.5. TRAINING PROGRAMMES FOR FIELD OPERATORS

Field operator qualifications are divided by job assignment into four categories: Unit I Electrical Operator, Unit II Electrical Operator, Mechanical Operator and Special Mechanical Operator Position with Electrical Operation Responsibility. Each of these job sub-categories has its own task specific training requirements. The training programme for each of the field operator positions lasts approximately one year. Trainees are required to work with related craft personnel for one month to develop knowledge of component construction. For example, an individual qualifying as a Mechanical Field Operator would spend one month working with a mechanical workshop. This is a useful way of enhancing lines of communication across departments while accomplishing the training goal.

Field operator continuing training was formalized this year as a training programme. Prior to this, field operator training occurred periodically on the request of individuals and supervisors. The new formal programme identifies a number of subjects that should be covered in continuing training such as industrial safety topics, chemical and oil control and specific system operations. Some periodicity for continuing training has been established but is not uniformly enforced. The team encourages the plant to better define and enforce expectations in this area.

2.6. TRAINING PROGRAMMES FOR MAINTENANCE PERSONNEL

Training for maintenance personnel is jointly coordinated by the Central Services Training Section and the Maintenance Section. The training section tracks training for each individual and provides training required for general station work practices. Specific maintenance training is planned and administered by the workshop personnel. As stated earlier, certified master technicians (mechanic, electrical and control technicians) mentor new employees, ensuring they are fully capable prior to authorizing them to perform independent work. Qualified technical personnel take pride in their skills. An expectation has been established for experienced personnel to take a large degree of responsibility for the training of others. This expectation works well for the plant, ensuring new personnel are effectively and safely integrated into the plant work force.

As it is typical of German industry, the plant regularly takes on young adults at age 16 and above for an about 3.5 year apprenticeship leading to technical certification under a nationwide examination process. Apprentice programmes are established at the plant for mechanics, electricians and controls technicians and each area typically takes on three to four new apprentices per year. Each discipline is led by a master craftsman, certified to mentor apprentices. The training areas are clean, well-lit and well-designed to support vocational training. The apprentices have been observed to take their work seriously, performing tasks carefully and deliberately to a high quality level. These apprentice programmes provide the plant with new employees that are certified personnel, well-trained in their craft, thoroughly familiar with and ready to assist in the maintenance of the plant.

Continuing training of maintenance personnel amounts is about 40 hours per year of structured training. Additionally, personnel regularly attend departmental meetings to discuss operating experience and plant concerns. A large number of training aids are maintained by the shops for on-going training. These include a coupled pump and motor for alignment instruction and various cutaway valves.

2.7. TRAINING PROGRAMMES FOR TECHNICAL SUPPORT PERSONNEL

Radiation protection and chemistry training are each discussed in their respective sections of this report.

Technical support personnel (plant engineering staff) come to the plant after graduation from university with extensive education in their discipline. Initial training for these personnel at the plant consists of a one year mentoring programme by experts in various technical sections of their department. Each programme is customized to provide the specific training needed for the assigned responsibilities. Additionally, external courses are arranged on an as-needed basis to address specific needs.

All personnel must maintain their qualification status through periodic training for their respective qualification levels (1, 2 or 3). In addition, the department recently developed a matrix to identify additional training expectations for each individual. These courses are categorized (as either 'must', 'should' or 'can') in terms of how important they are for the individual's job. However, there are no rigid requirements that these courses have to be taken within any particular time after beginning work in that area. The plant considers this training plan as an on-going project and has discussed additional improvements. The team encourages the plant to continue refining the training expectations in this area.

2.8. TRAINING PROGRAMMES FOR MANAGEMENT AND SUPERVISORY PERSONNEL

Training of management and supervisory personnel is required by German law and effectively controlled through the plant training manual. Senior personnel consistently attend more training than is required. Training for managers includes simulator training and ensures management and supervisory personnel maintain a high level of plant-specific technical knowledge.

The parent company (EnBW) trains supervisory personnel in a special programme to measure, analyze and improve business practices and achieve sustained quality improvement. Participation is obligatory. This training is conducted on a corporate level.

2.9. TRAINING PROGRAMMES FOR TRAINING GROUP PERSONNEL

Instructors in all disciplines possess good plant and technical knowledge. Technical knowledge is highly valued at Neckarwestheim NPP.

The plant uses a centralized system to track and manage training of personnel. This system allows for easy access to current training status by both the individual and his/her supervisor. Instructional personnel maintain current plant qualifications.

2.10. GENERAL EMPLOYEE TRAINING

New and existing employees receive training in basic radiation protection practices and industrial safety through two video productions on these subjects. This training is conducted prior to authorizing site access. Additional training is provided on specific industrial safety tasks, such as scaffold construction. However, employees are not provided with hands-on practical training in important practices such as putting on and removing anti-contamination clothing and respiratory apparatus. This is discussed further in the RP areas of this report.

A video is used for general employee training on radiation protection and practices. However, some radiation practices are performed improperly on the film. Additional information is provided in the radiation protection area of this report.

Initial general employee site access training assessments are performed using written tests. A multiple choice test is administered following student observation of each of the two videos. However, these tests are short (3 to 4 questions), simplistic and each question has only two invalid choices as distracters. The plant is encouraged to improve the quality of these written examinations.

General employee training does not include any detail on specific emergency plan alert. The team developed a suggestion that includes this comment in the EPP section.

NECKARWESTHEIM NPP FOLLOW-UP SELF-ASSESSMENT

The OSART team attested us a good practice in the TQ area related to our IT supported training management. Furthermore, the Team encouraged us during the discussions to improve several items such as written examinations, training feedback, and training expectations. We will take up these encouragements for further development of our Training processes.

DETAILED TRAINING AND QUALIFICATIONS FINDINGS

2.1. TRAINING POLICY AND ORGANIZATION

2.1 (a) Good Practice: On-line Training Management System

An on-line management system using business data processing software has been implemented at the plant. This system enables access to training services and allows the plant to effectively track personnel qualification.

Training and qualification records are centralized in a database, accessible from within the company network by all employees and their supervisors. Individual qualification records are linked within this system to the work planning process such that work planners are notified if they attempt to schedule work to be performed by individuals whose qualification has lapsed.

Initial and continuing training are scheduled as required by specific training programmes. However, complementary training courses are selected by the individual, approved by the supervisor and scheduled for implementation through this same system. Employees have the ability to select from courses already entered into the database or to input requests for new training services. The system displays a training calendar for each individual to assist in course scheduling. Enrolled students are automatically reminded of upcoming courses at one month before, one week before and one day before the scheduled class.

Important incoming documents are scanned on receipt and electronically distributed to responsible plant personnel through the work flow system integrated into this software. Managers and supervisors use this system to further distribute important information and operational experience items to their employees. This feature is just one of many customizations of the business software that has been further enhanced by Neckarwestheim personnel for use at the plant.

This system has resulted in better control of work processes through automatic personnel qualification verification. Delays in course scheduling have been reduced. The software facilitates re-scheduling because Central Services Training Section is automatically notified when courses are 80% full. Notification has enabled the training section to look ahead and schedule additional classes to accommodate need. Course attendance has been improved by automatic notifications sent to enrolled students.

3. OPERATIONS

3.1. ORGANIZATION AND FUNCTIONS

Clear goals and objectives are established and communicated in the department procedures. The Shift Supervisor is aware of the tasks required during his shift based on a procedure that outlines the routine work and a work schedule. Frequent meetings and discussions between the Shift Supervisor and head of operations are conducted to ensure the Shift Supervisor knows his team's goals and objectives. Each individual is made aware of general and specific job requirements and then receives a copy of the official job description. This procedure ensures that everyone knows their responsibilities in the department. The OSART team evaluated this to be an effective approach.

Administrative tasks are minimized for the shift crews. Tasks that the shift crews have to perform are included in the individual job descriptions.

The routine morning meeting assembles all works groups for reviewing work completion, identifying new problems (fault reports) and reviewing upcoming work.

The shift has criteria or a standard approach to determine a course of action for all irregularities or off-normal situations when conducting specific operating procedures dealing with abnormal situations. The shift decision making process has been based on the FORDEC process (Facts, Options, Risk, Decision, Execution and Check) explained in MOA area.

The Safety Management System (SMS) has eight processes owned by Operations and shared between Unit I and Unit II. There are a number of performance indicators for each programme. The implementation of the SMS concept was evaluated as a good practice and detailed in MOA area.

The shutdown risk assessment programme is an adequate significant step in the preparation and approval phase for each outage. The outage fire hazard risk assessment is an element of this process and is well structured.

The Head of Operations (BS I) determines the shift schedule and verifies that the required complement is present for each shift. The shift schedule is approved by Head of Operations. If a complement position does not report in at the beginning of the shift, the SS will retain the outgoing complement person until a substitute is called in. This approach has been successful in continuous maintenance of shift complement requirements.

3.2. OPERATIONS FACILITIES AND OPERATOR AIDS

Reliable communication systems are in use in the plant. Various means of communication with land phones, portable phones and portable radios were observed to be effective. Field phone stations are well distributed throughout the plant. Use of radio communication between the Main Control Room (MCR) and the Safety Officer was effective during a fire drill.

The plant has developed a process to allow the use of operator aids. However, the team noted aids which were uncontrolled from a documentation point of view. Without having a formal control of operator aids, the validity of the operator aid cannot be assured. This situation may generate misunderstanding among operating personnel and erroneous operation of equipment. The team developed a suggestion in this area.

The process computer is used to monitor important plant parameters on a continuous basis, and to provide immediate alarm when necessary. A color coded screen provides a good presentation of the information.

Plant cleanliness and good housekeeping is evident. Cleaning equipment is well stored and, where required, equipment is secured with chains providing good protection in case of a seismic event. Ladders, scaffolds, and rigging equipment are properly stored. Panel doors were locked as required and electrical panel covers are properly secured. Overall the housekeeping programme is very effective.

The tagging and locking system is well applied on site to protect workers during maintenance and also to ensure line up of the main circuits.

Isolations for work protection require field tags to be installed, and also equipment work in progress tags. The generation of these tags is automatic with the work authorization computer programme. Tags were observed to be in place where required, and this process is effective.

3.3. OPERATING RULES AND PROCEDURES

Parameters involved in Operational Limits and Conditions (OLC) are fully monitored by a computerized system called PRISCA. Limits are always indicated in the Safety Specifications paragraph of the Operating Manual and are covered by alarm. All procedures checked and used to operate the plant are consistent with those limits. Any operating limit reached is entered into the Shift Supervisor log and the alarm response manual or Alert Card is referenced for the required actions. The Plant Manager and head of operations are informed. Performance in this area is satisfactory.

When significant procedure errors are discovered, a fault report is initiated to correct the procedure. For minor errors, an informal approach is taken. The Shift Supervisor copies the page to be corrected, with the modification in red, and sends it to the shift support office. The use of the informal process results in difficulty to track the exact status of the procedure correction. No record or list of these minor changes in procedures is available. The plant is encouraged to use the same revision process for all procedure changes.

Procedure reviews are conducted twice a year to ensure that the correct procedures are in the main control room. This process is effective however it does not ensure the control of procedure quality. Handwritten notes were observed in some procedures. The team encourages the plant to enhance expectations and improve formality in the area of procedure change control processes.

Alarm procedures are in place and are of good quality to enable an effective operator response. These procedures are controlled by the same process used for normal operating procedure. Initial training and continuous training with ongoing realistic drills are frequently performed at the plant. One drill was observed to be very effective. In this particular drill, emergency fire procedures made use of Alert Cards to support key actions and roles of response personnel. A good practice has been developed in this regard.

Emergency and abnormal operating procedures are efficient and of good quality. Deviations from emergency operating procedures (EOP) are done only with the approval of Emergency Management Team. The Plant Operation Manual contains the safety specifications (SSP) for this and it is approved by the state regulator (UM). This chapter identifies situations in which the Shift Supervisor is allowed to deviate from the procedure. If this occurs, a report must be made to the state regulator (UM). An external analysis will be initiated by the state regulator. Afterwards internal analysis regarding the decision to deviate will be done. This situation would be a reportable event. This is considered as acceptable.

3.4 CONDUCT OF OPERATIONS

The Main Control Room was observed to be generally quiet and restricted to required business activities. The operator expectation requires at least one operator should monitor the panels. The MCR panels have a minimum number of alarms, making it much easier to recognize new or changing plant conditions. Operators are required to notify the Shift Supervisor, refer to the alarm response procedures, and record annunciations. The team found that operators demonstrated attentiveness to their panels and alarms.

Operating expectations require that plant parameters are to be checked at regular intervals.

A policy for procedure adherence (BI-FAW-019) is in place and the OSART team observed good procedure adherence during MCR surveillance testing. Guidelines within this policy are satisfactory for situations directly related to keeping the plant within safe operating conditions.

The operators use a verbal communication technique in which one operator reads the instruction, a second operator points to the correct item and repeats back the instruction.

Shift turnovers are well conducted. All necessary and important plant information is prepared in advance for turnover review. Access to the MCR is not permitted for one hour during the shift turnover to ensure no distractions. The information exchange is effective.

The MCR staff are the primary administrators of the work authorization process, and are always aware of equipment and conditions in the plant that are covered by work isolations. This process is supported by a strong computer tool that includes constant recording of change in position of field equipment. All safety related and selected important components are monitored electronically and situations such as out of positions are recorded in the computer. As a result, plant status control and awareness from the MCR is very good.

There are a number of key control cabinets in the MCR. These keys are used to control the status of safety related equipment. Each panel of keys is visible for easy determination of the keys in place. Any missing key would be readily obvious. Confirmation of keys in place is a shift turnover step and is recorded in the log. This process is procedurized and effective.

Only staff who possess a security card clearance can open the MCR door. The policy for control room access and restrictions is posted on the door to the MCR. Only staff that needs to perform work related business has security access, although a qualified person can also bring others in at the same time.

The surveillance test programme is based on a prepared weekly surveillance test schedule based on a master list which covers all required testing at the appropriate test interval. All required tests were completed as required. The plant has instrumented safety related equipment to enable a record of the measurement after completion of test. An in-house designed computer programme provides an immediate record of the test sequence and also indicates if the sequence was correct (pass or fail), thus significantly reducing test duration and the likelihood of error in reviewing test results.

The field operators are supervised by the electrical deputy SS and mechanical deputy SS. Work assignment and pre-job briefings are conducted. During the morning shift, Deputy SS's have limited time to spend in the field due to the large workload needed to support the fault report, work authorization and test programmes.

Operator rounds expectations meet IAEA standards and operators were observed to meet requirement. However no detailed written expectation exists for the field operator to identify industrial safety problems. Discussion on industrial safety between field operators and supervisors during pre-job briefings did not take place. The team developed a suggestion for the above topic.

Field Operators use a hand held computer tool to perform a consistent review of important field rooms and equipment. Independent verification is used in some situations and is mandatory for specific cases, such as work on electrical equipment, isolations for worker protection and situations where no procedures exist.

There is an operations procedure that provides reactor restart direction on requirements to be satisfied prior to restart. This includes determination of cause of trip and a series of approvals required to restart, including the independent technical expert. The Plant Manager has to approve the restart once all other approvals have been obtained. This approach is in compliance with IAEA safety standards.

The process and procedures for unit restart following an outage are very well aligned with the operating manuals and equipment checklists. This approach is very good as it keeps the shift crew focused on their responsibility for reactor safety and plant status control, and logically provides clear direction on the sequence of system restoration. There is an adequate structured management and regulator process that supports safe restart requirements.

3.5. WORK AUTHORIZATIONS

The work authorization process is systematically structured to ensure good control over work initiation (fault reports), review, prioritization and approval by the Shift Supervisor, and timely submission to the work planning department. A computer tool is used to assist and control all aspects of work control throughout the process. All key steps and decisions are done by qualified Shift Supervisors on shift or in the planning office. The work authorization process is very effective.

Procedures are comprehensive with roles and responsibilities of staff that progress work through the authorization process. All individuals involved with each step of the process are identified.

Any device manipulation required to support work isolations is captured by the computer tool used to process the work package.

A procedure is in place to bring attention to any reduction in safety system redundancy and it is logged and highlighted in the MCR.

All work scoped for a planned outage goes through a systematic fire safety assessment. This is reviewed with the regulator, Shift Supervisors and Plant Manager and is considered to be acceptable.

The temporary modification process is documented in the work permission procedures. Three types of temporary modifications are in use, each with specific control and approval steps. There are two primary steps, permission to do the modification and permission to install. Tagging and plant identification requirements are specified in the review / approval process. Review of the proposed modification is done by the planning Shift Supervisor to provide operations perspective. He will determine the need for documentation to support the change. The process is about one and half years old and has been effectively implemented. All types of temporary modifications are approved. Performance targets have been established and are monitored for each type. This process is in place and is satisfactory.

3.6. FIRE PREVENTION AND PROTECTION PROGRAMME

A comprehensive and systematic approach is taken to establish the fire protection programme and implement it across site. The fire response strategy is based on the fire safety analysis provided by AREVA and is periodically updated. A fire safety analysis and report is used in preparation of planned outages. All these elements are satisfactory.

All fire detection and alarm components are connected to the computer and provide the SS with all relevant data via data screen and printout in the MCR to initiate a fire crew response, and entry into the response procedure.

The plant is aware that the electrical switchgear rooms, which have a high fire load (electrical equipment and cables), do not have provision to test the flow to the fire sprinkler system with water. The plant is encouraged to expedite any remedial action.

Portable fire fighting equipment is well maintained with a specific code identification and test schedule. The equipment was observed to be in place and up to date in the plant.

A procedure specifies the requirements for temporary fire stops. The procedure covers opening and closing of fire barriers and temporary sealing when work is suspended. There are currently one hundred recorded fire barriers with work in progress. These are all recorded, reviewed and approved by the Safety Officer, and work approved by the Shift Supervisor. A specialist contractor performs work in this area. The work status on any particular fire barrier is not currently monitored by the Safety Officer. The team encourages the plant to implement stronger plant monitoring and oversight of the contractor in this regard.

Plant walk downs are scheduled and conducted by managers to confirm fire loading and that the storage of combustible material is adequately controlled. The Safety Officer also conducts routine inspections and visits to each building at least once per quarter. The field operators are mostly members of the fire brigade and have a good awareness of fire loading control requirements. General plant oversight in the area of fire loading is good.

The fire programme benefits from strong plant support and leadership. Performance of this programme is clearly a plant priority. The plant fire chief has many years of related in-plant and community experience and actively participates with the community fire brigades.

3.7. MANAGEMENT OF ACCIDENT CONDITIONS

There is a documented set of all roles and responsibilities, and specific procedures guide emergency response.

The shift crew complement is set to be able to manage short term response to design basis accidents. The notification process will systematically page support organizations, even if the event has not progressed to an accident state.

The operators have a structured set of symptom based procedures to respond to events and Operators are trained with. These are considered to be adequate.

NECKARWESTHEIM NPP FOLLOW-UP SELF-ASSESSMENT

In the OPS Area the team gave two suggestions apart from a good practice. Those suggestions were on the one hand to formulate clear expectations from the management for the shift crew to enhance operator performance and on the other hand to consider further development and implementation of the methodology to control the operator aids. For both issues we had intensive discussions within the organisation to create effective measures. The team as well encouraged us to think about improvements in some other areas. We incorporated all these encouragements into our corrective action programme.

STATUS AT OSART FOLLOW-UP VISIT

During the OSART mission, two suggestions were made – both issues were reviewed and evaluated as being resolved at the time of the follow-up mission.

Clarification is now given in the revision to procedure B1-FAW-019 with respect to control room operations staff, including Shift Supervisors, regarding their required frequency of panel walkdowns in the Main Control Room and specifically what they should review. The procedure has been reviewed twice since the OSART, indicating that the plant is dynamic in its approach to this issue. Also, requirements are in place regarding the reporting of industrial safety deficiencies, for field operators to identify and report such deficiencies.

A pre-job briefing is now conducted, if required by work supervisors, shift supervisors or if it is a non-routine activity or presents a potential danger for either the plant or job safety. These briefings include a portion concerning debriefing (post-job briefs).

The plant initiated a policy of ‘as few documents on site as possible’. Those documents which constitute ‘operator aids’ are now well-controlled within a system developed by the plant which ensures that all remaining operator aids are valid and relevant. Individuals are given the responsibility and ownership for operator aids within their specified jurisdiction and they are charged with controlling such aids. This information is now included in the updated revision of procedure BAW-185.

All departments at GKN have been informed about the new stamping arrangement and that BAW-185 is valid for all departments.

DETAILED OPERATIONS FINDINGS

3.1. ORGANIZATION AND FUNCTIONS

3.1 (1) Issue: Expectations for operations personnel are not fully developed and effectively implemented to enhance operator performance.

Although the plant has put in place many programmes, processes and procedures to support safe plant operation, the following facts indicate further effort is needed in this area:

– Operating Procedure B I-FAW-019 requires that plant parameters must be checked at regular intervals. There is no clear methodology for Shift Supervisors to walk the panel during the shift period, although Shift Supervisors do perform the walk down when work-load permits.

– The requirement for field operators to look for and identify industrial safety deficiencies is not specifically included in field rounds expectations B I-FAW-019.

– There is no specific procedure to identify and manage tests or situations that are infrequently performed or require special preparations that go beyond routine work planning and preparation.

Unclear expectations can lead to inconsistent operator work performance. This can result in a higher likelihood of errors or mis-operation of safety related equipment.

Suggestion:
The plant should consider fully developing and implementing the expectations for operations personnel to enhance operator performance.

IAEA Basis:

NS-G-2.4

3.6. The operating organization should establish high performance standards for all activities relating to safe operation of a plant, and should effectively communicate these standards throughout the organization. All levels of management should promote and require consistent adherence to these high standards. Management of the operating organization should foster a working environment that encourages the achievement of high standards in safe operation of the plant.

3.8. The operating organization should have a responsibility to monitor the effectiveness of safety management at the nuclear power plant and to take necessary measures to ensure that safety is continuously improved or at least maintained at the level established by design.

3.16. This is part of a manager’s role in setting the standards and expectations for all staff in all aspects of safe management of a plant. In addition, managers themselves should visibly meet these standards and should help staff to understand why they are appropriate.

DS347 Draft of safety standards: Conduct of operations

3.1. Shift Supervisor … the responsibilities of the Shift Supervisor normally should include the following:

Provide close oversight of activities supporting complex and infrequently performed plant evolutions, such as plant heat-up, startup and shutdown, physical tests, cool down and refueling.

– Perform plant inspections to identify and correct problems involving personnel performance, policies and procedures, housekeeping, material conditions and personnel hazards. Ensure deficiencies are identified and corrective actions are initiated.

