“Regulations on the Safety of Nuclear Power Plants Operation (PAK/913)”

PART-II
Statutory Notification (S.R.O)
Government of Pakistan
PAKISTAN NUCLEAR REGULATORY AUTHYORITY

Notification
Islamabad, the 14th December, 2004
Amended on 3rd November 2008

S.R.O. 995(I)/2004.- In exercise of the powers conferred by section 56 of the Pakistan Nuclear Regulatory Authority Ordinance, 2001 (III of 2001), the Pakistan Nuclear Regulatory Authority is pleased to make the following regulations.

1. Short title and commencement.-(1) These regulations may be called "Regulations on the Safety of Nuclear Power Plants Operation (PAK/913) (Rev. 1)".

(2) These regulations extend to the whole of the Pakistan.

(3) These regulations shall come into force at once.

2. Definitions.- In these regulations, unless there is anything repugnant in the subject or context,

(a) "accident" means any unintended event, including operating error, equipment failures or other mishaps, the consequences or potential consequences of which are not negligible from the point of view of safety or protection.

(b) "accident conditions" mean deviations from normal operation more severe than anticipated operational occurrences, including design basis accident and severe accidents.

(c) "accident management" means taking of a set of actions during the evolution of a beyond design basis accident:-

(i) to prevent the escalation of event into a severe accident.
(ii) to mitigate the consequences of severe accident: and
(iii) to achieve a long-term safe stable state.

(d) "anticipated operational occurrences" means operational processes deviating from Normal Operation which are expected to occur at least once during the operating lifetime of a facility, but which, in view of appropriate design provisions, do not cause any significant damage to items important to safety nor lead to accident conditions.

(e) "ASME code" means the American Society of Mechanical Engineers Boiler Pressure Vessel Code.

(f) "commissioning" means the process during which systems and components of installation(s) and activities, having been

constructed, are made operational and verified to be in accordance with design and to have met the required performance criteria.

(g) "comparable facility" means a nuclear power plant compare to the relevant nuclear power plant as determined by the Authority.

(h) "design basis accidents" mean accident conditions against which the nuclear power plant(s) is (are) designed according to established design criteria, and for which the damage to the fuel and the release of radioactive materials are kept within authorised limits.

(i) "EOL fluence" means the best-estimate neutron fluence projected for a specific vessel beltline material at the clad-base-meta interface on the inside surface of the vessel at the location where the material receives the highest fluence on the expiration date of the operating licence.

(j) "ionizing radiation" means radiation capable of producing ion pairs in biological materials and hereinafter termed as radiation .

(k) "license" means a license issued under section 19 of the Ordinance.

(l) "licensee" means the holder of current licence.

(m) "limit" means the value of quantity used in certain specified activities or circumstances that must not be exceeded and is acceptable to or/ and notified by the Pakistan Nuclear Regulatory Authority.

(n) "near miss" means a potentially significant event that could have occurred as the consequence of a sequence of actual occurrences but did not occur owing to the plant conditions prevailing at the time.

(o) "normal operation" means operation within specified operational limits and conditions.

(p) "nuclear safety (safety)" means the achievement of proper operating conditions, prevention of accidents or mitigation of accident consequences, resulting in protection of site personnel, the public and the environment from undue radiation hazards.

(q) "operating personnel" means individual workers engaged in the operation of the authorised nuclear power plant(s).

(r) “operating record” means documents, such as instrument charts, certificates, logbooks, computer printouts and magnetic tapes made to keep objective history of a nuclear power plant operation.

(s) “operation” means all activities performed to achieve the purpose for which a installation(s) was constructed.

(t) “operational limits and conditions” means a set of rules, which set forth parameter limits, the functional capability and the performance levels of equipment and personnel approved by the Authority for safe operation of an authorised nuclear power plant(s).

(u) “operational states” means states defined under normal operation and anticipated operational occurrences.

(v) “Ordinance” means the Pakistan Nuclear Regulatory Authority Ordinance (III of 2001).

(w) prescribed limits: See Limit.

(x) “pressurized thermal shock (PTS) event” means an event or transient in pressurized water reactors (PWRs) causing severe overcooling (thermal shock) concurrent with or followed by significant pressure in reactor vessel.

(y) “PTS screening criterion” means the value of RT_{PTS} for the vessel beltline material above which the plant cannot continue to operate without justification.

(z) “qualified individual” means the individual who, having complied with specific requirements and met certain conditions, has been officially designated to discharge specified duties and responsibilities.

(aa) “reactor operator” means technician authorized to carryout operations in control room and in the field.

(bb) “reactor vessel beltline” means the region of the reactor vessel (shell material including welds, heat affected zones and plates or forging) that directly surrounds the effective height of the active core and adjacent regions of the reactor vessel that are predicted to experience sufficient neutron radiation damage to be considered in the selection of the most limiting material with regards to radiation damage.

(cc) "RT_{NDT} "means the reference temperature for a reactor vessel material, under any conditions. For the reactor vessel beltline material, RT_{NDT} must account for the effects of neutron radiation.

(dd) "$RT_{NDT(U)}$ "means the reference temperature for a reactor vessel material in the pre-service or un-irradiated condition, evaluated according to the procedures in the ASME code, paragraph NB-2331 or other methods approved by the Authority.

(ee) "RT_{PTS} "means the reference temperature, RT_{NDT}, evaluated for the EOL fluence for each of the vessel beltline material.

(ff) "safety function" means a specific purpose that must be accomplished for safety.

(gg) safety limits: See Limit.

(hh) "safety systems" means systems important to safety, provided to assure the safe shutdown of the reactor or the residual heat removal from the core, or to limit the consequences of anticipated operational occurrences and design basis accidents.