Plant response/action:

Management's expectations with regard to the plant personnel's discharge of their duties have been clarified in the set of operating rules and procedures and imparted to the relevant persons within the framework of information events. In particular, Technical Procedure BI-FAW-019 mentioned in the report has been thoroughly revised. The following additions were made with regard to the facts stated in the issue:

- The cycle for walking the panels has now been specified for the group of persons responsible, comprising shift supervisors, deputy shift supervisors and reactor operators. Quality aspects for this duty have also been defined.
- The requirements for performance of checks during field rounds have been revised and expanded to address occupational safety aspects and to include specifics for the maintenance of industrial safety.
- The importance of pre-job briefings and risk analyses in the lead-up to work that is not part of routine plant operation has been emphasized in Technical Procedure BI-FAW-019. Along with the explicit use of higher-order human-performance tools for decision-making and the conduction of work (see the MARKER brochure) a standardized channel is now in place for the shift's internal handling of these tasks: A checklist for pre-job briefs has been compiled to cover all relevant points in the categories:

    1. Activity (content, scope, persons involved, …)
    2. Risks (radiation protection, industrial safety, hazardous mediums, …)
    3. How to conduct work (documents, communication, …)
    4. Safety (protective equipment, …).

    Important points to be noted for possible post-job briefs are also included. This is in line with the principle of continuous improvement.

Paralleling the operational implementation of the specifics outlined above, the Operations department is conducting various staff training measures and surveys and task observation programmes. Here, in plant walkdowns the focus is on safety at work, supervision of pre-job briefings and task observation in the control room. In addition, regular training courses and familiarization sessions specifically for plant attendants are held on the topics of hazardous substances, accident prevention and general industrial safety.

All in all, we will continuously evolve the processes involved in the issues for improvement identified from the OSART team.

IAEA Comments:

Clarification is now given in the revision to procedure B1-FAW-019 with respect to control room operations staff, including Shift Supervisors, regarding their required frequency of panel walkdowns in the Main Control Room and specifically what they should review. The procedure has been reviewed twice since the OSART, indicating that the plant is dynamic and using operating experience in its approach to this issue. Also, requirements are in place regarding the reporting of industrial safety deficiencies, for field operators to identify and report such deficiencies.

A pre-job briefing is now conducted, if required by work supervisors, shift supervisors or if it is a non-routine activity or presents a potential risk for either the plant or job safety. These briefings are undertaken using a concise form which also includes a portion concerning debriefing (post-job briefs).

During plant tours, there were no abnormal industrial safety aspects noted and this is indicative of, inter alia, the field operators now reporting such problems to ensure that the problems are timeously remedied.

Records of Pre-job Briefs were reviewed and evaluated as being adequate. Following discussions with plant staff, it was indicated that these were of good value to the plant.

Conclusion: Issue resolved.

3.2. OPERATIONS FACILITIES AND OPERATOR AIDS

3.2 (1) Issue: Methodology to control operator aids is not sufficiently developed and implemented.

The plant has developed a process to allow and control the use of operator aids; however, the team noted aids which were uncontrolled from a documentation viewpoint:

- Four operator aids were found in diesel room (room ZK0222 panels e.g. 1 FC 23, 25, 29; 3JK 82, 84, 85, 87, 88, etc.). Those aids contain technical information about reactor protection cabinets:
  - Drawing of electronic signal card,
  - Information about light indicator compliancy, and
  - Technical information on cable wires in the diesel rooms cabinets.

  The aids have been officially authorized (VOR ORT stamp mentions “valid forever”). They are not controlled documents. The same situation can be observed in the other three diesel rooms.

- In the MCR, an operator aid is displayed on Panel GC475 (Main cooling primary pumps).

  This operator aid is used to monitor some parameters before switching on the oil pumps of one of the main primary cooling pumps.

  Even if the display of this aid is authorized (VOR ORT stamp mention “valid until next revision”), this aid has neither revision number, nor controller name. This would not constitute a controlled document.

- In the MCR, an aid describes the routine work of the shift and provides a reference to original procedure (Fachanweisung B I – FAW – 019). Actually, this aid is the annex 2 of this procedure.

  The team observed that this aid included organization information and scheduling for:
  - Key log and key cases control.
  - Visual inspection of diesel engines parameters (EY91-95).
  - Several dozens of other controls and tasks.

However the team has noted that the aid was revised on 5th October 2007 but the original was revised on 24th July 2007.

Without having adequate formal control of operator aids, the validity of these operator aids could not be ensured. This situation may generate misunderstandings among operating personnel and erroneous operation of equipment.

Suggestion: The plant should consider further developing and implementing the methodology to control the operator aids.

IAEA Basis:

DS347: Draft of safety standards: Conduct of operations

6.17. The operator aids control system should prevent the use of unauthorized operator aids and other supportive materials such as unauthorized instructions or labels of any kind on the equipment, local panels, boards and measurement devices within the work areas. The aids should be placed in close proximity to where they are expected to be used and posted aids should not obscure instruments or controls.

6.18. The control system for operator aids should ensure that operator aids contain correct information, which has been reviewed and approved by a competent authority. In addition all operator aids should be reviewed periodically to determine if they are still needed, if the information in them has changed or been updated, or if they should be permanently incorporated in some manner.

NS-G-2-4

6.61. A suitable working environment should be provided and maintained so that work can be carried out safely and satisfactorily, without imposing unnecessary physical and psychological stress on personnel. Human factors which influence the working environment and the effectiveness and fitness of personnel for duty should be identified and addressed. The operating organization should establish an appropriate programme for these purposes. Examples of areas or activities to be reflected in this programme should include, but are not limited to, the following:

– adequacy of the resources, support and supervision provided to manage and perform the work;
– adequacy of lighting, access and operator aids.

Plant response/action:

The suggestions by the OSART team were grounds for us to review and modify the entire procedure for handling operator aids. The revised version of Operating Procedure BAW-185 that is now available for this purpose was harmonized with other EnKK plants and already released. The revised version details the following procedure for the handling of documents in the plant:

In principle, the number of documents as aids in the field should be kept to a minimum.

The various types of operator aid (e.g. system diagrams, procedures, signs, etc.) are to be assessed and assigned to various organizational units as regards responsibility for their maintenance and updating.

There are two different types of stamp marks for identification purposes:
– registered document with modification service,
– document for information only (without standardized change procedure).

In each case the stamp shows the organizational unit responsible and, in the case of documents for information only, the period of validity with a specific date. If a specific date declaration is not possible, the date-line is signed with “not specified”. Only the instances responsible in each case are authorized to use the stamps, in other words authorized to publish the documents, and these instances are then subsequently responsible to see to it that these documents are brought up to date.

By the time the follow-up takes place all operator aids will have been updated and stamped in accordance with the new procedure.

The modification of the original procedure is a significant improvement with regard to the quality assurance of documents and registration ensures the actuality of document status at all times.

IAEA Comments:

The plant initiated a policy of ‘as few documents on site as possible’. Those documents which constitute ‘operator aids’ are now well-controlled within a system developed by the plant which ensures that all remaining operator aids are valid and relevant. Individuals are given the responsibility and ownership for operator aids within their specified jurisdiction and they are charged with controlling such aids. This information is now included in the updated revision of procedure BAW-185.

The two different types of stamp (mark), which are used to signify the type of aid and validity, are clear and easily identifiable. All departments at GKN have been informed about the new arrangement and that BAW-185 is valid for all departments. A register is also kept of all aids which are under ‘Modification service’.

All ‘operator aids’ observed during plant tours were determined to be under the control of the new system and no uncontrolled documents were observed on the plant. There is also an efficient documentation system which is backing-up the control of operator aids.

Conclusion: Issue resolved.

3.3. OPERATING RULES AND PROCEDURES

3.3 (a) Good Practice: Use of Alert Cards support the work of the Coordinating Shift Supervisor

The plant has established a comprehensive set of simplified procedures that are specific to emergency conditions. This approach is based on alarm-specific instructions in the form of user-friendly response sheets called Alert Cards. The Alert Cards are designed to be complementary to all the plant response requirements, and focused on specific actions to be taken by all departments. Alert cards are used to address fire alarms, worker injuries, evacuation alarms, escape alarms, plant accidents, disaster alerts, bomb alarms, site security alarms, power plant crisis management team alerts, and hazardous substances situations.

The Shift Supervisor's Alert Card provides clear logic to assist in appropriate response decision making to ensure the event mitigation actions are promptly initiated, in parallel whenever required. This is often the case when a plant team approach is required; all responders have clear instructions without direct Shift Supervisor involvement. For example, if an alarm is received, the Shift Supervisor will select the appropriate Alert Card and initiate response actions. The post holder named in the header of each alert card undertakes the activities listed on the card and forwards the requisite information accordingly. The incident Unit Shift Supervisor is responsible for overall control and implementation of measures rendered necessary to mitigate the emergency condition. The Alert Card procedures define in detail all the actions to be implemented by each responding function, so replication of work is avoided and each individual knows exactly which duties have to be performed.

The parallel response approach of this alert-propagation concept permits speedy and coordinated processing of the alerts and alarms. The response process also transfers administrative actions to the non-incident Unit Shift Supervisor, thus enabling the incident supervisor more time to focus on the mitigating actions.

As a result a very efficient and user friendly emergency response procedure is in place. A complete set of alert cards is kept in each main control room, and the cards required by the responsible supporting staff for the various sub-alerts are kept in the appropriate offices. The alert cards also provide a means of documenting the time completed response actions. For ergonomic reasons, the alert cards are color-coded. This ensures that the alarms and alerts are processed as speedily as possible, in compliance with priorities, and without misunderstandings.

Observation of the use of the Alert Cards illustrated the benefit of enabling the Shift Supervisor to effectively respond to the emergent plant condition while at same time perform Main Control Room supervisory duties.

The burden on senior shift staff of the affected unit is eased as response responsibilities are systematically distributed. For example external notifications that can be made by the Shift Supervisor and Security staff of the unaffected unit.

4. MAINTENANCE

4.1 ORGANIZATION AND FUNCTION

The maintenance organization works for both units and is defined in the Personnel Organization Manual (PBO). It is divided into two main departments, Mechanical and Electrical Engineering, which are divided into sections, five for the mechanical department and six for the electrical department. The electrical department comprises Electrical and I&C groups. Each of the departments has a Quality Control Group that is responsible, among other tasks, for receiving plant spare parts at the warehouse and approving calibration sheets. All sections have their tasks and responsibilities addressed and the maintenance organization is well understood by plant personnel and contractors. Both departments are also responsible for system and equipment engineering and the responsibilities are adequately defined in procedures. Maintenance indicators are handled together with plant indicators and are established and well followed, via a computerized system, by maintenance management, resulting in good management of the department.

Plant maintenance procedures are written and revised according to the plant policy and their content is sound and clear for all maintenance activities. They are also mandatory for contractors, with the exception of specific work for which, after plant approval, vendor procedures may be used. Each contractor has a defined plant liaison person responsible for ensuring that the correct information regarding procedures and rules is well known and properly used.

The administrative maintenance procedures address management policies and expectations to be fulfilled by maintenance personnel. General plant aspects and expectations are addressed in plant level procedures in a clear and well structured way.

Maintenance personnel have a good understanding of plant operation and are conscious in ensuring safe operation of the plant. Neckarwestheim Nuclear Power Plant workers, both employees and contractors, as well as the management staff are skilled and qualified to perform and conduct their tasks. They have broad technical abilities as well as administrative knowledge in performing maintenance activities with accuracy, as could be observed during the mission. Plant maintenance personnel also have a very good educational background. The technical skills are provided through the use of extensive apprentice training that lasts 3.5 years for both mechanical and electrical sections.

During power operation and, in larger number during outages, contractors and specialists from vendors supplement the Neckarwestheim Nuclear Power Plant workforce. For all main components under revision, a specialist from a vendor may join the plant workers whenever necessary. The organization was evaluated by the team to be adequate.

4.2. MAINTENANCE FACILITIES AND EQUIPMENT

The maintenance workshops, hot and cold, and calibration laboratories are able to support both units in all maintenance specific areas. The very good material condition, housekeeping, organization, size and equipment in the workshops allow the maintenance department to handle all work that arises during a plant outage. Each workshop unit is led by a foreman responsible for controlling, following up and concluding the work as well as keeping the equipment in the best operational condition.

The team observed that the plant has excellent facilities and mock-ups (valves, actuators, pumps, electronic and calibration benches) for the training and qualification of maintenance personnel and contractors.

The electrical shops are well equipped to test and repair all kinds of plant breakers, electronic components, motors, switchgears, motor-operated valves. The mechanical shops are supplied with state-of-the-art equipment to perform the work. The training equipment is conforming to the plant equipment.

The instruments calibration shop ensures that the plant measuring instruments are suitably calibrated and traceable. The calibration labels are in place for testing equipment. The reference equipment is calibrated by national reference labs according to a programme established at the plant. The testing equipment receives a calibration label and the revision is done according to the testing equipment manual. All data are controlled in a computerized system and can be used for tracking trends on deviation from calibration. The use of calibrated instruments in field work is done after a second verification prior to its utilization. The plant has a calibration tag programme in place following lessons learned from Philippsburg NPP. At the time of the OSART review, the majority of the measurement equipment on site was not yet tagged in conformity with the improved programme.

The main component rooms are equipped with cranes and special tools to facilitate the maintenance activities. For work performed inside the controlled area, the plant provides special equipment, decontamination facilities, remote operated wrenches and all necessary provisions to reduce dose absorption. It was seen that all necessary equipment stored inside the controlled area is well secured by straps, permanently fixed to the walls or floor to prevent any movement.

Tool shops are well organized and the tools and equipment are ready for use. The tools and consumables are stored in adequate tool store cabinets, fireproof when necessary. The tool shop foreman is responsible for controlling the storage condition, use and release of the goods. The plant is compiling its entire inventory of special tools and devices to assure tracking and to make it easier for the planners to assign them for work activities requiring their use. This initiative is under development, and there are already tools and devices inspected and stored.

4.3. MAINTENANCE PROGRAMMES

The maintenance programme consists of Preventive Time-Based Maintenance, Surveillance and In-Service Inspection and Corrective Maintenance. The Time-Based Maintenance is compiled in the Maintenance Manual (IHB = Instandhaltungshandbuch). The Surveillance and In-Service activities are in the Surveillance and Testing Manual (PHB = Prüfhandbuch). The primary sources of these activities are the requirements from KTA (Kerntechnischer Ausschuss) and DIN (Deutsches Institut für Normung) standards.

The current Surveillance and Testing Manual (PHB = Prüfhandbuch) and the included test procedures has been approved by an external independent expert company (TÜV SÜD-Technischer Überwachungs Verein Energie und Systemtechnik GmbH), under contract of the state regulator (UM). It includes some hold-points in the course of the work that require the mandatory presence of an independent expert. In these procedures, there are also steps that require the presence of the system or component specialist.

The maintenance programme for safety relevant equipment is sent to the TÜV every year to be reviewed and approved. At the same time it is determined if the inspection hold-points that already exist in procedures will be maintained or modified. Normally, there is no major change to be implemented.

The plant has some predictive maintenance techniques implemented, e.g. online motor-operated valves measuring equipment, to additionally support the maintenance in keeping track of the equipment condition. The team encourages the plant to increase the use of predictive tools to assess and review the maintenance programme activities thereby increasing its reliability.

Neckarwestheim Nuclear Power Plant maintains a comprehensive database in which all electronic and electric component failures are entered. There are a great number of similar modules, assemblies and equipment in use at the plant, and the database applies statistical analysis to failures so that the behavior of the modules and assemblies over extended periods can be predicted. If necessary, affected assemblies, components or equipment will be replaced. The findings also form a constituent element of the annual status report on ageing management. The first maintenance ageing management status report was issued in 2006. It addresses some actions to be taken based on follow-up results, mainly related to I&C components.

In cases where a component is no longer available, the necessary modification is performed and the relevant documentation updated.

The plant is able to provide support to all other German nuclear power plants in the repair of I&C assemblies, or to modify equipment in line with the quality requirements. The team recognizes the trending, repair and maintenance of electronic safety related assemblies performed in the plant by maintenance as a good practice.

4.4. PROCEDURES, RECORDS AND HISTORIES

The plant has very good control of all maintenance records either computerized or in paper form. The maintenance files archive is very accurate and contains the equipment records since the beginning of plant operation. The records are easily retrievable, accurate, containing enough information to track back maintenance deficiencies. The archives rooms are monitored by a fire detection system and have a manual firefighting response.

The maintenance procedures cover the sequence of execution, precautions, contingencies, tools, spare parts and supporting activities to permit a good and sound performance of workers. Additional instructions can be provided by planners during the planning workflow process.

All procedures at the plant are available to be consulted in a computerized system (e-Doc) and are printed as part of the work package. If modifications to procedures that are supervised on site by the external expert are necessary, they will first have to be submitted for approval to TÜV.

4.5. CONDUCT OF MAINTENANCE WORK

All maintenance work at the plant has, in the work permit planning, a defined person responsible for the work (VDA-Verantwortlicher für die Durchführung der Arbeit) and a supervisor on the spot (AVO-Aufsichtsführender vor Ort).

It is the maintenance managers' expectation that the procedure, together with the work permit and all work package parts are with the worker at the place of work. This was verified in the work observed during the mission. The maintenance work is done under work permits released by the Shift Supervisor. The work is performed by plant and contracted personnel with technical and professional competencies.

The tagging system is sound and its verification in the field is done by the person in charge before the work is initiated. When specified in the work permit, a post-maintenance test is performed and the equipment released for a functional test to be performed by Operations. During the daily plant meetings, it was determined that the maintenance and operation departments' relationships were handled in a very professional way with a smooth and undisturbed workflow.

The contractors shall follow the plant rules and procedures during their work. Work performed by contractors is released and supervised by plant personnel. During work that requires actuation by different groups, either maintenance or others, the planning maintenance personnel are able to coordinate and provide the necessary information for releasing the activities. This coordination is done well and there has been no responsibility misunderstanding. As the work package is detailed to the point of defining spare parts, tools and possible operation disturbances, it can be executed in a fast and safe way.

To perform In-Service Inspections, the plant has its own staff as well as contracted personnel. The qualification and knowledge of teams is adequate for the activities they perform and there is also an external independent expert to inspect steps defined in the procedures. The results are submitted for a joint analysis and corrections can only be made if approved by the TÜV. The plant and contractors have equipment to perform the work and special activities are performed by specialized contracted companies.

The correct use of some Human Performance Tools, such as pre-job briefing and two-way communication, was observed, when touring maintenance activities, when in-service tests and maintenance work was being undertaken.

The plant has a foreign material exclusion (FME) programme in place and provides a high number of special fixtures to be used during the work like blind flanges, covers and plugs. The Spent Fuel Pool is surrounded by a Foreign Material Exclusion Barrier and there is no record of any fuel failure due to an FME problem. During the mission it could be observed that the workers and the plant management are committed to the Foreign Material Exclusion programme.

4.6. MATERIAL CONDITIONS

The plant material condition is very good. The equipment, although the plant has more than 30 years of operation, is in very good condition, well kept and providing high availability and reliability. The maintenance supporting equipment, such as special tools and automatic devices, is kept in very good condition, clean and well stored. It is identified, inspected and reviewed periodically.

During the field visit, some minor deficiencies were observed, e.g. air hoses on cable trays, several wires cut without any labeling and power supply cables for some Motor Operated Valves (MOVs) are not supported sufficiently. The team encourages the plant to investigate these minor deficiencies and take the necessary remedial actions.

4.7. WORK CONTROL

The maintenance activities are planned by senior maintenance personnel of the maintenance departments. A computer-based management system has been installed and data of previous systems migrated in such a way that makes it easy to use past works records to enhance the quality of new ones.

The maintenance corrective activities are done according to a prioritization defined in the work control procedure that also rules the work flow in the system.

During the planning process, the work flow ensures that all activities to be planned can only go to the next step if the previous step has been completed. This work flow includes the radiological protection, industrial safety, engineering evaluation, operation considerations and tagging. The support activities, such as testing cranes prior to use, installation of scaffolding, are part of the work package. The work packages are available to the maintenance foreman and supervisors for information before the work permit is released by operations. Usually the work packages are handed over for execution a work day before the starting date for planned works and a day for work resulting from fault reports.

The work is prepared according to a tagging system that allows the activities to be released and closed according to a safe sequence. The release is done by operations.

The planner is responsible for keeping the main control room updated on extensions or modifications on the planned activities after receiving feedback from the person responsible for the task.

In the daily meeting, chaired by an operations representative, the pending work is discussed with representatives of all departments and extension in time is approved if necessary. During the weekly planning meeting all maintenance sections are represented and the issues and upcoming work are discussed and approved. The participants make the decisions directly during the meeting, speeding up the implementation of corrective actions.

The same work control system and workflow is in place for both normal operation and outage. During outage, an accurate dependency control is set in order to help coordination of all activities. This control is very accurate and provides a good perspective of system conditions.

4.8. SPARE PARTS AND MATERIALS

The site has its warehouses very well structured and organized to receive and control spare parts and materials and to adequately support the storage of all material necessary to the plant either in operation or during outage. The access to the storage area is controlled and only authorized personnel has access to storage and reception areas as well as transition ones (Sperrlager). The spare parts are received and controlled in the warehouse in a flow path that routes them to a reception area for control and inspection according to the criteria defined in the purchase orders. The plant purchase system provides means to follow the material from request to use at the plant. After that, if the parts are not safety-related or have no special requirements, they can be directly sent to the final warehouse. If some quality or safety requirement is necessary, they are sent to a segregated area waiting for Quality Assurance control. Also non-conformance is registered and the material is not released until the issue is solved or a release from technical department and Quality Assurance is granted. The plant organization procedures define that the quality assurance sections are responsible for releasing these spare parts at the warehouse for final storage, thus avoiding the release of any non-suitable piece.

All commercial grade material is submitted to admittance control and stored according to procedures.

The plant warehouses have adequate humidity and temperature controls according to the material stored. The shelf-life of materials, mainly elastomers, is controlled upon reception of the items and input in the SAP database.

The warehouse manager is responsible for removing expired items after Quality Assurance release. The items that have reached expiration date or found degraded are separated and inspected in order to be eliminated. Unsuitable material is segregated and after inspection it is discarded in a controlled way.

The items are stored according to a logical and easy to understand tracking system. Each warehouse has a number assigned and the item position is defined and registered in the system.

Flammable and hazardous materials are stored in either fireproof cabinets or appropriate defined places with contents lists attached for consulting. The containers (bottles and flasks) are identified with the commercial and chemical names.

The minimum quantities for storage have been defined previously and are assessed by plant personnel. Inventory stocktaking is done once every three years. There are spot checks during the year and the warehouse personnel perform an inventory check also once per year.

Although the plant has periodic inspections for electric actuators, pumps and other safety-related items at the warehouse, the spare motors for safety-related equipment stored in the warehouse are not periodically checked to control their preservation for a long term period. Examples are spare motors for Residual Heat Removal System (TH) pumps, for Component Cooling System (TF) pumps and for Service Water System for Secured Plant (VE) pumps. The team encourages the plant to implement a periodic check programme for evaluating the status and preservation of safety-related motors stored in the warehouse.

4.9. OUTAGE MANAGEMENT

The outage organization is defined in the plant organization manual and its functions and

responsibilities are well known and understood by all departments involved.
The plant has planned outages once a year. The plant has a long-term scheduled plan for the main activities broken down into redundancies and including the overhaul of important equipment.

The main activities are defined in the maintenance manuals either IHB or PHB and are planned with the same processes used for the daily workflow. The corrective activities that can only be done during the outage are planned and included in the programme. All plant departments are integrated in the outage planning through the phases of approval. There are periodic meetings to assess the main activities and discuss incoming issues, allowing for a good follow-up.

Activities inside the controlled area are submitted to extensive planning to reduce the exposure to radiation, maximize use of special or remote tools and to reduce time of execution.

The tagging system is comprehensive, covering many activities, in order to reduce the operational impact in releasing work, minimizing the generation of radioactive waste and, after the activity is finished, returning the equipment for testing or system lineup in a safe way.

Prior to the outage, a complete chart is sent to all departments, the technical expert TÜV and the state regulator comprising all activities. During outages, the scheduling charts are updated 3 days in advance, ensuring a good preview in planning for the management and workers.

As in normal operation, the contractors are assigned to a responsible person of the plant that follows and reports the evolution of tasks and is responsible for ensuring adherence to the procedures and schedule.

The lessons learned after outages are used to review the activities after consideration by the departments involved.

NECKARWESTHEIM NPP FOLLOW-UP SELF-ASSESSMENT

In the maintenance area we focused on the encouragements the team gave us during the interesting discussions. Especially for the storage of safety related Motors in the warehouse we found a satisfactory solution.
The very important maintenance processes for handling fault reports, planning and conducting work-orders, and the reporting about the results are under a continuous improvement process.

DETAILED MAINTENANCE FINDINGS

4.3. MAINTENANCE PROGRAMMES

4.3 (a) Good Practice: Modification of obsolescent electronic equipment

Neckarwestheim Nuclear Power Plant has a very well structured and equipped I&C components workshop, where failed electronic assemblies can be repaired. In cases where a component is no longer available it is necessary to provide the modifications or redesign. These activities, resulting from non-availability of individual components, are clarified by updating the original documentation together with the sections concerned.

For assemblies used in safety systems, these modifications are adjusted with and approved by the independent expert (TÜV), and the relevant documentation is updated. Neckarwestheim NPP is able to provide support to all other German nuclear power plants in modifying equipment and to redesign some electronic cards in line with the quality requirements.

This good practice allows the plant to overcome the obsolescence of some electronic equipment.

5. TECHNICAL SUPPORT

5.1 ORGANIZATION AND FUNCTIONS

The technical support activities in the plant are mainly performed by the Mechanical Department, Electrical Department and the Physics Section of the Surveillance Department.

Each technical support department has an organizational structure that adequately defines approved positions and current staff levels. The responsibilities and authorities of each technical support department are clearly described in the Personnel Organization Procedure on department and section level. Delegation Agreements and Objective Agreements are fixed between managers and employees according to the EnBW rules.

Maintenance staff and technical support staff are working in the same departments/sections, which results in fewer interface issues between maintenance and technical support, and optimum transfer of system/component knowledge and operational experience between maintenance and technical support.

It was noted that the technical support personnel are safety conscious in the conduct of their technical support work and actively encouraged to develop methods to improve safety, quality and reliability. Also, the technical support personnel are encouraged to bring problems before their supervisor.

The responsible engineers are highly qualified and motivated. Many engineers in the technical support departments have more than 30 years of experience. The performance indicators of the technical support departments are in place, which includes the backlog number of modifications and fault reports.

The weekly plant tours of managers are defined in the mechanical department procedure. The managers do the field observation with a checklist in different areas. The findings of such field observation are discussed in the department meeting.

The interface between technical support and other plant on-site and off-site groups is clearly specified and working well. The communication between different levels of technical support staff is adequate. Responsible engineers within the department and from the various departments meet on a routine basis to discuss and exchange experience on the systems.

The scheduling of work during outage and operating periods is controlled in such a way that the unavailability of systems or equipment is controlled and minimized.

Adequate provisions exist to promote technical support of operations, after day staff working hours, in case of problems.

Contractors working for technical support are evaluated and participate in training if necessary. A database was set up to include work experience and training qualification of the contractors in order to facilitate the coordination of the training of contractor staff. The database will be supportive for the plant in future work as it will facilitate the selection of already trained and experienced contractors.

In general, the technical support functions relevant to the safe operation of the plant are well organized and most of the technical support activities are performed to high standards. However, sixteen modifications in both units remain open in the mechanical department and date from between 1996 and 2002. For example, a modification to a primary coolant pump in unit II was initiated in 1996 and remains open due to differing technical opinions between the manufacturer and the plant staff on the final detailed design. Furthermore, documentation revision after a modification can take four to five years. For example, the final documentation revision after a modification related to the post accident sampling system, took five years to complete. A backlog of work on some technical support activities was observed. The team encourages the plant to improve its response to plant modification closure.

5.2 SURVEILLANCE PROGRAMME

A surveillance programme is in place to verify that the structures, systems and components important to safety are ready to operate at all times and are able to perform their safety function as intended in the design.

Management is discussing an enhancement of this programme to contain three steps. The first step is to classify and identify the important systems and components. The second step is to record and analyze the existing surveillance programme and to optimize the relevant surveillance measures for trend pursuance. The third step is to verify the adequacies and effectiveness of the surveillance programme.

However, management procedures have not yet been issued for this process and systematic surveillance activities for structures, systems and components are not conducted sufficiently. The team made a suggestion in this area.

The periodic test scope and test frequency are defined in the Test Procedures Manual approved by the regulator. The adequacy is reviewed, currently there is nine hundred and fifteen periodic tests conducted in the plant. The periodic test programme is judged to sufficiently verify the safety status of the plant.

Changes to the manual are validated by independent experts under the regulatory authority supervision. The Test Procedures Manual consists of: notes on application, test list and test procedures.

There is an adequate administrative system for test scheduling in order to accurately control the times at which all tests are to be performed. Tests are conducted under as near as possible real conditions without preconditioning of the system or equipment prior to test. The administrative systems sufficiently support the scheduling and the intervals between tests are based on operations experience.

Test acceptance criteria are clear. The regulator and the independent experts receive the test reports and the test results as per the annual test list and on the occasion of outage. The Mechanical Department and Electrical Department initiate the corrective actions if the test fails. The evaluation is performed in a timely and comprehensive manner and corrective actions are performed without unnecessary time delay.

Safety system availability is recorded in the shift logbook and the event analysis department collects the data for the safety system availability indicators. In case of problems, the system engineer is informed to take the necessary actions. The responsible engineers need more involvement in the trending of safety system performance.

The first periodic safety review of the plant in accordance with the regulatory requirements was performed in 1997; the second review is under preparation.

5.3 PLANT MODIFICATION SYSTEM

All functions and responsibilities concerning modifications are defined in procedures QAW-02-04, QAW-02-05 and BAW-186. The modification procedure (QAW-02-04, 05) is applied for permanent modification of all systems including software, operating limits, and documentation.

The permanent modifications are grouped in 4 main categories: Category A, B, C and D based on the safety relevance. Safety assessment for every modification as well as an independent technical review, especially in the civil engineering area, is required.

The plant has a clear, well-understood flow path for the plant modification process consisting of: request, planning, design, review, implementation and completion.

The design process of modification adequately considers the impact of codes, standards and design configuration. There is an appropriate formal, interdisciplinary technical review and approval in place for all plant modifications. The team evaluated this programme as complete and robust.

The work programme belonging to the design modification package contains testing required after implementation of the modification, to check its proper functioning and effectiveness. The modification package contains a comprehensive checklist to fill out and up-date for identification of the necessary documentation revision. Before closing the modification, a quality check is in place to check whether these revisions have been implemented.

The temporary modification procedure (BAW-186) is applied for provisional arrangements and simulations. There are currently sixteen temporary modifications active in unit I. Periodic reviews are conducted in order to have control of the adequacy of the temporary modifications.

There is a “Modification Committee” in the plant, which is made up of participants from the heads of departments. The committee meets on a weekly basis to review the modifications.

Sufficient evidence for strictly following the procedure requirements has been provided that assures adequacy of the process, including simulator changes related to the modifications and operator training material.

5.4 REACTOR CORE MANAGEMENT (REACTOR ENGINEERING)

The reactor physics section in the Surveillance Department is responsible for the safe management of the reactor core. The core management functions are covered by the procedure (QAW-08-01 and FAW-006) starting from the fuel manufacturing, fuel receipt inspection in the plant and ending with the fuel discharge from the reactor core.

To fulfill the above responsibilities and functions, a set of procedures that are clearly understood by the related staff, such as BAW-121, 116 and 143 have been developed and implemented. The procedures define a clear line between the responsibilities of different working groups, e.g., Reactor Physics, Maintenance and Operations.

Fuel integrity is well maintained at the plant. No fuel failure was observed in the past ten years for unit I. An action plan for failed fuel has been established with necessary key elements such as action level for fuel investigation activities and restriction of power operation.

Reactor engineering personnel are well qualified and experienced, have clear responsibilities and authorities and are readily available to support plant operation during all modes of operation.

The reactor core data and associated safety parameters are adequately monitored and trended for safe and reliable operation with a monthly report being issued. The reactor engineering support work is demonstrated to be sufficient and effective.

On-line core monitoring is undertaken with the READAT system. The corresponding data in the process control computer are updated by the reactor physics section after each refueling and at defined intervals in the course of the operating cycle.

Software developed by the plant (programmes including DALI, ALFA, BETA, GAMMA) is in use for the administration of data from reactor operation and core components including planning and compilation of the sequencing data necessary for the core components.

A visualization function has been created for core loading and unloading in the computerized operation management system to support the shift crew when monitoring sub-criticality. It displays the state of fuel loading and unloading with charts (PRISCA) and time graphs. This system was found by the team to be a good practice.

A check of the historic record of an identified fuel assembly showed that fuel assembly movements and histories are kept up to date and accurate records of the control and receipt of nuclear material and shipments of fuel are kept.

5.5 HANDLING OF FUEL AND CORE COMPONENTS

The reactor physics section of the Surveillance Department is responsible for fuel handling control. This section also checks the in-core configuration (fuel assemblies, control assemblies, restrictors).

An effective foreign material control process was demonstrated by observing the status of the new fuel storage and spent fuel pool area.

The fuel is inspected by approved personnel in accordance with quality control procedures. It was noted that a detailed checklist is used for the inspection.

The reactor physics section developed the programmes for verifying the operational behavior of the core components and monitors the implementation of these programmes. The results of these inspections and measurements are documented and evaluated.

The facilities which are of significance in terms of fuel-assembly handling, fuel-assembly transport, and fuel-assembly storage are well maintained.

Appropriate authorization and independent verification for fuel movement is in place. There is a separate storage location for leaking fuel rods. At present, thirty four defective fuel rods are in storage. The handling of defective fuel rods was demonstrated to be performed in a safe way and easily traceable.

5.6 COMPUTER BASED SYSTEMS IMPORTANT TO SAFETY

The important computer applications in the plant mainly include process computer systems and administration systems. A comprehensive programme for utilization of computer capabilities and application is established and implemented to support and verify the safe operation of the plant.

Depending on protection requirements, several IT security zones are defined. Every zone is assigned to a responsible head of department. All systems within one zone are on a comparable security level. A policy regulates all communication aspects between zones. All communication between zones is regulated by technical systems. The team considered this to be a good practice.

Adequate controls are established for monitoring and modifying computer applications. Modifications for software / hardware are adequately managed. A quality assurance system is established for computer applications. A set of management procedures are in place, such as IT security management, access to IT server rooms, etc.

Data, such as fault reports, different kinds of measured values, findings from maintenance, documents and drawings, are generated on a daily basis. The resulting individual activities have to be coordinated and conducted in accordance with best practice in quality assurance. The computerized plant management system in the plant stores this information reliably, provides means of retrieving specific items of information quickly, processes the data and displays it in a suitable way.

Planning, technical clarifications, approval, work processing, documentation and evaluation of maintenance measures, periodic tests and in-service inspections are processed with computer assistance in the plant management system. The system is also used to control isolation tagging, regulate the prerequisites for safe working practices and conduct evaluations enabling internal feedback of experience. The system is therefore an important tool for technical support and maintenance and judged to be effective and comprehensive.

The human-machine interface was designed to provide the user with a sufficient and structured amount of information, and also to provide sufficient time to react. The team has the opinion that the human machine interface is supportive and easy to use for the Control Room Operators.

NECKARWESTHEIM NPP FOLLOW-UP SELF-ASSESSMENT

The Team found two good practices and one suggestion in the Technical Support Area. We used the suggestion to think in general about our surveillance concept already in place for safety-relevant systems and components. We further improved it by additional measures. Systematic trend analyses of suitable measured variables, with experience from maintenance and engineering expertise properly factored in, enable trends to be assessed and to locate the causes for these trends. Along with in-depth knowledge of and awareness for the long-term behavior of the systems and components, trend analysis therefore also permits the optimization of the maintenance strategy and even earlier detection of negative developments. Thus, trend analysis combined with in-depth knowledge of and awareness for the long-term behavior of the systems and components allows the optimization of the maintenance strategy and even earlier detection of negative developments.
The encouragement for shortening the duration until completion of plant modifications, is taken into account by optimizing our SMS process.

STATUS AT OSART FOLLOW-UP VISIT

During the OSART mission, one suggestion was made which was reviewed and evaluated as being resolved at the time of the follow-up mission.

The plant has developed a quarterly system health report. The report contains essential data and an overall assessment of the status for each safety related system. The report has proven to be a useful tool for the management to get a comprehensive overview of the status of the plant.

The plant has performed a comprehensive study to identify data to trend. The data selected comprises on-line measurements as well as measurements collected manually. In order to facilitate the analysis a catalogue has been developed that contains interpretations on possible causes of changes over time.

The plant has strengthened the vibration supervision with on-line measurements on relevant pumps and motors. Installations are complete on about 50% of the components. Installation for the remaining 50% will be performed during the upcoming outages.

DETAILED TECHNICAL SUPPORT FINDINGS

5.2 SURVEILLANCE PROGRAMME

5.2 (1) Issue: The plant surveillance programme is not sufficiently developed and implemented for all structures, systems and components to monitor and evaluate their performance.

In general, a surveillance programme is in place to verify that the structures, systems and components important for safety are ready to operate at all times and are able to perform their safety function as intended in the design. However, the team noted that:

- A renewed system surveillance process is under discussion at management level. The renewed management procedures have not been issued for this process. The system engineers are not yet fully knowledgeable regarding the details of the new system surveillance process.
- System health reports are not required in the system surveillance process.
- For the emergency feed water pump, no systematic trending of results below given limits is undertaken following periodic tests.
- There is no periodic vibration measurement for the residual heat removal pumps and safety injection pumps to evaluate and confirm the operating status of the pumps.
- The vibration level on the discharge line of the pressure test pump through penetration ZB 01 R012.00 in the CVCS pump room ZB 01-38 is high. There was no vibration measurement for this pipe although significant vibration was observed.

Without a fully developed and implemented comprehensive surveillance programme on structures, systems and components, the plant's safe and reliable operation may be adversely affected.

Suggestion: The plant should consider further developing and implementing its surveillance programme to monitor and evaluate the performance of all structures, systems and components.

IAEA Basis:

NS-G-2.6

9.1. A surveillance programme should be established by the operating organization to verify that provisions for safe operation that were made in the design and checked during construction and commissioning continue in effect during the operating lifetime of the plant and continue to supply data to be used for assessing the residual service life of SSCs.

NS-2.11

1.1. Operating experience is a valuable source of information for learning about and improving the safety and reliability of nuclear installations. It is essential to collect such information in a systematic way that conforms with agreed reporting thresholds for events occurring at nuclear installations during commissioning, operation, surveillance and maintenance activities and decommissioning, and on deviations from normal performance by systems and by personnel, which could be precursors of events.

I–1. For the purposes of this Safety Guide, a low level event (which includes near misses) is the discovery of a weakness or a deficiency that could have caused an undesirable effect but did not, owing to the existence of one (or more) barriers of defense in depth (Instead, there would have been minimal or no consequences of the low level event.) Low level operational events are those reported within the plant or operating organization as anomalies, conditions or situations that are usually screened out in the process of dealing with safety significant events (such as findings during testing, in-service inspection or surveillance). They would form the majority among the reported events at the plant. Individually they may appear to be unimportant. However, when aggregated with other low level events they can reveal features of common patterns, trends and recurring information that may be significant and useful for enhancing plant safety.

I–8. The aim of a programme for the feedback of operational experience is to ensure that the following objectives are achieved:

(3) The issues selected are analysed in sufficient depth to permit the identification of the underlying root causes in the design, in the surveillance activities carried out on equipment, in personnel qualification and in aids for personnel.

Plant response/action:

The system surveillance concept that was presented to the reviewers during the OSART mission and that received their positive acceptance has been further optimized in the interim and has also been largely implemented in operation.
In a first step the power plant has checked again all systems, components and measured variables of importance for safety so that they could then be utilized for a more in-depth analysis.

In a second step all measured variables registered with regard to these systems and components during periodic tests or recurring maintenance were studied to ascertain whether their systematic trending could furnish information on degradation effects, for example due to wear or dirt and/or incipient damage. On this basis suitable measured variables were selected and subjected to systematic trend analysis by the technical support staff.

In a third step the visualization and analysis program for the process-computer data was extended to include a function for quantitative assessment over a prolonged period of time of the trends of variables that are not continuously measured. Another process now in the course of being implemented ensures that the measured variables in question are available in analyzable form on the process computer, regardless of how they are captured. The systematic and regular analysis and assessment of the trends of important measured variables by the system engineers from technical support now supplements the system surveillance that has been in place already. Within the framework of the introduction of trend analysis, the intervals between vibration measurements of safety-relevant pumps – i.e. including the residual heat removal and the safety injection pumps -

were shortened by a considerable margin. This means that these measured values, too, can now be included in the trend analysis.

Regular reporting has also been introduced for the management of Technical Support; these reports present short, clear overviews of systems statuses on the basis of the criteria:

- Accumulations of fault reports on certain systems or components
- Degree of achievement of periodic-testing targets
- Abnormalities identified by measured-value trend analysis.

The vibrations in the discharge line of the pressure-test pump are measured regularly and technical support personnel regularly assess both the absolute level of vibration and possible emerging trends with regard to strength.

IAEA Comments:

In order to improve the existing surveillance programme the plant has made developments mainly in three areas:

- A system health report has been implemented.
- Electrically measured and manually collected data are trended and the trends are analysed regularly.
- Vibrations measurements on important pumps and motors have been or will be installed.

To improve the managerial overview the plant has developed a quarterly system health report. For each safety related system, information is provided about the number of reportable events, the number of discrepancy reports, deviations in trends and unplanned unavailability time. Based on this data an overall assessment of the status for the system is performed. The summarized status information is indicated by colour codes (green, yellow and red). The report is made up quarterly and the first report was issued after the third quarter of 2008. The report is discussed at the regular Monday department management meetings. Comments and measures in addition to those already taken by the mechanical and electrical departments are documented in the minutes of those meetings. The system health report has proven to be a useful tool, enabling the management to get a comprehensive overview of the status of the plant systems. The threshold levels for the three colour codes are fine-tuned as experience of the tool is gained.

The plant has performed a comprehensive study to identify important data to trend. The data selected comprises on-line measurements as well as measurements collected manually. Fingerprint measurements after major overhauls are used as reference values. It is the duty of the mechanical and electrical departments to perform both long and short-term trend analyses. These duties are supported by procedures. In order to facilitate the analysis of trends a catalogue that contains interpretations on the possible causes of changes over time has been set up for each family of components, e.g. pumps, valves, filters, etc.

The plant has decided to install on-line vibration measurement on relevant pumps and motors. Two types of measurements are made, measurements of vibration of component structures and shock pulse measurements (SPM). SPM are used to identify metal-to-metal contact problems, e.g. in rolling bearings, gearboxes, screw compressors etc. Installations are completed on about 50% of the components. Installations for the remaining components will be performed during the upcoming outages. Manual measurements with short intervals are made in the meantime. In parallel to the hardware installations, evaluation tools have been installed and qualified. Currently the plant is relying on external expertise for evaluations but two engineers are under training to become internal experts. The vibrations monitoring will be further enhanced when rpm measurement sensors are installed on all objects enabling, for example, online calculation of vibration phase angle. Currently the evaluation of vibrations is a specialist function. In the future the plant is encouraged to make the vibration measurements available to the control room staff thus making it possible to take mitigating actions earlier.

The plant has installed accelerometers on the discharge line from the pressure test pump. The dynamic stress level has been evaluated and the long-term integrity of the pipe has been assessed to well under the acceptable limit. The conclusion is that the vibrations do not pose any threat to the integrity of the pipe.
Actions undertaken have gone beyond the actions envisaged for the original suggestion.

Conclusion: Issue resolved.

5.4 REACTOR CORE MANAGEMENT (REACTOR ENGINEERING)

5.4 (a) Good Practice: Monitoring sub-criticality during fuel handling.

A visual display has been created for fuel loading and unloading in the computerized operation management system to support the shift crew when monitoring sub-criticality. It displays charts (PRISCA) and time graphs.

The purpose of this function is to support the supervision and the communication between the refueling machine operators, shift crew and the reactor physics section during fuel handling. The content of screen image is as follow:

Core cross section:

- Current core loading pattern (core cross section);
- Number of fuel assemblies in core, current step in fuel movement sequence plan;
- Neutron count rate and selectable time curves;
- Neutron count rate limits; and
- Boron concentration and temperature in reactor core.

Graphic content of time curves:

- Evolution of neutron count rates for both chambers of external neutron flux; and
- Associated limits (min./max.).

Sub-criticality of the reactor core is monitored by shift operators and reactor physics during fuel handling with the aid of these two graphs. If limit values are reached, the process computer triggers an optical and acoustic alarm. When a limit signal is given, the Shift Supervisor interrupts fuel loading and initiates the necessary corrective actions according to the operating procedures.

This system provides Control Room Operators with a better method of monitoring refueling status than is generally seen in other NPPs.

5.6 COMPUTER BASED SYSTEMS IMPORTANT TO SAFETY

5.6 (a) Good practice: Application of a zone model for the security of computer and digital based I&C systems

It is sensible to provide staged protection of computer and digital based I&C systems. The stages take into account the potential risk and threats depending on the system relevance to safety. One practical solution of a graded approach is to divide the computer and digital I&C systems into zones, where graded protection principles can be applied to each zone depending on its relevancy to safety or plant operations. A zone model makes it easier to apply similar protection needs in a complex computer infrastructure and at the same time facilitate the exchange of information in a safe way. The zone model makes it possible to define zone-specific guidelines depending on the protections needs.

At Neckarwestheim Nuclear Power Plant, a zone model to structure the computer and I&C based systems have been implemented together with the necessary and relevant criteria.

The defined computer security zones comprise computers with the same or similar importance concerning safe operation of the plant. Systems belonging to one zone have comparable demands of safeguards. Different computer systems belonging to one zone build a trusted area for internal communication. Zone borders require decoupling mechanisms for data flow in order to prevent un-allowed access or errors to propagate from a zone with lower requirements to a zone with higher demands, for example from the plant IT-system (zone 3) to the process computer (zone 2). Furthermore, demands for physical separation may be applied when defining zone boundaries. This method assures a further deepening of the barrier function and "defense in depth ".

Zones can be partitioned into sub-zones to improve the configuration in order to demarcate one area from another functionally, or to meet different protection needs within one zone.

The zone model easily offers possibility to assign responsibilities to personnel. At the Neckarwestheim NPP responsibility for the security within a zone is allocated to individual department heads. The responsible person manages and organizes all activities concerning computer security within a zone. In addition to that the plant has appointed a computer system security officer (CSSO) who is responsible for the zone model as such. The CSSO documents the zone requirements, advises and supports all those involved and encourages the cross-departmental exchange of information about IT security in general.

6. OPERATING EXPERIENCE

6.1 MANAGEMENT, ORGANIZATION AND FUNCTIONS OF THE OPERATING EXPERIENCE PROGRAMME

Two processes in the Safety Management System (SMS) are allocated to Operational Experience Feedback (OEF), covering internal and external OEF:

- U7.1 : "Recording of events and operating experience feedback";
- U8.1: "Event analysis".

The OEF processes are described in procedures and also in workflow format. This allows the process to be seen at a glance with a clear view of the steps of the process and also the interfaces and roles of the "actors".

Other documents, like the Quality Management Manual and the Maintenance Procedures Manual, support the process.

Three main players are involved in the process:

- The Nuclear Safety Officer (KSB = Kerntechnischer Sicherheitsbeauftragter) is required by law to ensure that OEF is well implemented in the plant.
- The departments are responsible for reporting deviations, performing basic analysis of their events and tracking the corrective actions arising from these analyses. In each department, four people are "contact partners" for the OEF process; they are key-people in promoting the process in their department.
- The Event Analyses section (ZS section) is responsible for screening the internal deviations and the external reports. ZS section also performs cross-department basic analyses, in-depth or human factors analysis, and tracks the actions arising from these analyses.

The roles and responsibilities, at the managerial level, are described in the Personnel Organization Procedures (PBO = job profiles).

The ZS section is the OEF process owner, in charge of animating the process and ensuring that it works well. The Nuclear Safety Officer (KSB) is also the team leader for Event Analyses. Four times per year, KSB chairs the Internal Safety Committee (ISA), during which special topics related to internal and external OEF are discussed. Corrective actions arising from ZS analyses are approved and distributed to the affected departments.

Regarding objectives, one collective objective is defined at Board level (EnKK) for OEF: implementation of a cross-site concept for dealing with events below the threshold for reportable events. At site level, there is no specific objective related to the OEF process. However, there are objectives at the level of certain departments, but they differ from one department to the other. Without a common objective, the plant does not use all opportunities to provide full support to the OEF process. The team has provided a suggestion to improve the control of the OEF process.

Personal objectives around OEF are established for staff involved in OEF. The team found

this to be a good way to ensure accountability for the process.
A strong commitment is shown by the Heads of Departments, Heads of Section, KSB, ZS section and contact partners to promote the OEF processes. For example, internal and external OEF is a topic on the agenda of the weekly department meetings and the engineers' meeting. Heads of Departments and the ZS section organized special meetings and training in order to launch the basic analyses process that began mid 2006.

Tools are used to help perform basic and in-depth analyses. Training is also provided to people in charge of analyzing events.

The OEF process is reviewed once per year during the Safety Management Review meeting.

6.2 REPORTING OF OPERATING EXPERIENCE

The Operating Procedures Manual (so called BHB = Betriebshandbuch) states that all deficiencies (mainly material linked) must be reported by means of "fault reports" if they have a real or potential impact on safety, or if there is a risk for people or for the availability of systems or components. This requirement is also included in the Management Expectations related to safety (named "Sicherheitmerkheft") and in the basic training for new employees.

The fault reports are recorded by staff in a computerized plant management system (BFS = Betriebsführungssystem). All fault reports are checked by the Shift Supervisor, the Nuclear Safety Officer and finally by the Unit Manager to see if they are reportable events to the authority in accordance with the legal criteria. If they are reportable, they are categorized. Three categories exist: S (must be reported immediately), E (must be reported within 24 hrs) and N (must be reported within 5 working days), depending on their impact on safety. Criteria to categorize these deficiencies are written in the BHB and are very clear. In addition, all fault reports are discussed in the daily morning meeting.

Additionally, the management expectations for human performance (booklet "Marker für professionelles Handeln") requires that any deviation ("Abweichungen" including low level events and human factors events) must be reported. This booklet was widely distributed and, moreover, presented during training sessions: 400 staff was trained.

If any employee notices a deviation (low level event), this employee needs to discuss with his hierarchy or one of the contact partners of his department. The hierarchy or the contact partner can decide to perform a basic analysis or to present the topic in the morning meeting or in the engineers' meeting. Staff may also ask for an anonymous human factor analysis directly to ZS section. However, even if deviations are reported and some of them are analyzed, the team found that not all low level events, near misses and precursors were recorded for further analysis or trending. The team suggests that the plant fully implement a comprehensive system to report low level events. The goal of this is not to perform a basic analysis of each event, but to perform a global analysis of all the tracked and trended events collected during a period of time in order to find recurrences or common root causes.

Procedures or internal notes support the process of basic analyses in certain departments (BI-FAW-023 for Operations unit I, E-FAW-100 for the Electrical department, an internal note for the Surveillance department, but there is nothing written for the Mechanical department). The team encourages the plant to produce procedures for the surveillance and mechanical departments to have a uniform process in place.

6.3 SOURCES OF OPERATING EXPERIENCE

Sources of external OEF are the following:

- VGB reports: VGB is an association of power plants (NPPs), mainly located in Germany, but also in Switzerland, Spain, The Netherlands and Brazil. This association publishes “internal” reports coming directly from its members, and “external” reports coming, for example, from World Association of Nuclear Operators (WANO) or the event database of the IAEA (IRS).
- The plant receives all the “internal” reports, and also “external” reports selected by VGB, on the basis of criteria determined by a steering committee, with German NPPs representatives. The plant also receives a German translated copy of the most interesting “external” reports.
- GRS-WLN information notices: GRS is a group of experts ordered by the environment ministry of the federal government. These experts analyze the VGB reports, IRS reports, and, for certain events, they send recommendations to the plant and the plant must respond within two months.
- EAW: analysis reports made by Areva (all the German plants are Areva licensed). The IRS reports also come in the plant via this way and VGB, as the plant asked Areva to pre-analyze IRS reports. Since 2005, the plant has received 30 IRS reports.
- Operator information bulletins.
- VGB working groups.
- Manufacturer’s information bulletins (from Areva, KSB).

The sources of external OEF are broad and quickly available when they come from within Germany. However, the team found that the plant should pay more attention to the reports coming from outside Germany.

Sources of internal OEF are various and as the following:

- Fault reports recorded by the staff in the computerized plant management system (BFS); those fault reports come from corrective or preventive maintenance interventions, the surveillance programme of Operations or periodic testing. There are, on average, ten fault reports per day per unit.
- Meetings are a source of general information: if a problem is worthwhile, it is reported during the departments meetings, the morning meeting, and if necessary, to the weekly engineers’ meeting. The criteria to report events during these meetings are based on the experience of management.
- Some small events and near misses (low level events) are collected via the departments meetings or the BFS system.
- Events related to human factors; a special agreement was signed with the work council to guarantee anonymity in certain cases, a ‘no blame’ culture is in place and that a work council representative would attend during interviews.
- Transients like scrams, turbine trips, load reduction.

6.4 SCREENING OF OPERATING EXPERIENCE INFORMATION

The external OEF reports are screened every day by ZS section. All the reports coming from VGB (“internal” or “external” VGB reports, including IRS and WANO reports) are sent for information to the Technical Director, Plant Managers, Nuclear Safety Officer and Heads of affected departments. Some of those reports are distributed, following the decision of the Nuclear Safety Officer, for further analysis if they are applicable to the plant. In this case, ZS section asks for an answer within four weeks. In 2006, four hundred and forty four reports were sent for information and eighty nine for analysis. In 2007, two hundred and forty seven reports were sent for information and forty nine for analysis.

The use of a computerized system for distribution of the external OEF from VGB to the plant and a daily screening in the plant allows a very quick transfer (2-3 working days) of information to the affected departments. The team recognizes this as a good performance.

Other external OEF coming from suppliers or manufacturers are directly screened by the affected departments.

The fault reports (internal OEF) are screened every day by the departments and the ZS section in preparation for the morning meeting. On the basis of this screening, ZS or the departments may ask for an analysis. In certain cases, the Unit Manager (LdA = Leiter der Anlage) or the Technical Director also ask for an analysis.

In the departments, deviations which are reported directly by staff, but without fault reports due to their low significance, are discussed in daily and weekly meetings in order to decide whether or not it is valuable to produce a basic analysis. Most of the basic analyses provided by the plant come from fault reports: around 80 to 90 % in most departments. The team encourages the plant to expand these reports during the daily and weekly meetings and to use it for further trending and global analysis.

6.5. ANALYSIS

When screening the fault reports, or after discussion during a meeting, a department may decide to provide a basic (simplified) analysis. This is performed in the departments, by the contact partners, for “simple” or “small” events with mainly technical or limited organizational aspects. These basic analyses are performed in a “holistic” approach which includes man, technique and organization. The contact partners are trained in this approach following a one-day training course with the Nuclear Safety Officer.

In order to facilitate the basic analysis, ZS section developed a pre-printed form with questions related to the three areas (man, technique and organization). The use of this pre-printed form helps the contact partners to perform their basic analyses in a systematic and timely manner.

The contact partners in the departments keep lists of ongoing or completed basic analyses. These lists are reviewed periodically (mainly during the 3-monthly meetings) by the departments. Forty-four basic analyses were performed in 2006 (since mid-year when the process started) and sixty three in 2007. This is an industry norm.

For more complex events, an in-depth analysis will be performed:

- where the 3 aspects "man, technique and organization" (MTO) are present; or
- if the root cause is not clear in the basic analysis, or/and
- on demand of the LdA or the Technical Director.

For in-depth analyses, a comprehensive methodology, developed by the VGB, is used: the event is divided into single events (called "modules") depending on chronology and "actor". For all the modules, direct and indirect causes are determined. A user-friendly software tool (SOL-VE) supports in-depth and basic analysis in the ZS section.

In the last three years, a few in-depth analyses were performed: two in 2004, zero in 2005, two in 2006 and one is ongoing for 2007. The plant intends to promote in-depth analyses in 2008.

A human factor analysis can be provided by the ZS section if requested. The Human Factor analysis is performed on the basis of eleven standardized questions, developed by VGB. The report is distributed to the affected person and his hierarchy, with the plant manager and Technical Director included. The Human Factor analyses reports do not refer to individuals by name. The report approach guarantees that there will be no blame for individuals, which is a pre-requisite condition for staff reporting events and human errors. Thirteen human factor analyses were provided in 2006. For 2007, three are ongoing and one is closed. One explanation for the decreasing number is that since mid 2006, human factor aspects are included in the basic analyses.

In order to perform basic analyses, in-depth and Human Factor analyses, staff of the ZS section undertakes four weeks of internal and external training and this includes theoretical and practical training. The team considers this as a good performance.

6.6 CORRECTIVE ACTIONS

Corrective actions arising from basic analysis are followed by the affected departments. Electrical and Mechanical departments, for example, review their corrective actions during a meeting every three months.

Corrective actions arising from internal analyses performed by section ZS are recorded in the SOL-VE software. Meanwhile, in order to harmonize its activities, the plant intends to transfer the data to a database containing all the open actions on the site (E-LOP software).

All corrective actions do not have a deadline and are not prioritized. The team suggests that the plant fully implements the follow up and control of the OEF process.

Corrective actions arising from analyses of external OEF are followed by ZS. TÜV approves the completion of these actions. Eight actions are ongoing for 2007.

6.7 USE OF OPERATING EXPERIENCE

External event reports for information are transmitted to the affected departments via a computerized system (e-Doc), which tracks the dissemination of the information. Information about external event reports is also part of the weekly meeting in the departments. Some special meetings with all impacted personnel are also organized. Moreover, the public relations department publishes some operating experience reports in an electronic daily newspaper (Infoline) common to EnKK. The team found that these are good methods to disseminate external OEF.

Regarding external OEF, the plant sends all the reportable event reports to the VGB and to the Regulator and then to GRS. VGB then decides which reports must be sent outside Germany to other associations such as WANO. GRS decides which reports must be sent to the IAEA-IRS.

Some uses of the internal OEF are highlighted below.

After completion of a job internal OEF is integrated in the work process. The lessons learned are used in two ways: procedures and job order modifications. These modifications are performed by personnel accountable for the work as the following:

- A report is edited by Operations after each outage. This report includes the lessons learned for the next outage.
- Internal OEF is also used during training for operators in simulator sessions.
- The plant uses the data from its own internal OEF (fault reports, maintenance and tests reports) and records the data in a database in order to be used for the plant specific Probabilistic Safety Analysis (PSA). The team recognized this as a good practice.

6.8 DATABASE AND TRENDING OF OPERATING EXPERIENCE

All the fault reports recorded in the BFS are classified into ten groups including ergonomics, preventive, fire detection or protection, work not finished, reworks, planning faults and “near misses”.

Except for human factor analyses, no trending is made of the root causes of events. Without a global analysis of the root causes of the events, the plant may miss recurrences or common mode failures. The team suggests that the plant fully implements the control and follow-up of the OEF process.

6.9 ASSESSMENT AND INDICATORS OF OPERATING EXPERIENCE

There is a one-day Safety Management Review per year, to assess the processes included in the SMS. In preparation for this review, the Safety Management Officer collects the indicators and analyzes them in terms of:

- how are they used,
- the way the process works,
- the trend of indicators.

Thirty indicators are used in the OEF process. Many are linked to the reportable events. Twenty-one of them are considered to be more statistical than performance indicators for use as tools to improve the process. The team encourages the plant to revise the OEF indicators so they accurately reflect plant performance. This will allow weaknesses in the OEF process to be made visible.

The status of the OEF process is also checked during the regular Safety Committee meeting (ISA). The team observed technical presentations during this meeting. Corrective actions were proposed and decided, however there was not always a vivid exchange of views.

NECKARWESTHEIM NPP FOLLOW-UP SELF-ASSESSMENT

In the OE Area the team found two issues and formulated suggestions regarding on the one hand the handling of low-level events and on the other hand a consequent follow up and control of the whole OE Process to improve its effectiveness.
The main precondition for the handling of low-level events is the willingness of the employees to participate actively in this process. The Event Analysis team could further improve this readiness by several measures.
The system for reporting and tracking low-level events has been significantly improved by a binding call on highest-level management, by extended use of available sources of information, and by introducing a comprehensive trending concept. A more robust structure has also been developed for the use of international operating experience. The result is, that this information is communicated more rapidly in the power plant. The degree of detailing of the analysis of this information is extended in a practical manner. Consistent and broad-based feedback on findings from event analysis has further promoted acceptance by and participation on the part of the power-plant staff. By the implemented measures and the developed processes a better possibility to learn from low-level events in our own plant and other plants is now realized.

STATUS AT OSART FOLLOW-UP VISIT

In the Operating Experience Feedback area, 2 suggestions were developed during the OSART mission in 2007, one related to the follow up and the control of the Operating Experience (OE) process, and the other one to the reporting of low level events (LLE).
Since then, the plant revised the management expectations (Marker für professionelles Handeln) in order to focus more on the operating experience feedback process and the no blame policy.
The 2009 objectives for the plant include a strict use of the OE process and a minimum number of basic analyses to be carried out by each section. Deadlines to perform basic analyses or in-depth analyses are now written in the OE procedures and tracked by indicators. A target of 1000 low level events to be reported per year was also defined.
All corrective actions arising from event analyses now receive a deadline. Departments remain accountable for closing out their actions, but the Nuclear Safety Commissioner (KSB - process owner for the OE process) has periodic meetings with the contact partners inside the departments to assess the tracking of actions.
A new procedure describes the trending concept. Different sources are available to make trending, including LLE and the root causes of the event analyses. Especially for LLE, the plant uses 4 sources: field walk downs of managers, technical fault reports, LLE identified in

the Chemistry section (the plant considered Chemistry section as a pilot before full implementation of LLE for all other sections), and LLE concerning industrial safety identified in the Construction section within the framework of a special action plan.

The plant put in place a broad program to motivate the staff to report LLE. In 2008, about 600 staff were integrated in this program conducted by ZS section.

In 2008, 1714 LLE were reported. Two trending reports were issued, including trending of LLE and of root causes of the event analyses. After further trending in 2009, the plant intends to take corrective actions, depending on the results of the trends.

The set of indicators was revised. New indicators were developed to monitor the efficiency of the OE process. These latter indicators have two threshold values, determining three zones (green, yellow and red), and corrective actions are defined when a threshold value is reached.

However, the process of reporting LLE from departments still needs to be well-defined. The team encourages the plant to develop the reporting of LLE to include all departments and sections.

The issue related to the follow up and control of the OE process is resolved. The issue related to the reporting of LLE has satisfactory progress to date.

DETAILED OPERATION EXPERIENCE FINDINGS

6.1 MANAGEMENT, ORGANIZATION AND FUNCTIONS OF THE OPERATING EXPERIENCE PROGRAMME

6.1 (1) Issue: The follow-up and the control of the operating experience (OE) process are not yet consistently implemented.

Although the operating experience process is very well described in the Safety Management System, the team found the following facts:

- There are no formally written objectives or management expectations about the time needed by Event Analysis section (ZS section) to perform analyses or for departments to perform basic analyses. Currently the time needed to edit an in-depth analysis varies from 1 to 4 months**.**
- The corrective actions arising from basic analyses performed by the departments have to be followed in the departments. No deadlines are given to the corrective actions followed by Electrical and Mechanical departments and Chemistry section, nor are they prioritized.
- No trend analysis has been performed yet concerning the root causes established from basic analyses, in-depth analyses or fault reports. However, this was done for the Human Factors analyses.
- With regard to indicators:
  - Of the 9 performance indicators related to the OE process just four are related to reportable events as required by law: the time between the reportable event date and the completion of actions; the number of reportable events with no final report at the end of the year; the average time to get the preliminary report of reportable events; the time to get an in-depth analysis of a reportable event. These four indicators should be usefully extended to all events, not only reportable events as required by law.
  - No thresholds or targets have been defined for the 9 performance indicators.
  - Except for reportable events as required by law, there is no indicator reporting the number of in-depth analyses and the time required to produce such analyses.
  - Except for reportable events as required by law, there is no indicator related to corrective actions, such as the number of corrective actions that are open or overdue.

Without consistent follow-up and control, the plant may miss opportunities to improve the operating experience process.

Suggestion: The plant should consider implementing the follow-up and the control of the operating experience process in a more consistent manner.

IAEA Basis:

NS-G-2.4

6.2. The areas to be covered by various management programmes for the safe operation of plant should include, but are not limited to, the following:
… feedback of operational experience …

6.7. When establishing such programmes, due consideration should be given to:
… objectives to be achieved …

NS-G-2.11

8.2 Indicators of the effectiveness of the process should be developed. These may include the number, the severity and the recurrence rate of events and the causes of different events.

5.1. The safety significance of the event, which includes its potential consequences, determines the depth of the cause analysis necessary and subsequently determines the type of corrective actions and the time limit for their implementation.

5.6. Corrective actions should therefore be prioritized. Those actions affecting safety should be given the highest priority, while the actions that are desirable rather than essential should be shown as such. Corrective actions may be either immediate, interim or long term with a need for detailed evaluation.

Plant response/action:

In order to track the feedback of experience (Operating Experience programme) more consistently on the basis of the potential for improvement identified by the OSART team and to control the process more effectively, several measures have been implemented or initiated since the OSART mission.

Management expectation - targets

- Management's expectation that internal and external OE should be logged and utilized at GKN NPP has been explicitly incorporated into the MARKER brochure.
- Deadlines for completion of basic analysis ("Basisanalysen") by the ZS section and by the departments have been written into the procedures for operating experience feedback. On account of the many different interdependencies such as scope of analysis, availability of the persons to be contacted, and processing capacity, the deadlines are stated as guide values as follows:
    - Basic analysis 4 weeks
    - In-depth analysis 8 weeks.

Tracking actions

- The Event Analysis team defines the do-by date and the priority for measures derived from analyses and these dates and priorities are administrated centrally in the e-LOP IT system (electronic list of open items). The departments themselves define the do-by dates and priorities for action deriving from their analyses and track these decisions.

Trending

- International experience in this sector was utilized to identify the relevant parameters that are suitable for a viable system of trending. Good input was brought back from an informative visit to Wylfa NPP in the UK, which we visited in this context. WANO classes this plant as exemplary in the field of operating experience feedback. Furthermore, contacts to the Tihange plant in Belgium was used to obtain field-proven approaches for implementing a trending system.
- The outcome was the introduction of a comprehensive system for identifying trends from all sectors of event analysis so that this data would be available for evaluation. The aspects covered by trend analysis include for example:
  - Cause groups for the relevant discrepancy reports
  - Number of the different types of analysis conducted in each case
  - Contributory factors from basic analyses, HF analyses, industrial-safety-events analyses and in-depth analyses
  - The number of actions and the proportion of actions that are overdue
  - The number of training courses concerning operating experience feedback
- The trends identified in this way are summarized in an annual report. They are used in event analysis to derive actions and are available to management as a basis for decision making.

Indicators

- The set of indicators was focused on the evaluation of process quality. This in turn results in two major positive aspects. Firstly, the number of indicators is cut considerably by eliminating the purely statistical data on reportable events (LERs). Secondly, the new set of indicators enables a better assessment of the "experience feedback" and "event analysis" processes. The following are examples of indicators that belong to the new set of indicators:
  - The number of basic analyses (“Basisanalysen”) conducted by the ZS section
  - Number of engineering-related basic analyses in the departments
  - Average time to completion for basic analyses
  - Recurrence of similar events

As a conclusion the operating experience feedback programme was extended by a very explicit description of management expectations in the MARKER brochure. Targets were defined for time to completion for analyses undertaken by the ZS section and for the number of events to be at least analyzed by the departments. Together with comprehensive trending and a revision of the set of indicators, actions were initiated or implemented that have the cumulative effect of further improving operating experience feedback.

IAEA Comments:

The plant revised the management expectations (Marker für professionelles Handeln) in order to focus more on the operating experience feedback process and the no blame policy. The 2009 objectives for the plant include a strict use of the OE process, and at least a minimum number of analyses to be carried out by each section. Deadlines to

perform basic analyses or in-depth analyses are now written in the OE procedures and tracked by indicators.
All corrective actions arising from event analyses receive a deadline. Departments remain accountable for closing out their actions, but the process owner (KSB) has periodic meetings with the contact partners inside the departments to assess the tracking of actions.
A new procedure describes the trending concept. Different sources are available to make trending including the root causes of the event analyses. Two trending reports were issued in 2008. After further trending in 2009, the plant intends to take corrective actions, depending on the results of the trends.
The set of indicators was revised. New indicators were developed to monitor the efficiency of the OE process. These latter indicators have two threshold values, determining three zones (green, yellow and red) and corrective actions are defined when a threshold value is reached.

Conclusion: Issue resolved.

6.2 REPORTING OF OPERATING EXPERIENCE

6.2 (1) Issue: The reporting system of low level events is not fully implemented.

Although management expectations require that any deviation should be reported, the team found the following:

- A chemist and a manager stated that they report about 2 events per week at their daily or weekly meetings, i.e. approximately 80 events since the beginning of 2007. Nine basic analyses were performed by the Surveillance department since the beginning of this year; the other 70 events were not recorded for further trending.
- Radiation Protection periodically monitors for smearable surface contamination in the reactor building. A radiation protection employee stated that the expected value should be less than 0.5 Bq/cm^2. If it is above this value, he will request cleaning work, search for the cause and report it to the Shift Supervisor in order to inform the next shift. However, only the measures above 1 Bq/cm^2 will be put in an indicator. This indicator has no threshold and is not further analyzed.
- Non-oily waste was found in an oily bin in the turbine hall near the main turbine - no fault report was written.
- Foreign material was found in a sump in the emergency feedwater pump building - no fault report was written.

Without fully implemented reporting of low level events, the plant may miss the opportunity to identify precursors to more significant events. Without having a consequent number of reported events, tracking and trending could not be done efficiently.

Suggestion: The plant should consider full implementation of a comprehensive system to report low level events.

IAEA Basis:

NS-G-2.4

6.66. Operating experience should be carefully examined by designated competent persons to detect any precursor signs of possible tendencies adverse to safety, so that corrective action can be taken before serious conditions arise. Trending should identify recurring similar events and continued problems based on the causes and initiators of previous events. Event trend reviews and conclusive interpretations should be provided periodically to the plant manager and to the management of the operating organization.

NS-G-2.11

Annex I.1. Low level event individually may appear to be unimportant. When aggregated with other low level events they can reveal features of common patterns, trends and recurring information that may be significant and useful for enhancing plant safety. They would form the majority among the reported events at the plant.

SF1:

3.17. Despite all measures taken, accidents may occur. The precursors to accidents have to be identified and analysed, and measures have to be taken to prevent the recurrence of accidents. The feedback of operating experience from facilities and activities — and, where relevant, from elsewhere — is a key means of enhancing safety. Processes must be put in place for the feedback and analysis of operating experience, including initiating events, accident precursors, near misses, accidents and unauthorized acts, so that lessons may be learned, shared and acted upon.

INSAG-15

3.4. Failures and 'near misses' are considered by organizations with good safety cultures as lessons which can be used to avoid more serious events. There is thus a strong drive to ensure that all events which have the potential to be instructive are reported and investigated to discover the root causes, and that timely feedback is given on the findings and remedial actions, both to the work groups involved and to others in the organization or industry who might experience the same problem. This 'horizontal' communication is particularly important. Near misses are also very important because they usually present a greater variety and volume of information for learning.

Plant response/action:

At GKN NPP, there is in place an effective overall concept for reporting, evaluating and eliminating deviations. So that the potential for improvement from the reporting of low-level events can be put to even more effective use, the action described in the following has been completed or initiated in the intervening months since the OSART mission.

Sensitisation of the power-plant staff for the reporting of low-level events

The main precondition for the comprehensive reporting of low-level events is the willingness of the people employed at GKN to participate actively in this process. The Event Analysis team in the ZS section fosters this readiness by:

- Close and contemporary integration of the departments into the processing of basic analyses ("Basisanalysen")
- Regular and consistent information and harmonization with operating experience feedback in the weekly engineers' meetings and in the Plant Safety Committee
- Reporting of weaknesses and the need for improvement in the management review
- Broad-based feedback on findings from event analysis in regular training (approximately 600 participants in 2008)
- Communication of expectations to the designated contacts in the departments
- Detailing of the process description for how to proceed in the departments

Setting targets for the reporting of low-level events

Target specification is based on the IAEA event pyramid, in which only a small number of serious events are at the top and by several orders of magnitude more low-level events - classified by significance – form the basis for improvement. The objective specified for the number of events to be recorded for GKN, therefore, has the following system of classification:

0-1	serious event	-> in-depth analysis
10	complex events	-> In-depth analysis
100	simple events	-> Basic analysis
1000	low-level events and near misses without analysis	-> Trending

Regarding the number of serious and complex events reported there is no need for improvement, because on account of their effects these events are automatically subjected to further evaluation and analysis. Similarly, with regard to the simple events reported and forwarded for basic analysis, with approximately 80 analyses conducted per year, GKN has already achieved good performance. Consequently, the focus is on the better reporting of near misses and low level events which, on account of the no more than slight effects, do not necessitate analysis but that have to be taken into account in trending. In order to obtain a viable and verifiable goal, the target value for trending analysis of near misses and low level events was set to 1000 per year.

<u>Sources for trending of near misses and low level events</u>

- A large potential is exploited in the deviations identified in the routine walkdowns undertaken by management. In order to obtain findings that are as detailed as possible in this respect, the deviations identified in this way were classified by the Event Analysis team in the ZS section in a special system of categories that permits subsequent trending.
- Another source of near misses and low level events for trending is afforded by deviations which occur in the departments. Department U collects these kind of events already in a structured manner and passes them to the Event Analysis team in ZS for the purposes of categorization and evaluation. After a test period this procedure is intended to be extended to further departments to also get the potential of learning from near misses and low level events in a more structured manner.
- The station fault reports recorded in the computerized plant management system are categorized continuously every working day. This procedure is harmonized across the three EnKK plants and described in detail in the "concept for dealing with events below the threshold for reportable events".

By consistently utilizing the existing opportunities for capturing and reporting low-level events and the other measures described here, GKN makes use of the available possibilities for learning from low-level events, introducing improvements, and identifying precursors to more significant events. Close contact with all instances that deal with the structured reporting and utilization of operating experience and the broad-based feedback of findings from event analysis to the plant staff promote the conviction of the employees that the utilization of operating experience is of considerable benefit for improving the safety of the plant.

IAEA Comments:

The plant put in place a broad program to motivate the staff to report low level events (LLE). In 2008, about 600 staff were integrated in this program conducted by ZS section.
A target of 1000 LLE to be reported per year was defined.
The plant is using 4 sources for LLE : field walk downs of managers, technical fault

reports, LLE identified in the Chemistry section (the plant considered Chemistry section as a pilot before full implementation of LLE for all other sections), and LLE concerning industrial safety identified in the Construction section within the framework of a special action plan.
In 2008, 1714 LLE were reported and trended: 687 coming from field walk downs, 453 from technical fault reports, 385 from Chemistry section and 189 from Construction section.
However, the process of reporting LLE from departments still needs to be well-defined. The team encourages the plant to develop the reporting of LLE to include all departments and sections.

Conclusion: Satisfactory progress to date.

6.7 USE OF OPERATING EXPERIENCE

6.7 (a) Good practice: Use of operating experience for determining plant-specific reliability indicators for probabilistic safety analysis.

The plant uses all sources of internal operating experience for determining reliability data for plant-specific probabilistic safety analysis.

Probabilistic Safety Analyses (PSA) is used as an addition to the safety evaluation based on deterministic fundamentals. In the Neckarwestheim NPP Event Analyses section (ZS section), the existing PSAs for power and no-power operation were updated and stage 2 of the PSA was added for power operation. New PSAs will be made available by the end of the year for the cross-plant events of fire and earthquakes.

The assessment indicator for each PSA is the core damage frequency. For a valuable PSA, up-to-date plant-specific reliability data must be used. This requires continuous analysis of operating experience of the components modeled in the PSA.

Neckarwestheim NPP has been recording plant-specific failure data since 1994. This involves analyzing fault reports, maintenance and test reports as well as job orders, and documenting in a database any failures of PSA-relevant components in the form of event reports. The database also includes the so-called master data (plant identification and technical features such as design and operating values) and annually updated operating reports (component lifetimes and standby times, repair, isolation and outage times, test intervals) for all components modeled in the PSA. The completeness or quality of the data collection is ensured by storing all reports relevant for the analysis in the operations management system and by a peer checking method in event assessment.

The event and operating reports for one year are sent to the central reliability and event database, to which all German nuclear power plants, as well as the Siemens/KWU plants at Borssele – NPP in the Netherlands – and Gösgen – NPP in Switzerland – supply failure data.

The benefits for the plant are:

- Incorporation of the current technical status and operational experience of the plant itself.
- Improvement of the statistical dependability of the reliability data by making use of the operational experience of similar plants.
- Meaningful PSAs for the plant itself (assessment of modifications, modification of test frequency).

7. RADIATION PROTECTION

7.1 ORGANIZATION AND FUNCTIONS

The Radiation Protection Section (RP) at Neckarwestheim Nuclear Power Plant (Neckarwestheim NPP) is part of the Surveillance Department.

The responsibilities of RP are based on regulations. The key document in this context is the Radiation Protection Ordinance (Strahlenschutzverordnung StrlSchV), which defines two functional levels: the Radiation Protection Supervisor and the Radiation Protection Officer. The function of the Radiation Protection Supervisor is performed by the Technical Director of Neckarwestheim NPP. He has appointed several staff members as Radiation Protection Officers. Each of them has clearly defined duties and areas of responsibility, which are laid down in the Radiation Protection Procedures (Strahlenschutzordnung).

The RP section has developed twenty Safety Management System (SMS) indicators for tracking and assessing performance. These indicators primarily address issues associated with their compliance with regulatory requirements and, therefore, focus on long-term considerations. However, out of these twenty (20) only ten (10) are further analyzed and trended to provide management with sufficient insights to identify and correct performance deficiencies.

ALARA principles are defined and understood. A minimization practice has been established in the radiation protection activities. Important radiation protection issues are dealt with in the regular engineer's consultations and in the meetings of the internal Safety and Security Committee (Interner Sicherheitsausschuss, ISA).

The RP section is independent of the Operational and Maintenance departments as required. The Surveillance Department head reports directly to the Technical Director. The RP budget is sufficient and covers all aspects and needs of the group.

The RP section is kept up-to-date with news and information from outside Neckarwestheim NPP through the Event Analyses Section (ZS). Experiences and incidents inside Neckarwestheim NPP are evaluated for RP relevance and possible changes to existing plant RP procedures. For example, airborne radioactivity in the containment building is caused by lifting the reactor head. A procedure was developed to cover the reactor cavity with balloon silk, which resulted in a decrease of collective effective dose and gaseous effluents. This procedure was recognized as a good practice by the team.

After any outage, a workshop on dose minimization is conducted with employees of the RP section. The workshop covers a radiological summary of the outage and addresses in particular the most striking positive/negative issues experienced by employees during outage daily routines. The lessons learned from the operators are taken into consideration for the next outage.

The RP section performance is periodically evaluated by SMS and TÜV and this is annually reported during the management review meeting.

Overall, the training and qualifications of the RP staff are adequate. The basic training for category A workers provides very general information advising the trainees to look for additional information or consult the RP staff. The proper use of the Personal Protective Equipment (PPE) is not emphasized enough through practical training.

The RP duties are well performed by qualified and committed employees. All members of Neckarwestheim NPP radiation protection staff have special radiation protection and health physics training. The majority of staff also have many years of experience in the RP area. Great emphasis is placed on continuous training and education of the personnel, including the exchange of experience with the RP staff of other plants. Special training, for example on the steam generator mock-up, is provided before the work begins to simulate the working conditions in order to minimize the time spent in high dose-rate areas and consequently minimize the individual effective dose (IED) and collective effective dose (CED).

All radiation workers in Category A are annually checked by the approved physician to ensure they meet the requirements for working in the radiation controlled area (RCA). Workers in Category B (with more strict dose limits) are checked before first entry and afterwards only on the demand of the physician according the national regulation (Radiation Protection Ordinance - StrlSchV).

7.2 RADIATION WORK CONTROL

Radiation work control at Neckarwestheim NPP is being accomplished in an effective manner that assures the overall health and safety of plant personnel. In addition to the Maintenance Procedures Manual and the modifications procedures, the electronic computerized plant management system regulates the preparation and implementation of activities (work authorization procedure), which ensures that radiation protection is integrated into the planning phase at an early stage.

Each activity performed inside the controlled area is subject to radiation protection planning based on the RP procedure. The radiation work permit (RWP) sets out personal and dose reduction measures as well as surveys (e.g. dose rate, air-borne activity or contamination). The head of RP section reviews the measures planned and authorizes the work by signature. The on-site supervisor acknowledges on the RWP that he has taken note of the radiation protection measures. Personal protective measures, dose-reducing measures and surveys are, if necessary, specified and implemented on site. All work activities in the RCA have to be carried out according to the routine radiation protection procedure or the special radiation protection procedure (in the case of a high radiation risk – IED >6 mSv or CED >25 mSv). The special radiation protection procedure is subjected to TÜV approval as well as the following report and analyses.

The layout of and the access to the RCA are in compliance with the IAEA Guidelines. Most areas are classified as clean. In the case that the dose rate could exceed 3 mSv/h, the room is classified as a no-go area and access is only permitted under RP technician surveillance. No worker can enter the no-go area alone. After issuing an RWP for the no-go area, the RP technician has to check the actual radiation situation and if required, supervises the work on site. This is considered to be a good performance.

The personal contamination monitors at the exit from the RCA are able to simultaneously detect beta and gamma contamination. The detection limit is 200 Bq for Co-60 according to the manufacturer’s data. In case of some internal contamination the worker is sent directly to the whole body counter and the dose assessment is more accurately measured.

At the boundary of the RCA there is personal contamination monitoring; however additional personal contamination monitoring are not available inside the RCA when the plant is in operation. Hand-foot Monitors are installed at the exit of the containment building only during outages.

During the review the team noticed that the radiation worker practices were not being consistently adhered to and implemented. The RP staff did not correct on the spot the deviation on staff behavior related to RP practices. A suggestion to consider improving radiation protection procedures and practices to ensure high standards of contamination control was developed by the team.

7.3. CONTROL OF OCCUPATIONAL EXPOSURE

The main objective of radiation protection at Neckarwestheim NPP is to keep the radiation exposure (individual and collective doses) of the plant personnel and the general population as low as possible in accordance with stipulations laid down in the Radiation Protection Ordinance (StrlSchV).

A major contribution toward reducing the radiation level in Neckarwestheim NPP Unit I was made in the 1990s. An extensive amount of work was undertaken to replace primary-circuit materials containing antimony and cobalt to reduce the sources of activation products. This has significantly reduced the radiation levels of the primary circuit at Neckarwestheim NPP and, eventually, has resulted in lower collective effective doses.

The plant has adopted an effective dose control system. The personal electronic dosimeters used at Neckarwestheim NPP are programmed with individual limits by the scanner at the RCA entrance with a main alarm limit and a pre-alarm limit set at 80 % of the main alarm limit. The pre-alarm must be acknowledged by the operator, so that he can leave his workplace before the main alarm is activated. In addition, an alarm limit for the dose rate is set, which is generated from the planning data of the radiological work permit as a job-related limit. Since all activities in the RCA are not only planned by work permit but also in terms of the radiation protection required, each radiation work permit includes a maximum expected dose rate for each job. If the dose rate alarm is activated during a job in the RCA, the operators and the RP technician attending to them receive an audible warning, alerting them to take appropriate action in order to minimize dose.

A well-established programme for internal contamination dose assessment is in place. All Category A workers must undergo annual checks for internal contamination at the whole body counter. Contractors are required to undergo this procedure upon arrival for check-in and before departure for check-out. In addition every person leaving the RCA is monitored with beta and gamma-sensitive portal detectors. Indirect measurements of bioassay samples to estimate committed effective doses from tritium intake are initiated in case of need. The committed effective dose assessment complies with requirements established by the regulatory authority and is consistent with ICRP-78.

Each person entering the RCA has to wear at least two dosimeters – the passive one with a monthly evaluation period (RPLD) and an electronic one with alarms (EPD) set for deep dose equivalent and dose rate. Contractor workers are required to wear their additional company dosimeter. A TLD dosimeter is required if the worker has to be in a neutron field. In special cases, extremity dosimeters are required. The electronic dosimeters are evaluated directly after leaving the RCA; all the passive dosimeters are evaluated by the official agency approved by the regulatory authority. Following the effective dose assessment from these two independent systems (RPLD and EPD) the obtained doses are compared and deviations greater than ±20% are subjected to further investigation. The radiation field in the RCA does not contain significant amounts of weakly penetrating radiation, and so measurement of deep dose equivalent is sufficient to assess worker's exposure. However, periodic tests are conducted to detect any significant changes in the radiation field. The programme for routinely monitoring exposures is well established. The contractor doses are tracked via the Radiation Protection Passport system.

7.4. RADIATION PROTECTION INSTRUMENTATION, PROTECTIVE CLOTHING, AND FACILITIES

The plant has a sufficient amount and diversity of radiation protection instrumentation to survey the RCA. The metrology of RP instrumentation is done by the plant staff and regularly reported to the regulator and confirmed by their independent experts (TÜV). The periodic testing and maintenance are the responsibility of RP technicians certified by TÜV.

Internal contamination monitoring is effective. The whole body counter detector is used for internal contamination dose assessment. All equipment is approved and annually checked by TÜV.

Gaseous and liquid effluent monitoring equipment is properly installed and functional. The responsibility for the use of the instrumentation is shared primarily between the RP and Chemistry Sections. The QA is assured by the means of cross-checking performed by the regulatory authority. Once a year, an independent analysis validation exercise with external laboratories, sometimes referred to as a 'round robin', is carried out for particle monitoring. Once every three years the Bundesamt für Strahlenschutz (BfS) conducts a "round robin" campaign (national inter-calibration tests) for the monitoring of noble gases.

The inventory of protective clothing (PC) is adequate. The PC is sorted, prior to washing, according to the type (higher contaminated overshoes are washed separately from overalls and underwear). The respiratory equipment is checked periodically and/or after each use, a tightness test is carried out. The rules specifying the protective clothing are clear; however the radiation protection procedures do not provide instruction for the proper removal of contamination control clothing. The plant is encouraged to provide clear instructions.

Laundry, storage and other RP premises are well maintained. Space is sufficient and housekeeping is adequate. The route for undressing and dressing to enter and exit the RCA is well organized. The laundry is well equipped. Adequate control of the decontamination process is evident. Clothing that is contaminated above the set threshold is separated out. The plant has effective and well maintained decontamination facilities.

7.5. RADIOACTIVE WASTE MANAGEMENT AND DISCHARGES

The programme for managing the production and discharge of gaseous, liquid and solid wastes is well managed and is capable of accurately assessing the discharges that are associated with both normal and abnormal operations.

Neckarwestheim NPP has a comprehensive concept for the treatment of low-level radioactive waste from plant operations which includes the secured paths and methods of disposal for the various waste types. Restrictions at the entrance to the controlled area are one of the first provisions for minimizing the quantity of radioactive waste. Waste and residues produced within the RCA, which are compliant with the limit values laid down in the Radiation Protection Ordinance (StrlSchV) can be removed from the RCA. In accordance to an overall plant concept for waste processing, the waste is collected at the source and subsequently sorted at Neckarwestheim NPP according to its ultimate destination. If necessary for transportation, the volume is minimized. Until its transport to external conditioning, the pretreated waste is stored on site in small containers or 200-liter drums.

In order to ensure continuous and complete tracking of radioactive waste covering all treatment, storage and transportation stages from raw waste through to the transfer/handover to a final repository of the conditioned waste containers, the IT-supported waste tracking system AVK (waste flow tracking and product control system, a nationwide system for all nuclear power plants) was introduced in Neckarwestheim NPP in 1988. AVK is a cross-plant documentation system which has been implemented as a decentralized interconnection system (NPP operators, conditioning contractors, intermediate and final repository operators) with uniform structures for all users. When radioactive raw waste is no longer subjected to operational modification it is registered with the AVK system. The system automatically assigns a unique ID number (AVK-ID) for each registration. This ensures that sidetracking, disappearance, addition to or unapproved swapping of radioactive waste is prevented and that all such manipulative actions are tracked, and that processing steps, transportation and place of storage can be identified at all times.

Effluent monitoring instruments are positioned in such a manner to effectively monitor the impact of gaseous and liquid releases at the site boundary and the surrounding environment. Fixed and portable monitoring equipment is in place and appropriate quality verifications are present. Expected activity levels laid down in the operating license are complied with. The actual detection limits are well below the limits required by the regulatory authority. Gaseous discharges are managed to minimize their impact through engineering considerations (reactor head cover) and process controls. Liquid discharges are likewise closely controlled and monitored. The liquid effluents are mainly evaporated. The objective of EnKK for 2007 is to remain below the average emissions of the last ten years.

The sampling and measuring procedures required for emission monitoring are in accordance with the national regulations. Samples are taken from various environmental mediums at defined measuring points at distances up to 10 km from the plant. The environmental monitoring laboratory is well equipped with analysis equipment necessary to prepare and measure environmental samples.

A set of RPLD detectors around the plant premises monitor the dose. Redundant RPLD detectors are provided by LUBW. Both set of dosimeters are evaluated by the same monitoring service approved by the regulatory authority. Environmental monitoring results are trended over a five year period and show a stable trend.

In addition, Neckarwestheim NPP has an off-site programme for agricultural-meteorological monitoring of the environment. The objective of this off-site monitoring programme is to preserve evidential proof with regard to possible effects of operation of the Neckarwestheim

NPP cooling towers on agricultural undertakings in the vicinity. In order to ensure reproducibility and comparability, measurements and sampling is performed and documented in accordance with a programme agreed with the regulatory authority and independent experts.

7.6. RADIATION PROTECTION SUPPORT DURING EMERGENCIES

The chapter on EPP procedures included in the Operational Manual (BHB), clearly defines responsibilities in the case of a radiological emergency. In addition, there is a special procedure detailing the responsibilities of the Surveillance Department. Resources are shared with other nuclear power plants as well as Kerntechnische Hilfsgesellschaft (KHG) to assure their continuous availability.

Radiological measuring equipment includes stationary devices, portable devices and two mobile vans containing instrumentation in adequate quantity and quality. The portable devices for the fast response are located in the auxiliary emergency center. For further measurements, the plant will use the portable devices from the unaffected unit and/or KHG. All equipment is checked regularly and back up power is available as necessary. As a service provider, KHG conducts quarterly background in-situ γ-spectroscopy measurements.

There is monthly training for radiation protection and chemistry staff to ensure that every RP department employee participates in at least two training sessions per year. In addition, there is one exercise per unit per year for personnel involved in an emergency response. Since these exercises are carried out after regular working hours, the employees not directly involved in emergency response do not participate. The emergency exercises are analyzed and the areas of improvement identified and addressed in a timely manner.

NECKARWESTHEIM NPP FOLLOW-UP SELF-ASSESSMENT

Besides one good practice the OSART Team found an issue in the area of contamination control and suggested to consider improving radiation protection training, procedures and practices. We took up this suggestion and discussed the different possibilities for further improvements in contamination control with our RP-experts. Finally we decided to implement some measures with a good benefit and expenditure relation. Some measures are already in operation, some under construction, and some in planning.

STATUS AT OSART FOLLOW-UP VISIT

One issue on contamination control was made by the OSART team and this issue was evaluated as being resolved at the time of the follow-up mission.

The plant has undertaken a number of initiatives to address this issue.

The induction training video has been totally revamped and now correctly details all the necessary checks which personnel should undertake when exiting the controlled zone.

Further training sessions have been undertaken, for plant and contractor staff, to ensure correct contamination control behaviour is practised. Inadequate staff behaviour was not observed during the follow-up plant tours. Training was also undertaken by the involved radiation protection staff. Feedback from these training sessions has been used to update the relevant procedures.

A rapid-response foot contamination monitor (Kadet) was developed by the plant staff. This monitor detects low levels (>0.5Bq/cm^2) of gamma radiation in a short (<1.5secs) counting time and was successfully used during the last plant outage. This was seen by the follow-up team as a good initiative.

A new procedure has been developed to designate and delineate contamination controlled zones.

Hand and foot monitors have been placed in strategic locations to allow personnel to monitor themselves on a more regular basis and budget plans are in place for further hand and foot monitors.

There are also budget plans in place for a centralised contamination monitoring station. This shows that the plant has become pro-active in its approach to contamination control and this initiative will aid in the identification of sources of contamination.

Plans are also in place, with a projected timescale of completion by 2009, to install a fixed contamination monitor in the truck airlock.

DETAILED RADIATION PROTECTION FINDINGS

7.1 ORGANIZATION AND FUNCTIONS

7.1 (a) Good Practice: Reduction of exposure and emission discharges during reactor pressure vessel (RPV) head opening**.**

In the past, flooding of the reactor cavity caused an increase of aerosol concentration within the containment building. In particular in the initial flooding phase of the reactor cavity, the air volume from the loop lines passes the dried top of the core support structure, carrying over radioactivity. The discharged activity led to higher ambient air activity, and thus, to higher contaminations in the entire reactor building.

The corrective action taken was a temporary coverage of the reactor cavity, which encloses the activity volume discharged in the reactor cavity. The radioactivity underneath the cover is extracted by a suction system equipped with aerosol and iodine filters. The cleaned exhaust air is discharged.

For the purpose of opening the primary circuit, the loop lines are pre-filled, and the reactor pressure vessel head is lifted. It is placed on its designated parking position, and the cover is pulled over the reactor room and utility room on a substructure. Once the reactor cavity is completely covered and the suction system is operational, the shift supervisor is informed that he may start flooding the reactor cavity.

Continuous radioactivity monitoring of ambient air in the operating rooms is used to check and to help decide whether personnel protective equipment (PPE) should be worn including, among other things, masks and respirators. Activity surveys are also conducted underneath the cover; in some areas, they show higher activity concentrations. A comparison of activity levels inside and outside the reactor cavity cover provides evidence on the effectiveness of the cover.

The benefits of this process are prevention of an increase in ambient air aerosol concentrations and associated higher contamination of the operating rooms by opening the primary circuit and flooding of the reactor cavity (maximum contamination in this area is 10 Bq/cm^2 under the travel path of the reactor pressure vessel (RPV) head), reducing the subsequent cleaning required and resulting in a reduced dose. The operators who need to be present on the site to open the primary circuit are less exposed as a result of the reduction of ambient air activity. The iodine and aerosol emissions during the first week of an outage are reduced as a result of this practice.

7.2 RADIATION WORK CONTROL

7.2 (1) Issue: Some radiation protection training, procedures and practices do not adequately ensure high standards of contamination control.

Training and Procedures.

The training and procedures for plant personnel are generally comprehensive, however, the team found some weaknesses:

– The general employee radiation safety training video incorrectly demonstrates contaminated shoe removal without using protective gloves and also demonstrates removal of a potentially contaminated overshoe with the foot suspended directly over the non-contaminated side of the boundary.

– The proper use of Personal Protective Equipment (PPE) is not enough emphasized through practical training.

– Radiation protection procedures do not provide instruction for the correct removal of contaminated clothing.

Although contamination levels in the plant are very low, the plant expectation should always maintain a high focus on the good practice of radiation workers. Incorrect behavior when leaving a potentially contaminated area was observed and tolerated by RP staff and witnessed by the team:

Personnel Behavior.

– One staff member entered a contaminated area (labeled as such) without protective gloves.

– Three staff members were observed removing the PPE in a way that was not in accordance with the training programme.

RP Staff Control.

– Except the personal contamination monitoring at the boundary of the RCA, there is no additional personal contamination monitoring available inside the radiation controlled area (RCA) when the plant is in operation. A Hand-Foot Monitor is installed at the exit of the containment building only during outages.

– Personal contamination events are not systematically recorded. The threshold of reporting is based on the decision of the RP technician on duty. For example, a person detected in the monitor as potentially contaminated is allowed to wash their hands twice to remove a slight contamination.

Equipment Control.

– Only manual radiation measurement is taken to monitor vehicles entering or leaving the plant premises. The plant does not have stationary equipment.

Incorrect contamination control behavior or inadequate reinforcement of the practices by the radiation protection staff can result in the spread of contamination.

Suggestion: The plant should consider improving radiation protection training, procedures and practices to adequately ensure high standards of contamination control.

IAEA Basis:

BSS115

1.10. Workers shall: (a) follow any applicable rules and procedures for protection and safety specified by the employer, registrant or licensee.

2.40. Records shall be maintained of the results of monitoring and verification of compliance, including records of the tests and calibrations carried out in accordance with the Standards.

NS-R-2

8.4. “All site personnel shall have individual responsibility for putting into practice the exposure control measures which are specified in the radiation protection programme. Consequently, particular emphasis shall be given to training all site personnel so that they are aware of radiological hazards and of necessary protective measures.”

NS-G-2-7

3.32. The operating organization should draw up a preventive maintenance schedule for all radiation monitoring systems. The performance of monitoring systems should be tested. Performance testing should always include calibration of the instrument and verification of the calibration facilities. These steps will ensure that doses are being assessed correctly, which in turn will enable the plant management to confirm the adequacy of controls exercised at workplaces.

3.55. “Site personnel, including contractor personnel, should be specifically trained and qualified in the use of protective clothing and special protective equipment, as appropriate. Those persons handling, issuing or decontaminating protective clothing and respiratory protective equipment should also be appropriately instructed.”

6.8. All installed radiation monitors, hand held radiation meters and dosimetry equipment should be tested and calibrated according to an authorized programme. The results of the tests should be recorded so that the testing and repair history for each instrument can be retrieved. Records of tests and calibrations are required to be maintained.

TS-R-1

541. “Each package, overpack and freight container shall bear the labels …”

Plant response/action:

The expectations for a very high standard of contamination control have been defined, detailed and implemented as follows:

We have undertaken national and international endeavours to explore the procedures for contamination control in various nuclear facilities and compared these procedures with our own processes and experiences.

The results included a redefinition of the concept for GKN's contamination protection zones and the development of standard types for the operational implementation of contamination protection. Along with uniformity, the objectives included the combination of actions working in different ways to ensure a very high level of effectiveness and in particular the simplicity with which the actions could be performed by employees.

A new type of contamination meter was also developed. Using this meter, contamination measurements of footwear and hands can be performed very rapidly and with a low detection limit directly in the field, even despite an elevated level of radiation.

All measures are being implemented in the controlled areas of GKN I and II.

The results of these investigations and the actions both planned and implemented were communicated regularly in the routine meetings of the heads of EnKK-US departments in order to ensure the feedback of operating experience between the EnKK NPPs.

Radiation-protection and health-physics induction training
In the heavily revised version of the radiation-protection and health-physics induction training (video), the issues of the correct use of protective clothing and of the correct behaviour when checking for contamination are dealt with and emphasized. The details of how to do it correctly are shown in the film, and possible human errors are underscored visually and acoustically in order to permanently impress on workforce that these measures are important and make sense. The revised version of the radiation-protection and health-physics briefing has been in use since November 2008.

Drills and exercises
Drills and exercises are employed as means of providing hands-on training to reinforce the correct use of protective clothing. In this respect, regular training measures have been conducted since April 2008 for plant and contract staff; these training measures also cover the aspect of how to behave correctly in potential contaminated areas.

These training events have as their target group both new employees and in particular employees with many years' experience in the controlled area.

The drills and exercises, part of the routine training programme of the Training section, are conducted by the Radiation Protection Officer responsible, in order to impress the importance of the subject on employees.

Radiation protection procedures
An operating procedure (BAW 210) details the sequence of steps to be observed on accessing and leaving contamination protection zones and how to use protective clothing

correctly. Experience from the evolved contamination-protection zones concept was incorporated into this operating procedure. This procedure is the basis for the measures trained in the practical drills and supports the behaviours and the correct use of protective clothing shown in the video used for the radiation-protection and health-physics induction training.

Contamination controls in the plant

Since the outages in 2008 at GKN NPP units I and II, two hands/foot monitors have been in operation continuously at the exit from each containment, GKN I and GKN II, in order to detect possible contamination.
Users receive visual instruction on the correct behaviour in the event of contamination being detected.

Currently, moreover, hands/foot monitors (2 of each) are being obtained for continuous use at the following locations:

- Exit from annulus ZB / UJB
- Nuclear auxiliary building ZC / UKA at the "hot workshop" / truck airlock

The monitors will be obtained in 2009 and are itemized in the budget plan (P 565109 and P 565809).

The concept for contamination controls in the plant also includes the provision that all contamination control monitors in the controlled area are to be networked and that contamination readings will be shown not only on the monitors in the field but also displayed online and logged at a central monitoring station at the controlled-area check desk, which is continuously staffed by specialists during normal working hours.
This enables the radiation protection and health physics staff to respond immediately and take individual (protective) action.
The networking concept will be put in place at the same time as the procurement of the hands/feet monitors.
The financial resources are itemized in the budget plan (P 565609, P 565209, P 565509).

The above-mentioned measures for contamination control and the procedures to be adopted if contamination is detected are laid down in the written operating procedures.

The members of staff of the radiation protection and health physics section receive due notification of the measures implemented and the procedures to be followed in the regular meetings and briefings for the outages. In this context, particular emphasis is laid on the importance of the exemplary nature of these persons' behaviour and the expectations of management for instances in which deviations are identified (rigorous reinforcement of radiation-protection issues).

Activity monitoring in the truck airlock UYE

The EN section is to install a permanent activity monitor for motor vehicles in the truck airlock in building UYE.
Deadline: 2nd half of 2009
The financial resources are itemized in EN's budget plan (P 2009.2342)

All in all, the experience gained in normal operation in 2008 and in the GKN I and GKN II outages demonstrates the efficacy of the concept.

IAEA Comments:

The plant has undertaken a number of initiatives to address this issue.
The induction training video has been totally revamped and now correctly details all the necessary checks which personnel should undertake when exiting the controlled zone.
Further training sessions have been undertaken, for plant and contractor staff, to ensure correct contamination control behaviour is practised. Inadequate staff behaviour was not observed during the follow-up plant tours. This training has included topics such as dose awareness, correct behaviour within the Controlled Zone and any current topics concerning radiation protection. Training was also undertaken by the involved radiation protection staff. Feedback from these training sessions has been used to update the relevant procedures.
A rapid-response foot contamination monitor (Kadet) was developed by the plant staff. This monitor detects low levels (>0.5Bq/cm2) of gamma radiation in a short (<1.5secs) counting time and was successfully used during the last plant outage.
A new procedure has been developed to designate and delineate contamination controlled zones. It also provides target values for allowable contamination on clothing.
Hand and foot monitors have been placed in strategic locations to allow personnel to monitor themselves on a more regular basis. Budget plans are in place for further hand and foot monitors.
There are also budget plans in place for a centralised contamination monitoring station. This indicates that the plant has become pro-active in its approach to contamination control and this initiative will aid in the identification of sources of contamination. These actions are over and above the original expectations of the OSART issue.
Plans are also in place, with a projected timescale of completion by 2009, to install a fixed contamination monitor in the truck airlock.

Conclusion: Issue resolved.

8. CHEMISTRY

8.1. ORGANIZATION AND FUNCTIONS

The Chemistry section at Neckarwestheim nuclear power plant (NPP) is part of the Surveillance department. The head of the department reports directly to the Technical Director. The responsibilities of the chemistry section are defined in the operating manual, the so-called “Betriebshandbuch”, Part 1-1, section 4.7.2, and these principally focus on the operation of three laboratories for chemical and radiochemical analysis. There is one active laboratory for each of the two operating units, and a non-active laboratory that serves both operating units. The active laboratory for unit I is a facility recently renovated.

In order to ensure that staff is fully informed of relevant issues from plant management, there is a series of cascading briefs, starting with a plant management meeting on a Monday morning and ending with briefs to chemistry staff by the laboratory supervisors on a Tuesday afternoon. There is good interaction between functions, with the chemistry section head representing chemistry at the daily plant meeting. The laboratory supervisors visit the main control room twice a day to perform a health check on the on-line chemistry monitoring, and produce a daily log of activities and issues for their respective laboratory, which is available to other staff.

Staff competence is assured in part by the application of the German apprenticeship model, whereby the majority of students leaving school spend around three years in vocational training before being eligible to go to further education (e.g. University) or full time employment. The chemistry section in Neckarwestheim NPP supports this programme by training a number of apprentices. A well structured programme for this training is in place. The chemistry section has also recently developed a training programme for permanent laboratory chemists, which includes a check sheet where existing competent staff, acting as trainers, sign off to confirm that a particular training activity has been completed. The team would encourage the plant to continue to improve the programme, particularly in relation to the setting of clear acceptance criteria, so that it can develop into a fully systematic approach to training.

Chemistry staff works normal working hours, except during outages when the section provides 24 hour shift cover. Out-of-hours technical advice is provided by a rotation system of two on-call chemists, one for the primary side and one for the secondary side. The duty chemists are also available to provide support in the event of a site emergency.

Chemistry section staff is friendly, professional and enjoy a good working relationship with the chemistry leaders with no evidence of barriers to open communication. The atmosphere in the laboratories and offices is positive.

In the area of chemistry control, performance indicators are used. The plant reports also the WANO chemistry performance indicator. The chemistry section has also an effective performance indicator in the area of waste discharges, together with a fuel reliability indicator.

Annual goals and objectives are set for the plant, and these are translated at department levels into goals for individual sections. These goals are well communicated within the section.

Targets for individuals are also agreed in annual appraisals, where personal development goals are also discussed.

Regular meetings are held with chemistry counterparts at Philippsburg NPP, the Company's other operating nuclear plant, and a programme is in place to improve the consistency and quality of practices between the two sites, which the team recognizes as a good performance.

8.2 CHEMISTRY CONTROL IN PLANT SYSTEMS

Operational chemistry control across the different systems is described in the Operating Procedure Manual (BHB). The standards are drawn from VGB guidelines and the BHB provides a clear statement of action levels and limits, and the actions to be taken by the operator in the event of entry into an action level condition or a limit being exceeded. The section of the BHB for primary chemistry has been recently updated to reflect the recent revision of the VGB primary circuit chemistry guidelines.

The principles of primary and secondary chemistry control are described in a chemistry handbook. This document originated as a manual from the plant manufacturer but has recently been updated. It is a valuable reference source and training guide.

For the management of laboratory chemistry data, the plant has developed a valuable database tool called UCDVMS. Chemistry control data are entered by the analyst, and if the parameter is outside the expected or required range, a warning window will appear directing the analyst to seek the approval of the data from the laboratory supervisor. The laboratory supervisor will then initiate the necessary action, for example as laid out in the BHB. The system will not accept an out-of-range result without the electronic approval of the laboratory supervisor. This approach is judged by the team to be an effective tool that supports good chemistry control.

In the primary circuit, the plant operates to a modified coordinated chemistry regime, using enriched boric acid and isotopically pure lithium-7 hydroxide. The target pH is 7.4 at 300° C and reducing conditions are maintained by hydrogen in the range 2 – 4 mg/kg. Zinc injection has recently commenced on unit I, which was supported by a programme of enhanced monitoring. This showed the release of active nuclides from the surfaces of the primary circuit. All control parameters, including boron, lithium, chloride and hydrogen, have been well maintained within the defined acceptable operating ranges. A good programme of laboratory measurements is employed to validate the results from on-line instrumentation, for example in measurements for boron.

In the secondary circuit, all volatile treatment is applied with the ammonia concentration maintained at around 10 mg/kg by the addition of hydrazine to the circuit. This approach, plus the introduction of mechanical filters to the circuit, has resulted in low feedwater iron levels, typically ~1 µg/kg. Again, control parameters have been well maintained within the defined acceptable operating ranges. Due to a recent change in operational mode from base load to load following, there have been increases in feedwater after-cation conductivity into action level condition, resulting from small transient air ingress during load changes. The plant data confirms the source of the after-cation conductivity excursions was carbon dioxide and the relevant BHB was revised in a timely manner, including with the required approval of the external agency, to permit operation under these conditions.

The plant has installed equipment to inject oxygen into the reheating steam in order to reduce the release and deposition of iron oxides, replicating a successful practice applied at Philippsburg NPP.

Shutdown monitoring is thorough and consistent with the expected standards. Activity releases during shutdowns are well monitored and trended. The chemistry section has compiled a series of detailed check sheets to assist in the management of the chemistry related outage activities and this has been put forward as a good practice. There is a short chemistry section in each outage report which summarizes the key messages from the chemistry related activities.

The quantities of iron being removed from steam generators during sludge lancing are relatively low, and the plant policy is to visually inspect steam generators in order to decide whether a further campaign of sludge lancing is required.

The chemistry section is responsible for the analysis and treatment specification for liquid waste streams. In recent years, the plant have implemented a policy of zero radioactive liquid discharges (except tritium), although it is noted that this results in an effective increase in solid active waste. Ammonia is also removed from the liquid waste stream using an ammonia destruction unit, reducing the environmental impact of the plant. This is considered by the team to be a good practice.

A coordinated flow assisted corrosion (FAC) programme is in place, in which the plant design is assessed for locations at risk, non-destructive testing (NDT) inspections are carried out, and the plant assessment revised in light of the results obtained. Where required, replacement with a high chrome steel is carried out.

8.3 CHEMICAL SURVEILLANCE PROGRAMME

A comprehensive suite of approved analysis procedures is in place and these have been formally issued through the e-Docs system. However, as a result of the chemistry computer network being separate from the plant network, a folder of the approved analysis procedures is locally maintained by the chemistry section. The standard of the analysis procedures reviewed was high.

An electronic annual analysis plan has been developed within the chemistry section which provides a good clear mechanism for identifying the analysis requirements on a day-to-day basis and for verifying that all the required analyses have taken place.

The arrangements for sample collection and labelling were found to be of a high standard. The results of analyses are stored electronically on the UCDVMS database and printed versions are routinely placed in the plant archives in order to provide the plant formal record.

The quality assurance programme is defined in document UC-FAW-030, which stipulates the requirements for the preparation and use of control charts. This document also describes the participation of the plant in analysis validation programmes with external laboratories, sometimes referred to as ‘round robin’ programmes. Neckarwestheim NPP participates in three such programmes. Control chart data is entered onto the UCDVMS system, from where control chart trends can be obtained. A review of several control charts indicated they were being used properly, including where action was taken when control chart data failed to meet the defined acceptance criteria.

Instrument calibration procedures are described in the analysis methods, and good calibration records were available when requested. Calibration methods investigated were found to be good, with appropriate statistical analysis for accuracy and limits of detection. Calibration data reviewed showed that multipoint calibrations were employed in a measurement range suitable for the intended application.

Suitable standards for chemical and radiochemical analysis were employed. The authenticity of the standard could be traced and certificates of conformance for commercial standards were available when requested. The plant policy on the acceptable shelf life of standards of different concentrations is clearly stated in UC-FAW-030 and laboratory inspections confirmed this policy was being followed.

8.4 CHEMISTRY OPERATIONAL HISTORY

The UCDVMS system has good tools for data trending, and there are a number of reporting methods employed to provide chemistry performance information to both internal and external stakeholders. These were found to focus principally on compliance with the required standards and generally addressed a relatively short timescale, for example monthly.

The chemistry section operates a small events process, and was the first section at the plant to do so. However, except for the first year of the system when forty six events were reported, the annual number of reported small events has been ten or lower. This has been followed up in the Operational Experience (OE) area.

The chemistry section maintains good links with external sources of operational experience, for example from Philippsburg NPP, the plant manufacturer, VGB and through participation in peer reviews. The plant is also a member of the chemistry programme of an organization, ANT, who employs internationally recognized experts in their respective fields to collate and review international experiences and provide recommendations on potential improvements to members.

8.5 LABORATORIES, EQUIPMENT AND INSTRUMENTS

A high standard of equipment is provided in the chemistry laboratories and duplicate equipment exists in a number of areas, especially in the active laboratory where equipment in the active laboratory of the other operating unit is available if needed. Equipment manuals were available in close proximity to the instruments.

The renewed unit I active laboratory is maintained to a high modern standard, with plenty of room and a very good level of housekeeping. The main non active laboratory room had a good level of housekeeping.

The post accident sampling system (PASS) is well maintained and includes a sample controller that can provide gas and liquid samples diluted 10x, 100x or 1000x for collection by syringe. A training exercise (and at the same time periodic test with independent experts) is carried out annually and monitored by an external agency. Regular training exercises are carried out within the chemistry section. The unit II active laboratory is used for analysis as it has lower background radiation levels in emergency situations.

The management of laboratory chemicals was generally very good, in particular the standard of storage equipment for flammable substances and poisons. However, there were a few observations of practices that could be improved and these have been incorporated into a suggestion relating to the storage and handling of hazardous substances.

Care is taken using clear labeling to ensure that laboratory chemicals which are used for training purposes are not used in analyses being carried out in support of plant operation.

8.6 QUALITY CONTROL OF OPERATIONAL CHEMICALS AND OTHER SUBSTANCES

Substances are only approved for use on site if they are pre-approved on one of two specified databases or they have been analyzed by the chemistry section. The current procedure requires that substances for use on safety equipment must be labeled with a red (suitable for exterior surfaces only) or green (suitable for interior and exterior use) sticker, but that other substances do not need to have a sticker. The procedure will shortly be updated so that all substances for use anywhere on site must receive a sticker in one of four colors according to five category definitions where the fifth category is reserved for those substances that are banned for use anywhere on the site. For substances that require testing, a sample is tested for every batch that is delivered to the plant. When new chemicals are delivered to the stores department, they are held in a locked room until clearance is provided from the chemistry section that they can be released.

The new arrangements for the quality control of operational chemicals are part of a wider implementation of a comprehensive chemical management module within the plant’s work management system. This system will hold the chemical control list of all substances on site, all the material safety data sheets, the risk assessments for use of the substances, and the hazard warning notices to be displayed in areas where the substances are present.

A number of observations were made in relation to the delivery, transfer and storage of bulk solutions of acid, caustic and hydrazine, and these have been incorporated into the suggestion relating to the storage and handling of hazardous substances. It was also noted that pipework systems for hydrazine and for an alkaline solution of a complexing agent were painted in the color designated for acid systems. It was reported that the color coding of pipework systems is being updated, and the team would encourage the plant to ensure this is completed correctly as one of the systems identified was in an area where the color coding was believed to have been completed.

NECKARWESTHEIM NPP FOLLOW-UP SELF-ASSESSMENT

The results of the OSART mission in the chemistry area focused our attention on hazardous material and have given us reasons to closely analyze and revise the operating procedures related to the handling of hazardous materials and substances. The new operational regulations for the storage and handling of hazardous substances have been communicated to a large part of our employees through training courses. The implementation of the regulations is checked during management plant tours. We also have implemented or initiated some extensive hardware modifications.

STATUS AT OSART FOLLOW-UP VISIT

In the Chemistry review area there was one suggestion developed during the 2007 OSART mission. Neckarwestheim NPP analyzed the OSART issue and used a systematic approach to resolve the suggestion and associated encouragements. A comprehensive action plan was developed and implemented. The plant is using a powerful central database to store information on all chemicals, auxiliaries and consumable materials. The database contains all safety datasheets and necessary information from the manufacturers. In addition operating procedures for handling these substances are part of the database. The procedures contain all necessary safety precautions and are used for the training and retraining of the staff and are posted in the corresponding rooms of the plant, where a particular substance is used. The appropriate storage and labeling of hazardous substances was confirmed during comprehensive plant tours.

The plant has revised relevant procedures for handling hazardous substances. The quality assurance and responsibilities of managers and staff have been integrated into the procedures.

The plant conducted a number of training activities to familiarize the staff and contractors regarding the hazardous substances management system. Finally the plant has implemented two hardware modifications to resolve the concern of the OSART issue.

The team considered the Chemistry issue as being resolved.

DETAILED CHEMISTRY FINDINGS

8.2. CHEMICAL SURVEILLANCE PROGRAMME

8.2 (a) Good Practice: The use of formalized, detailed and signed-off check sheets for the preparation and implementation of all chemistry related outage activities is an effective tool for managing increased workloads during outages.

The Chemistry section has a detailed checklist for chemical monitoring of plant shutdown and start-up. The checklist covers both the primary and the secondary loops and is broken down into a series of check sheets which cover the following time periods relating to the outage steps:

- Preparatory actions and measurements taken prior to the outage, for example including: checking the condition of the mixed bed filters, checking the levels in the concentrate tanks, operation of the coolant degasification system, stopping zinc injection.
- The measurement programme running from start-up of the degasification system to the time that the Chemistry section switches into 24 hour cover.
- The measurement programme running from the start of chemistry shift covers in the laboratory until clearance is received in order to open the reactor pressure vessel head. This period includes hideout return measurements.
- The measurement programme runs from clearance to open the reactor pressure vessel head to pond flooding including preparatory work for sipping.
- The measurement programme runs from flooding to start-up including all measurements needed for compliance with the safety specifications.
- The measurement programme runs during the period of the outage when oxygen is removed from the circuit.
- The measurement programme runs after clearance to reheat the primary circuit to operational levels including start-up of the cleaning filter systems.
- The measurement programme and the close-out activities during the first two days of operation after full load conditions have been achieved.

The checklist contains useful additional information, for example measuring parameters, measurement frequency, limits, waiting periods that need to be met, reference to relevant documents, procedures and regulations, and explanatory background information. The chemistry staff on duty signs off each action after completion. After the outage, the check sheets are retained as formal records from the outage within the Chemistry section for reference and in order to ensure lessons learnt are retained in the preparations for future outages.

This approach ensures that all the required actions are taken and that activities carried out are properly communicated among staff.

8.2 (b) Good Practice: The use of an ammonia destruction unit on liquid waste provides a significant benefit in reducing the environmental impact of the plant.

The secondary circuits of the two pressurized water reactors (PWR) of Neckarwestheim NPP unit I and II operate on high ammonia chemistry. Ammonia is removed from these circuits by the steam generator blowdown ion exchange resins, which operate in the hydrogen form. The ammonia enters the waste stream each time the steam generator blowdown ion exchange resins are regenerated. The purpose of the ammonia destruction unit, which was not part of the original plant design, is to remove ammonia from the waste water stream prior to discharge into the river.

The ammonia destruction unit comprises a two part stripping column, a chemical reactor, a fan, an air reheater, two heat exchangers and two feed pumps. The strippers remove the ammonia from the waste water, where it is heated in air to about 300°C and the ammonia is converted into nitrogen and water. The process reduces ammonia concentrations from around 1400 ppm to less than 12 ppm.

The system runs for around seven days in feedback mode with one of the collection tanks containing the waste liquid to be treated. The water from the stripping column is fed back to this collection tank to effectively lower the ammonia load of the collection tank. After about seven days, the ammonia concentration in the collection tank is about 10 ppm, and the waste water is then processed for discharge.

This unit provides a significant reduction in the environmental impact of the plant, as ammonia can have an adverse impact on natural waters.

8.6. QUALITY CONTROL OF OPERATIONAL CHEMICALS AND OTHER SUBSTANCES

8.6 (1) Issue: The expectations regarding the storage and handling of hazardous substances in workplace areas across the site are not fully developed and implemented.

Generally, hazardous chemicals are well respected and looked after at Neckarwestheim NPP, and a good electronic system for overseeing the management of hazardous substances is in the latter stages of deployment. However, in workplace areas, a number of deficiencies were observed:

- The chemical store cabinet clearly marked for oxidizers in the laboratory chemistry storeroom 3ZL 0123 contained flammable substances together with oxidizing substances.
- Chemical hazard notice for hydrazine in area ZF0113 was positioned in a corner where it was not likely to be seen and chemical hazard notice for hydrazine in area ZF0225 was located in a position where you need to climb up next to the concentrated hydrazine vessel to read it.
- The majority of the chemical hazard notices around the site have not been updated since 2001. The hydrazine chemical hazard notices relevant to area ZF0113 have been updated but the notices on the plant have not been changed.
- Acids and alkalis are stored in the non-active laboratory 4UYA 07-030 in cupboards that do not have hazard warning notices on the doors. In the laboratory areas, acids and alkalis were stored together.
- The container for the storage of oil based waste in area 8ZL had no external signs to describe the purpose of the container or the hazardous materials contained within.
- The bunding for the bulk storage tanks for hydrochloric acid and caustic, room ZG0101 is not segregated.
- A trolley containing a collection of non-segregated hazardous materials for materials compatibility analysis was left in the office adjacent to the non-active laboratory.
- Connections for the transfer of hydrochloric acid and caustic from tankers to the bulk containers in the water treatment plant are of exact similar design and immediately adjacent which could increase the risk of flash manipulation.

The inadequate storage and handling of hazardous substances can increase the potential for personnel injury and enhance the risks to plant and personnel posed by fire and other incidents.

Suggestion: Consideration should be given to fully develop and implement expectations regarding the storage and handling of hazardous substances in workplace areas across the site.

IAEA Basis:

Safety Series SS-50-C-SG-Q13

403. Chemistry and radiochemistry work normally consists of ensuring the proper handling, storage, use and disposal of bulk chemicals, spent resins, laboratory chemicals, corrosive agents and cleaning agents.

Plant response/action:

Technical aids:
In the intervening period, a comprehensive hazardous-substance management system has been introduced across EnKK. The data of all chemicals, auxiliaries and consumables used at the plants are registered centrally in the operational computer network. The database contains all safety data sheets, safety proposals for handling these substances, and the "Operating Procedures in Accordance with the Hazardous Substances Ordinance". These operating procedures are used for the initial and refresher training of employees by each section that uses the hazardous substances. In addition, these operating procedures are posted in the corresponding parts of the plant. By means of this system it is now possible to use the computer system to print out in incoming goods store, in the workshops and in the chemistry laboratory the identification labels necessary for the containers used in the plant.

Set of operating procedures:
The set of operating procedures for handling hazardous substances has been revised. Stipulations from quality assurance and various individual rules have been integrated into operating procedure BAW-069 "Requirements for auxiliaries and consumables".

Responsibilities and operational processes are now described in greater detail in operating procedure BAW-045 "Hazardous materials and water-endangering substances, handling of operational chemicals". Conceptual, cross-site requirements such as EnKK's corporate implementation of the storage concept set out by the German Chemical Industry Association (Verband der Chemischen Industrie, VCI), which also includes the rules for storage of small-capacity containers, are now being integrated into the EnKK Environmental Management Manual.

Stipulations for labelling equipment in accordance with the ASR A1.3 "Identification for Safety and Health Protection" (Sicherheits- und Gesundheitsschutzkennzeichnung), which is part of the "Technical Rules for Workplaces" (Technische Regeln für Arbeitsstätten) are also in the process of being integrated into EnKK's Environmental Management Manual.

The EnKK environmental management system earned DIN ISO 14001 certification in November 2007. The first follow-up audit was completed successfully at GKN in October 2008.

Employee training:
In training events, each several hours in duration, a large proportion of all the members of technical staff at the site has now received training in the EnKK hazardous-substances

management system. These training events were conducted primarily by the head of the Surveillance department.

Controls:
Checking compliance with the set of plant procedures, also as regards handling hazardous substances, is a duty that falls within the remit of management. Consequently, the check for missing or illegible identification labels on hazardous-substance containers, the check for missing or illegible signs for room areas for the handling of hazardous substances and for the storage of hazardous substances and the check to prevent the storage of hazardous-substance containers at locations not intended for this purpose have been included as to-do items in the checklist for the housekeeping rounds undertaken by managers.

Modification of hardware:
The transfer station for acids and alkalis at the building of the demineralization plant has been modified and fitted with two doors with different locks, so that the possibility of incorrect filling of the chemical tanks is now excluded.

The bunding for hydrochloric acid and sodium hydroxide in building ZH0101 has been divided in a very extensive complicated manner. In addition to the construction of a separating wall, enlarging the volume of the bundings by higher bordering and replacement of the complete coating, main parts of the piping had to be rebuilt and new chemical pumps and an additional leakage detection system were installed.xxx

IAEA Comments:

Neckarwestheim NPP analyzed the OSART issue and used a systematic approach to resolve the suggestion and associated encouragements. A comprehensive action plan was developed and covered five main areas:

1. Powerful database
2. Revision of operating procedures
3. Staff training and retraining
4. Checking compliance
5. Hardware modifications

The plant is using a powerful central database to store information on all chemicals, auxiliaries and consumable materials. The database contains all safety datasheets and necessary information from the manufacturers. In addition operating procedures for handling these substances are part of the database. The procedures contain all necessary safety precautions and are used for the training and retraining of the staff and are posted in the corresponding rooms of the plant, where a particular substance is used. The users can print appropriate labels for each particular substance directly from the database. The appropriate storage and labeling of hazardous substances was confirmed during comprehensive plant tours.
The plant has revised relevant procedures for handling hazardous substances. The quality assurance and responsibilities of managers and the staff have been integrated into the procedures.
The plant conducted many training activities to familiarize the staff and contractors about hazardous substances management system. In 2008, 20 training sessions consisting

of 1536 hours for 264 employees and 140 hours for contractors have been performed. These training sessions are continuing in 2009.
The plant recognized the importance of checking the compliance with new hazardous substances management requirements. These items are included into regular management walk downs.
Finally the plant has implemented two hardware modifications to resolve the concern of the OSART issue. The transfer station for hydrochloric acid and caustic from the tankers to the bulk containers in the water treatment plant has been appropriately modified. In addition the plant has implemented a comprehensive physical segregation of the bunding for the bulk storage tanks for hydrochloric acid and caustic in the building ZG0101. This was complicated and comprehensive work completed successfully recently. There are good material conditions and housekeeping in the water treatment station.

Conclusion: Issue resolved.

9. EMERGENCY PLANNING AND PREPAREDNESS

9.1. EMERGENCY PROGRAMME

The management of nuclear and radiological emergencies is regulated, together with other types of emergencies, by the State Act related to these types of events. This act delineates and assigns the responsibilities among the different bodies involved. The technical and scientific basis for emergency management is a federal guideline issued in 1999, which is followed by the plant.

The responsibility for protecting the public residing in the vicinity of the power plant is divided between the federal and state level civil defense forces in such a way that the state level forces are responsible for administrative and organizational stipulations and for implementing protective actions around the plant. The area surrounding the power plant is further divided into a central zone (about 2 - 2.5 km radius), a middle zone (of 10 km radius), and an outside zone. Twelve sectors are defined in the middle and outside zones.

The emergency preparedness and planning activity is managed by the operations support section under the direct supervision of the plant manager of unit I. This section is additionally responsible for elaborating operating procedures, system isolations and for coordinating outages.

The radiological emergency plans of the off-site organizations are consistent, the scope of authorizations are properly specified and followed for the three defined phases of a radiological emergency (release, cloud phase, ground phase); overlapping responsibilities do not exist in the system. Sufficient human and equipment resources are available for conducting an emergency response, both on-site and off-site.

The situation report including the technological and radiological parameters of the plant are not reviewed by the off-site organizations prior to their approval. The latest approval of a modification to the emergency response organization required 14 months to complete.

The on-site emergency response organization consists of about eighty positions, for which about two hundred and fifty persons are trained and exercised; the composition of the organization is very stable. Emergency plan and the associated procedures for emergency response and technical mitigating actions, with the exception of precautionary urgent protective actions and transition from emergency to long term recovery operations, are properly developed. One type of procedure describes the tasks to be conducted during an emergency, while the other type of procedure describes the tasks of the various task-force units. The emergency operating and response procedures are under the general quality control programme of the plant.

The transition from normal to emergency operation is very smooth. The plant considers the emergency operation as an extension of the normal operation. The managers are involved in the emergency organization, the hierarchy remains valid; each person is responsible for the same activity as during normal operation. Through training conducted on the simulator and through emergency response exercises, the emergency procedures are under continuous review by the management.

9.2. RESPONSE FUNCTIONS

A three-level classification system is applied. The Shift Supervisor, by comparison of pre-defined criteria to measurable parameters, decides which emergency level (information stage, pre-alarm, alarm) is reached by the technological and radiological situation. The emergency classification is based on a recommendation issued jointly by the German Federal Reactor Safety Commission and the German Federal Radiation Protection Commission in 2004.

The alarm process made on the basis of the emergency classification initiates the setup of the plant's emergency response organization. The management team of the emergency response organization is responsible for supporting the Shift Supervisor on shift by continuously assessing the state of the plant and giving advice on the application of emergency operating procedures and taking decisions on the implementation of potential severe accident management measures. The management team takes decisions on protective actions to be implemented on site. The different task force units of the emergency response organization are responsible for executing the decisions taken by the management team.

In accordance with the relevant act, the NPP is responsible for classifying the emergency in case of a nuclear or radiological emergency, alerting the off-site organizations, mitigating the consequences of the accident from a technical point of view, implementing protective actions on the site and conducting environmental measurements in the 2.5 km zone, in the 10 km sector most affected by the current radiological situation, and in the two adjoining 10 km sectors. After receipt of the alert from the NPP, the regulator at state level sets up its crisis team, starts to diagnose and forecast the technological and radiological situation, and develops proposals for protective actions for the public. These proposed actions are then sent to the regional disaster management organization, where the decision on the protective actions to be implemented is taken, based on the proposal and the available resources. The primary responsibility for the implementation of the protective actions is laid on the local civil defense forces. In order to support the response activity of the plant, an independent private organization was founded by nuclear companies in Germany. The organization possesses suitable capabilities and equipment for conducting environmental measurements and implementing supporting measures in the plant under harsh environmental conditions, and for decontaminating persons and vehicles. The nearby nuclear power plants are also available to give support including the environmental measurement activities of the plant.

Within the last five years, a public information brochure providing information on protective actions was distributed only once in the 10 km zone around the plant. It was not distributed to hotels or companies with workers coming from neither outside nor to people who moved to the area after the brochure had been distributed. The team encourages the plant to work with the regulator who is in charge of distributing the information to improve this situation.

The personnel of the plant's fire fighting organization are well trained and committed; all necessary equipment is available on the site. A minimum of nine firefighters are always available on the shift. The firefighters are well exercised for mustering personnel in, and evacuating from the controlled area. More explanation could be found in OPS area chapter 3.6.

Assembly points are well indicated and the personnel are trained for building evacuation. The route to the closest muster point is indicated in every office next to the door. Nevertheless, the employees and visitors in the administrative building located outside the security controlled area but inside the fence are not necessarily be registered. If an evacuation of the site is required, the personnel responsible for implementing the evacuation shall conduct a comprehensive search, which may result in their undue exposure. The team encourages the plant to improve the established procedure, and test it to avoid any delay in locating personnel who could be injured somewhere in the administrative building.

Regarding the initial phase of a radiological emergency when a release takes place within a short time after the accident, the team recognized weaknesses in the implementation of on-site urgent protective actions; therefore the team developed a suggestion in this area.

9.3 EMERGENCY PLANS AND ORGANIZATION

The emergency response organization of the plant consists of the management team led by the plant manager of the affected unit, eight task force units subordinate to the member of the management team concerned, the fire brigade and the first aid team. If the situation requires, the emergency response team can be completed by calling on additional personnel. At least three persons are trained for a given position, therefore the long term operation of the emergency response organization could be ensured. However, this exceptional situation has not been drilled yet, since the emergency exercises last only three or four hours and so no lessons learned could be learnt from.

Both, the on-site and off-site emergency response plans, are based on a currently valid recommendation that was issued by the Federal Government in 1999. The on-site emergency organization makes diagnosis and forecasts, but since the plant is responsible for response measures within the fence, the emphasis during the analysis will be on a technical assessment of the plant's state. The criteria for implementing urgent protective actions on site are based on actions levels.

The agreements with off-site technical support organizations (i.e. AREVA and KHG) are based on solid contracts. Environmental monitoring is made by the plant radiation protection team and by the supporting organization (KHG). The notification of off-site organizations is timely, however, according to the national regulation the plant does not recommend any urgent protective actions to off-site response organizations.

9.4. EMERGENCY PROCEDURES

Emergency procedures cover the technical mitigation and response activities. The emergency operating procedures are well elaborated and validated. The scope of the emergency operating procedures covers accidents beyond the design basis as well. In order to facilitate the implementation of the emergency operating procedures a color coded decision tree system was developed. The emergency operating and response procedures are well organized and can easily be followed.

The emergency response manual and the related procedures have an approval system. The regulatory body approves only the table of content and the emergency organization. The emergency operating procedures are reviewed by an external quality control organization (TÜV). The situation reports within the emergency response procedures are internally released by the plant without any external review. The modification of emergency procedures is based on needs.

The number of personnel involved in the emergency response organization and the level of emergency operating and response activities depend on the emergency class; a gradual approach was established by the plant. The team recognized that emergency arrangements established at the plant (i.e. emergency response facilities and emergency equipment, exercise practice and the classification procedure) are not in full compliance with the IAEA standards, therefore the team developed a suggestion in this area.

9.5. EMERGENCY RESPONSE FACILITIES

The rooms used for conducting an emergency response are used for meetings during normal operation. The emergency response centre is equipped with various communication devices: several desk top telephone units and fax machines, cell phones and radio devices are in stand-by. The rooms are also equipped with computers. Updated copies of operating and response procedures are available. All technological parameters can be accessed by the authorized users through the intranet of the plant. Two additional schemes collecting the most important measured data are also available. An external alternative emergency response centre is also available outside the plant boundary close to the plant.

A medical doctor, two (2) permanent rescue assistants and two (2) practice assistants are available at the plant. They are well trained. Their ability and the equipment (including 2 ambulances and well equipped examination rooms) put at their disposal ensure their applicability for handling any industrial or radiological event. If any person receives serious radiation exposure, the treatment can be handled by two specialized medical institutes, with which the plant has contracts. In addition to the dedicated medical staff, about 60 employees obtain periodic paramedic training (20 hours per year) and another 100 employees are trained (at least 4 hours per year) so that they will be able to provide first aid. The plant puts emphasis on building confidence and maintaining good relations with the nearby hospitals.

9.6. EMERGENCY EQUIPMENT AND RESOURCES

Cabinets containing fire-protection and first aid equipment are located at strategic points from a fire protection point of view. Emergency equipment is stored within the containment in an emergency cabinet; however, it only serves as additional equipment for the radiation protection personnel. Another cabinet of this type is located in the auxiliary emergency centre. Breathing devices for firefighters are stored in various locations within the plant. Smoke masks are located in accordance with the effective firefighting regulations. Hundreds of breathing devices that may be used in a radiological emergency are stored in the controlled area of the unit.

The fire trucks and firefighting equipment are located in various strategically important points of the plant. This good performance ensures that no environmental conditions or industrial events can impair the firefighting activity. The firefighters can reach any point inside the plant within ten minutes of the alert sounding. Drills have proved the effectiveness of this organization.

Two vehicles are at the disposal of the plant for monitoring the environment outside the fence. Additional capability is ensured by contracted off-site organizations or plants within one hour of the alert being declared. The monitoring cars are well equipped. The plant has adequate measuring capability for analyzing the environmental samples. In accordance with the international best practice the cars are equipped with dose rate measuring instruments and communication devices.

The meteorological parameters required for assessing the radiological consequences are measured by a sophisticated system called SODAR, but traditional wind speed and direction, and precipitation measuring devices are also available as a back-up. The software used for making forecasts relating to the environmental consequences is fast, and it is able to provide the information required to support decision makers.

9.7. TRAINING, DRILLS AND EXERCISES

The basic training for non-emergency workers, contractors and visitors does not fully cover emergency protection procedures. The same alert signals are used and the workers shall follow the same procedure as in the case of a fire. The knowledge of alert signals is a requirement for entering the site. Everyone is required to pass a short exam.

A comprehensive training programme has been developed and implemented at the plant. Every professional working at the plant must go through an initial training, followed by refresher training carried out on a three-yearly basis. The training for emergency actions and procedures is organized by the plant's training department. The training department is responsible for selecting qualified and experienced lecturers for training. The initial training for emergency actions, as part of the general training programme for those who will be members of the emergency response organization, includes simulator and field drills. These exercises have to be attended by every member of the emergency response organization prior to becoming a permanent member of the organization. Each of the members shall furthermore participate in an emergency response exercise. A minimum of three persons are trained and exercised for each position in the emergency organization. Additional qualification criteria are not established for emergency workers, since the personnel will do the same job as during normal operation. The members of task force units are designated by the head of departments, based on their ability and skills shown during normal operation.

The plant annually organizes two exercises involving the entire emergency response organization. Two additional drills for the radiological task force unit, six fire alert exercises for the plant's firefighters (two out of six with external firefighters) and three drills for the evacuation of an office building are conducted. The plant's technical information system, which provides data for the main safety parameter displays used by the emergency response organization, may be linked to the simulator in Essen. It makes the exercise conducted more realistic and beyond design basis scenarios may also be used as the basis for an exercise. The availability of personnel involved in the emergency response organization is checked by periodical exercises. The evaluation of these exercises shows an almost 100% availability of the personnel in a timely manner.

The plant level emergency exercises involve all emergency personnel. Most exercise scenarios are developed on the simulator. Evaluation reports are prepared after each exercise, which identifies the areas for improvement. The identified areas for improvement are considered in a timely manner, in such a way that a systematic feedback is applied. The team encourages the plant to develop integrated scenarios, during which all response functions may be exercised.

9.8. QUALITY ASSURANCE

The quality management programme of the plant covers all emergency procedures, maintenance of the equipment, the communication systems and calibration of instruments. In accordance with the requirements of the quality control system of the plant, the emergency response plan and the emergency operating procedures are reviewed every six months to ensure their completeness, correctness and appropriateness.

The maintenance and repair of emergency response tools and equipment is made by the organization responsible for their use. The radiation measuring instruments are regularly calibrated.

The doses received by the emergency workers are recorded in accordance with the international radiation protection standards.

NECKARWESTHEIM NPP FOLLOW-UP SELF-ASSESSMENT

The findings of the OSART team with regard to emergency preparedness were a reason for us to once again review in-depth the IAEA requirements, the plant's design principles, and the applicable German legislation. In this context we have also taken into account international standards, exploring the policy, procedures and technical provisions for emergency preparedness and response adopted in other plants. In addition, an exchange of experience with other German nuclear power plant operators regarding this OSART issue was conducted in the pertinent German committees. The actions derived by GKN as the outcome of these endeavours extend from the modification of procedures, the training of employees and the undertaking of drills and exercises through to extensive technical measures and building projects.

STATUS AT OSART FOLLOW-UP VISIT

During the OSART mission, two suggestions were made. One of the issues was reviewed and evaluated as being resolved at the time of the follow-up mission, while the other issue was reviewed and evaluated as having satisfactory progress to date.

To cover events with a very low probability that could lead to the release of radioactivity the plant has added a new section to the Emergency Procedure Manual. The new section provides guidance and rules for operational intervention levels with general measures as well as radiation protection and dosimetry measures.

The plant has maintained the general emergency signal for evacuation of the plant in case of a radioactivity release. The signal is combined with information over the loudspeaker system. However a new alarm level has been introduced in cases when there is a risk of a radioactive release. The announcements over the loudspeaker for the general evacuation alarm have been segregated in escalating levels, depending on the prognosis for the radiation level. Different personnel categories are ordered to evacuate depending on the level. This system is rather complex and the team encourages the plant to review the categorization and, at the same time, reconsider their position to have the assembly point inside a building instead of outdoors. The team considers this as satisfactory progress to date.

A comprehensive online dose-rate measurement system has been installed and the system provides a good overview of the radiological situation around the site should an radiological accident occur.

The plant has relocated the emergency response staff (ESK) to rooms in the vicinity of the main control room of unit 2. The meeting room for the ESK and adjacent rooms forms an emergency centre equipped with sufficient supporting aids. The functionally of the centre was verified during an emergency response drill. The team considers this as resolved.

DETAILED EMERGENCY PLANNING AND PREPAREDNESS FINDINGS

9.2. RESPONSE FUNCTIONS

9.2 (1) Issue: The plant is not fully prepared for implementing precautionary urgent protective actions on-site during a radiological emergency.

Due to the design of the German plants, a prompt release of radioactivity following an accident is calculated to have a low probability of occurrence (9.6 10^{-10}/y as declared by the plant in the periodic safety analysis report). The team checked the technical document dealing with emergency planning and preparedness organization. The team took that information into consideration; however the team suggests that the plant can be prepared for managing the consequences of even these low probability events.

Further preparations for implementing precautionary urgent protective actions on-site during a radiological emergency are needed. The team found that:

- The threat assessment forming the basis of emergency response made by the plant is not fully in accordance with the practice described in the IAEA safety standards. It does not cover the emergencies with very low probability.
- The plant has no specific emergency alert signal for radiological emergencies; the general emergency signals are used for different types of emergencies, however the loudspeaker system is used for informing the personnel about the type of the emergency.
- Operational intervention levels used as a basis for prompt implementation of urgent protective actions on site are not developed by the plant.
- If an evacuation is ordered, the personnel should go to assembly points outside the building (as in the case of fire) and then wait for further instructions. Consequently, in the event of a prompt release, personnel would be subjected to undue exposure.

Without establishment of precautionary urgent protective actions, the risk of severe deterministic health effects cannot be reduced substantially on-site before a release of radioactive materials occurs or shortly after it begins.

Suggestion: The plant should consider being more prepared in the implementation of precautionary urgent protective actions on-site in the case of a radiological emergency.

IAEA Basis:

GS-R-2

3.15. The full range of postulated events shall be considered in the threat assessment.

3.16. Operators, the national coordinating authority and other appropriate organizations shall periodically conduct a review…This review shall be undertaken periodically to take into account any changes to the threats within the State and beyond its borders, and the experience and lessons from research, operating experience and emergency exercises.

4.38. Arrangements shall be made to initiate a prompt search and to issue a warning to the public in the event of a dangerous source being lost or illicitly removed and possibly being in the public domain.

4.51. The operator of a facility in threat category I, II or III shall make arrangements to ensure the safety of all persons on the site in the event of a nuclear or radiological emergency. This shall include arrangements: … to take appropriate actions immediately upon notification of an emergency; … to take urgent protective action…

4.82. All practicable steps shall be taken to provide the public with useful, timely, truthful, consistent and appropriate information throughout a nuclear or radiological emergency.

5.33 …These (exercise) programmes shall include the participation in some exercises of as many as possible of the organizations concerned…

5.34. The staff responsible for critical response functions for a facility in threat category I, II or III shall participate in a training exercise or drill at least once every year. For facilities, practices or jurisdictions in threat category IV or V the staff responsible for critical response functions shall participate in training exercises or drills on an appropriate schedule.

5.35. The officials off the site responsible for making decisions on protective actions for the population within the precautionary action zone and/or the urgent protective action planning zone shall be trained in the strategy for protective action and shall regularly participate in exercises.

5.37. The operator of a facility, practice or source in threat category I, II, III or IV and the off-site response organizations shall establish a quality assurance programme, in accordance with international standards, to ensure a high degree of availability and reliability of all the supplies, equipment, communication systems and facilities necessary to perform the functions specified in Section 4 in an emergency. This programme shall include arrangements for inventories, re-supply, tests and calibrations, made to ensure that these items and facilities are continuously available and functional for use in an emergency. Arrangements shall be made to maintain, review and update emergency plans, procedures and other arrangements and to incorporate lessons learned from research, operating experience (such as the response to emergencies) and emergency drills and exercises.

NS-R-2

2.37. The emergency plan shall be tested in an exercise before the commencement of operation. There shall thereafter at suitable intervals be exercises of the emergency plan, some of which shall be witnessed by the regulatory body. Some of these exercises shall be integrated and shall include the participation of as many as possible of the organizations concerned. The plans shall be subject to review and updating in the light of experience gained.

Plant response/action:

- Low probability events

  In response to the suggestions of the OSART team, the database available in the power plant was again subjected to verification. As the results obtained from the probabilistic safety analyses (PSA) - called for on a recurring basis by the German safety code - show, an early failure of the containment is evaluated quantitatively with a probability of 9.6 $x10^{-10}$/y. In accordance with the results, several possibilities for improvement were identified in the past and implemented with retrofits as -engineered safety measures in the plant. In addition, GKN unit I is the first plant in Germany to undertake the compilation of mitigatory emergency measures (SAMG). On account of its scope, particularly the compilation of the database and the computations involved, this project is still in progress. The project is scheduled for completion by the end of 2009.

  To protect staff in the event of a prompt release of activity to the environment, emergency actions with intervention thresholds have been compiled, tested in emergency response drills, and incorporated into the Emergency Procedures Manual. These intervention thresholds describe immediate protective action for persons in the event of an on-site activity release; these actions have to be initiated as response depending on the on-site local dose rate either measured or anticipated.

- Special alarm signal

  The alarm signals in the power plant were put in place in accordance with the German regulations (KTA code). If it becomes necessary to evacuate the plant, the appropriate alarm signal (evacuation alarm) is used along with a verbal alert broadcast on the loudspeaker system (“Evacuate entire Plant!” ("Räumung der Gesamtanlage"). This is the practice adopted in many German plants. In response to the OSART suggestion in GKN unit I this issue was discussed in the national committees for emergency preparedness and response in which the German plant operators are members. As a result, GKN has expanded the existing alarms. The expanded alarms now include the required alarming measures that will have to be triggered for the protection of the staff in case of events with a rapid release of radioactivity into the environment.

  As preparatory protective action for persons on the power-plant site in the event of an activity release, on October 01, 2008 a drill was held during normal working hours in which the entire plant was evacuated with the exception of the shift personnel, the site-security personnel, the members of the crisis-management team and the observers of the drill. The alarm described above was used for the evacuation drill. In the framework of the full-scale emergency preparedness and response drill/civil defense drill from February 05 to 07, 2009, in which participated all the organizations (civil authorities, the utility company, the power plant) involved in emergency preparedness and response, another complete evacuation of the same scope as that detailed above was drilled on February 06, 2009. Both plant evacuations were successful.

- Operational intervention thresholds

  Measures corresponding to the intervention thresholds have been defined to form the basis for the immediate implementation of urgent and immediate emergency response action on site for scenarios with prompt activity release. The descriptions of the actions thus defined have been incorporated into the Emergency Procedures Manual (see also preceding item).

- Evacuation concept

  The evacuation concept has been revised to make due provision for cases in which it becomes necessary to evacuate the entire plant on account of a sudden activity release. In future, in accordance with the stipulations in the above-mentioned new chapter of the Emergency Procedures Manual, immediate measures will be initiated that lead up to complete evacuation of the plant through escalation stages that depend on the severity of the release.

All in all, the OSART team's results concerning emergency planning and preparedness have given us grounds to carefully scrutinize the design basis of our plant and the pertinent German codes of law and reflect them against the IAEA requirements in this context. We also discussed these issues in the national bodies in which the German utilities are members. The actions we have taken are well suited to address the issues identified by the OSART team.

IAEA Comments:

To cover events with a very low probability that could lead to the release of radioactivity the plant has added a new section to the Emergency Procedures Manual (Notfallhandbuch). The new section is entitled "Radioactivity protection measures due to event-related release of radioactive substances outside of the controlled area". The new section provides guidance and rules for operational intervention levels with general measures as well as radiation protection and dosimetry measures.

The plant has maintained the general emergency signal for evacuation of the plant in case of a radioactivity release. The general emergency signal is, as before, combined with information over the loudspeaker system. However a new alarm level (level 0) has been introduced in cases when there is a risk for radioactive releases. The new alarm requires the staff to stay inside buildings and close doors and windows.
The announcements over the loudspeaker for the general evacuation alarm have been segregated in four escalating levels (1-4), depending on the prognosis for the radiation level. Different personnel categories are ordered to evacuate depending on the level. This system is rather complex and it will impose difficulties for the plant in assuring that all personnel belonging to a certain category have transported themselves to the designated assembly points or left the plant when only a partial evacuation is ordered (levels 1 and 2). A full scope evacuation (level 3 and 4) is easier to supervise which the successful full scope drills which were performed in October 2008 and February 2009 proves. The plant has not made any significant changes as regards the assembly points. These are still located outdoors but at two opposite locations.
The plant have implemented training for all personnel as regards the radiation protection alarms, the evacuation scheme as well as other responses to the emergency (see issue 9.4 (1)). The training is today given separately from the radiation protection instruction video, but will in the near future be included in the film.

During the follow-up visit the complexity of the new four level evacuation system was discussed and the team encourages the plant to look over the categorization of people to be evacuated at the different intervention levels as well as the number and location of the assembly points. Simplified categorization and an increased number of indoor assembly points would facilitate the supervision and control of a partial evacuation.

Conclusion: Satisfactory progress to date.

9.4. EMERGENCY PROCEDURES

9.4 (1) Issue: The infrastructure in the field of emergency preparedness and response is not consistent.

The plant's emergency response staff is trained and committed, however the infrastructure in the field of emergency preparedness and response are not fully implemented at the plant.

- The plant provides pencil detectors to the personnel of those off-site organizations (i.e. firefighters, police and medical services) that enter the site in the case of an emergency. The pencil detectors are not suitable for alerting when the pre-defined turn back dose is reached.
- The emergency response procedures do not cover the arrangements for transition from emergency phase to routine long term recovery operations.
- Not all employees are trained for emergency alerting and protecting procedures.
- On-line dose-rate measuring stations are not installed on-site. Therefore personnel must measure the dose-rate manually; this could result in unnecessary exposure for those conducting the measurement within the fence.
- The rooms primarily used by the plant's emergency response staff are not protected against radiation. Fresh air and emergency power supply are not ensured. The rooms are not suitable for fulfilling their intended task after release into the environment.

Without full implementation of infrastructure to support the effectiveness of emergency response activities may not be assured.

Suggestion: The plant should consider improving the current infrastructure in the field of emergency preparedness and response to be more consistent

IAEA Basis:

GS-R-2

4.19. The operator of a facility or practice in threat category I, II, III or IV shall make arrangements for the prompt identification of an actual or potential nuclear or radiological emergency and determination of the appropriate level of response. This shall include a system for classifying all potential nuclear and radiological emergencies that warrant an emergency intervention to protect workers and the public, in accordance with international standards, which covers emergencies of the following types at facilities and other emergencies

4.62. Arrangements shall be made for taking all practicable measures to provide protection for emergency workers for the range of anticipated hazardous conditions.

4.99. Arrangements shall be established for the transition from emergency phase operations to routine long term recovery operations.

5.26. …These emergency facilities shall be suitably located and/or protected so as to enable the exposure of emergency workers to be managed in accordance with international standards.

5.27. Appropriate measures shall be taken to protect the occupants for a protracted time against hazards resulting from a severe accident.

5.34. The staff responsible for critical response functions for a facility in threat category I, II or III shall participate in a training exercise or drill at least once every year. For facilities, practices or jurisdictions in threat category IV or V the staff responsible for critical response functions shall participate in training exercises or drills on an appropriate schedule.

NS-R-2

2.34. The emergency plan shall include arrangements for emergencies involving a combination of non-nuclear and nuclear hazards, such as a fire in conjunction with significant levels of radiation or contamination, or toxic or asphyxiating gases in conjunction with radiation and contamination, with account taken of the specific site conditions.

2.38. Instruments, tools, equipment, documentation and communication systems to be used in emergencies shall be kept available and shall be maintained in good operating condition, in such a manner that they are unlikely to be affected by or made unavailable by the postulated accidents.

NS-G-2.8

4.32. A training programme for emergencies should be established to train and evaluate plant staff and staff from external emergency response organizations in confronting accident conditions, coping with them and maintaining and improving the effectiveness of the response. Emergency preparedness exercises should be designed to ensure that plant staff and staff from other participating organizations possess the essential knowledge, skills and attitudes required for the accomplishment of non-routine tasks under stressful emergency conditions.

Plant response/action:

- Electronic dosimeters to replace pencil detectors

  In circumstances in which members of external organizations (including for example fire service, police, medical services) have to enter the power plant in an emergency, the previous practice of issuing these persons with pencil detectors has been superseded by the issue of electronic dosimeters. The advantage of electronic dosimeters is that as well as registering dose rates they can issue alerts if a preset limit is reached (known as the turn-back dose).

- Transition from emergency phase to routine long-term recovery operation

  As the investigations show, the accidents in which emergency response measures have to be undertaken are assignable to the residual-risk sector. Given the unlikely probability of occurrence, the damage scenarios that might occur in an emergency situation are all the less amenable to description in specific terms. Consequently, descriptions of the transition to long-term recovery routine operation can only be formulated as strategies. Whenever possible, strategies for the engineered emergency response measures detailed in the Emergency Procedures Manual have been set down to describe the cessation of emergency response actions in preparation for restoring routine operation. In addition, the responsibilities of the Operations Manager (LdA) (also appliccable tor the Deputy Operations Managers) for drawing up measures for restoring routine operation have been added to the manual.

- Instruction of employees

  In order to improve the employees' state of information regarding emergency alerts and emergency preparedness and response, appropriate changes have been made to the training programme. All employees now receive instruction on how to respond to alarms. This training has been expanded to include the requirements for emergency alerts and the emergency response measures to be implemented in the event of an alarm. Hands-on verification of the emergency response measures as instructed in the training courses in this way takes place within the framework of the emergency preparedness and response drills conducted at the plant every year. The first of these drills took place on February 06, 2009.

- Online dose-rate measuring stations

  To prevent unnecessary exposure of the persons who would be tasked with performing dose-rate measurements inside the perimeter fence, a dose-rate monitoring network is being installed along the outer perimeter fence surrounding the GKN site. Wireless probes with Geiger-Müller counter tubes are used. The positioning of the probes is such that all 12 sectors in the zone and sector overview map are covered. The local dose-rate measurements, the setting off of alerts and malfunction alarms and the storage of the measured values are displayed via a data station.
  The transient for local doserates measured by the detectors can be called up at the data station for each dose-rate measuring station.

  A signaling unit in the vicinity of the data station indicates violation of limits and incoming malfunction alarms from the measuring instruments.

  In addition, the signal of a continuously plotting local dose-rate measuring station will be injected into the control room instrumentation. This measuring station is installed on the roof of the GKN unit II switchgear building.

  The establishment of the local dose-rate measuring network ensures reliable automatic registration of local dose rates for the entire GKN site inside the perimeter fence.

- Rooms for the emergency response organization's staff

  The first immediate action taken after the OSART mission included the relocation of the rooms to be used by emergency response staff from the administration building to the rooms adjacent to the main control room of GKN unit II. These rooms are protected by air supply systems against activity entering from the outside. These rooms meet the same requirements that apply to the MCR. In the case of activity releases to the environment the rooms have to be supplied with fresh air for the emergency staff via a filtered fresh air supply system keeping the pressure inside above the atmospheric. The rooms are also connected to the emergency power supply. The use of these rooms was successfully practised in the emergency response drill that took place on February 6, 2009. Thus, this action is now closed out.

IAEA Comments:

The plant has replaced the pencil detectors at emergency entry points with electronic dosimeters. In the cabinets where the dosimeters are situated there is also a form to be filled in after the usage of the dosimeters so that the correct dose for each individual can be recorded properly.

The Emergency Procedures Manual (Notfallhandbuch) contains technical measures for recovery to routine operation after an emergency. The responsibility to convert the strategies into concrete action plans rests on the plant manager (LdA) and his deputy. This assignment of responsibility has been added to the Plant Manager Handbook. The Plant Manager Handbook has a checklist that supports the LdA in taking care of an emergency and bringing the unit back to normal operation. Further development of the Emergency Procedures Manual is expected as results of new knowledge and experience is gained from exercises and exchange with other utilities.

The training of the staff as regards emergency alerts is commented in issue 9.2 (1).

A comprehensive online dose-rate measurement system has been installed and the information is available on a dedicated computer system situated in the emergency response staff centre. The system provides a good overview of the current dose rates around the site as well as the dose rate history at each measuring point.

The plant has relocated the emergency response staff (ESK) to seven rooms in the vicinity of the main control room of unit 2. The meeting room for the ESK, together with the adjacent rooms forms an emergency response centre. This emergency response centre meets all requirements as regards ventilation, back-up electric power supply etc. The emergency response centre is facilitated with sufficient supporting aids and the functionality was verified during an emergency response drill in February 2009.

Conclusion: Issue resolved.

SUMMARY OF STATUS OF RECOMMENDATION AND SUGGESTIONS
OF THE OSART MISSION TO NECKARWESTHEIM – 11-14 May 2009

	ISSUES PROPOSED	RESOLVED	SATISFACTORY PROGRESS	INSUFFICIENT PROGRESS	WITH-DRAWN
Management, Organization, Administration	R : 1	1	-	-	-
Training and Qualification					
Operations					
	S : 2	2	-	-	-
Maintenance					
Technical Support					
	S : 1	1	-	-	-
Operating Experience					
	S : 2	1	1	-	-
Radiation Protection					
	S : 1	1	-	-	-
Chemistry					
	S : 1	1	-	-	-
Emergency Planning and Preparedness					
	S : 2	1	1	-	-
TOTAL Rec (%)	R : 1	1	-	-	-
	100 %	100%			
TOTAL Sug (%)	S : 9	7	2	-	-
	100 %	77,8%	22,2%		
TOTAL	10	8	2	-	-
	100 %	80%	20%		

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 IAEA Safety Standards or 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. Absence of recommendations can be interpreted as performance corresponding with proven international practices.

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 and 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.

Note: if an item is not well based enough to meet the criteria of a 'suggestion', but the expert or the team feels that mentioning it is still desirable, the given topic may be described in the text of the report using the phrase 'encouragement' (e.g. The team encouraged the plant to…).

Good practice

A good practice is an outstanding and proven performance, programme, activity or equipment in use that contributes directly or indirectly to operational safety and sustained good performance. A good practice is markedly superior to that observed elsewhere, not just the fulfillment of current requirements or expectations. It should be superior enough and have broad application to be brought to the attention of other nuclear power plants and be worthy of their consideration in the general drive for excellence. A good practice has the following characteristics:

- novel;
- has a proven benefit;
- replicable (it can be used at other plants);
- does not contradict an issue.

The attributes of a given 'good practice' (e.g. whether it is well implemented, or cost effective, or creative, or it has good results) should be explicitly stated in the description of the 'good practice'.

Note: An item may not meet all the criteria of a 'good practice', but still be worthy to take note of. In this case it may be referred as a 'good performance', and may be documented in the text of the report. A good performance is a superior objective that has been achieved or a good technique or programme that contributes directly or indirectly to operational safety and sustained good performance, that works well at the plant. However, it might not be necessary to recommend its adoption by other nuclear power plants, because of financial considerations, differences in design or other reasons.

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

SF-1; Fundamental Safety Principles (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.117; Operation of Spent Fuel Storage Facilities

NS-R-1; Safety of Nuclear Power Plants: Design 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)

NS-G-2.11; A System for the Feedback of Experience from Events in Nuclear Installations (Safety Guide**)**

GS-R-1; Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety (Safety Requirements)

GS-R-2; Preparedness and Response for a Nuclear or Radiological Emergency (Safety Requirements)

GS-R-3; The Management System for Facilities and Activities (Safety Requirements)

GS-G-2.1; Arrangement for Preparedness for a Nuclear or Radiological Emergency (Safety Guide)

GS-G-3.1; Application of the Management System for Facilities and Activities (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-1.8; Environmental and Source Monitoring for Purpose of Radiation Protection (Safety Guide)

WS-G-6.1; Storage of Radioactive Waste (Safety Guide)

DS347; Conduct of Operations at Nuclear Power Plants (Draft Safety Guide)

DS388; Chemistry Control in the Operation of Nuclear Power Plants (Draft Safety Guide)

INSAG, Safety Report Series

I**NSAG-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

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Safety Report Series No.48; Development and Review of Plant Specific Emergency Operating Procedures

TECDOCs and IAEA Services Series

IAEA Safety Glossary Terminology used in nuclear safety and radiation protection 2007 Edition

Services series No.10; PROSPER Guidelines

Services series No.12; OSART Guidelines

TECDOC-489; Safety Aspects of Water Chemistry in Light Water Reactors

TECDOC-744; OSART Guidelines 1994 Edition (Refer only chapter 10-15 for Pre-OSART, if applicable.)

TECDOC-1141; Operational Safety Performance Indicators for Nuclear Power Plants

TECDOC-1321; Self-assessment of safety culture in nuclear installations

TECDOC-1329; Safety culture in nuclear installations - Guidance for use in the enhancement of safety culture

TECDOC 1446 OSART mission highlights 2001-2003

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TECDOC-1477; Trending of low level events and near misses to enhance safety performance in nuclear power plants

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