(ii) "shift engineer" means second in command assisting shift supervisor.

(jj) "shift supervisor" means engineer responsible for and in-charge of operation shift.

(kk) "station health physicist" means technical head of the health physics department.

(ll) "severe accidents" means accident conditions more severe than a design basis accident and involving significant core degradation.

(mm) "supervised area" means a defined area not designated a control area but for which occupational exposure conditions are kept under review, even though specific protection measures and safety provisions are normally not needed.

3. Scope.

. These regulations deal with the safety aspects of management, commissioning, operation and decommissioning of nuclear power plants.

4. Interpretation.

The decision of the Chairman of the Authority regarding the interpretation of any word or phrase of these regulations or applicability of these regulations shall be final and binding on the licensee.

LICENSEE'S REQUIREMENTS

5. General.

(1) The licensee shall have the responsibility for the safe operation of nuclear power plant. The licensee shall retain prime responsibility for safety but it may delegate authority to the plant management for the safe operation of the plant. In such cases the licensee shall provide the necessary resources and support. The management of the plant shall ensure that the plant is operated in a safe manner and in accordance with all legal and regulatory requirements.

(2) The licensee shall place special emphasis on safety in operation. It shall establish and effect policies that give safety matters the highest priority.

(3) The licensee shall establish an effective organizational structure. Consideration shall be given to the following management functions, while establishing organizational structure:

(a) Policy making functions, which include setting management objectives; establishing policy for nuclear safety and for quality; allocating resources; providing material and human resources; approving the contents of management programs; setting policies on fitness for duty; and establishing a program to make the necessary changes to any of these functions on the basis of the performance in achieving objectives.

(b) Operating functions, which include executive decision making and actions for the operation of a plant, both in operational states and in accidents.

(c) Supporting functions, which include obtaining from both on-site and off-site organizations the technical and administrative services and facilities necessary to perform the operating functions.

(d) Reviewing functions, which include critical monitoring of the performance of the operating and supporting functions, and review of the plant design.

(4) The organizational structure shall be established and documented so as to ensure that the following responsibilities are discharged with respect to achieving safe operation of nuclear power plants:

(a) Responsibilities shall be allocated and authority shall be delegated within the licensee.

(b) Satisfactory conduct of management programs shall be established and verified.

(c) Adequate training for personnel shall be provided.

(d) Liaison shall be established with the Authority and with public authorities for the purposes of ensuring understanding of and compliance with safety requirements.

(e) Liaison shall be established with organizations for design, construction, manufacturing and plant operation and with other organizations (national and international) as necessary to ensure the proper transfer of information, expertise and experience and the ability to respond to safety issues.

(f) Adequate resources, services and facilities shall be provided.

(5) A document describing the plant's organizational structure and the management arrangements for discharging all these responsibilities shall be made available to the Authority for review. In addition, proposed changes to the structure and associated arrangements, which might be significant to safety, shall be systematically reviewed by the licensee and shall be submitted to the Authority for review.

(6) The document describing the plant's organizational structure shall indicate the staffing arrangements within the categories of direct line operating personnel and supporting personnel. Clear lines of authority shall be established to deal with matters bearing on plant safety. The extent to which the support functions are self-sufficient or dependent upon services from outside the plant organization shall be demonstrated by means of functional organizational charts, which include personnel resource allocations and specify the duties and responsibilities of key personnel.

(7) The licensee shall be staffed with competent managers and sufficient qualified personnel having a proper awareness of the technical and administrative requirements for safety and motivated to be safety conscious. Attitude towards safety shall be a criterion for the hiring or promoting of managers. Staff performance appraisals shall include a section on the attitude towards safety.

(8) Functional responsibilities, levels of delegated authority and lines of internal and external communication for the safe operation of plants in all operational states, for mitigating the consequences of accident conditions and for ensuring an appropriate response in emergencies shall be clearly defined in writing.

(9) All activities that may affect safety and which can be planned in advance shall be conducted in accordance with established procedures. Such procedures shall be submitted by the licensee to the Authority on request.

(10) When activities with safety implication or concerned with safety or safety related systems are proposed that are not included in the normal procedures, special procedures shall be written in accordance with established administrative procedures. These special procedures shall include the contents and the operational details of the proposed activity. Such activities and special procedures shall be carefully reviewed for any safety implications. The approval of these special procedures shall follow the same process as that for the normal procedures of the plant. The proposed

procedures shall be submitted to the Authority on request.

(11) A policy on safety shall be developed by the licensee and applied by all site personnel. This policy shall give safety the utmost priority at the plant, overriding if necessary the demands of production and project schedules. The policy shall include a commitment to excellent performance in all activities important to safety and shall encourage a questioning attitude.

(12) All activities that may affect safety shall be performed by suitably qualified and experienced individuals. Qualified individuals outside the plant structure (such as contractors) may perform certain activities with a bearing on safety. These activities shall be clearly defined in writing. The implementation of these activities on or off the site shall be subject to the approval of the licensee/plant management. Contractors' staff shall be properly controlled and supervised by the plant staff.

(13) The plant management shall ensure that regular reviews of the operation of the plant are conducted, with the aim of ensuring: that an appropriate safety consciousness and safety culture prevail; that the provisions set forth for enhancing safety are observed; that documentation is up to date; and that there are no indications of overconfidence or complacency. Where practicable, suitable objective performance measures shall be used. Based on the results, appropriate corrective actions shall be taken.

6. Quality assurance

The licensee shall prepare and put in place a comprehensive quality assurance program covering all activities, which may affect the safe operation of the plant. The quality assurance shall be integral part of every activity, which may affect safety.

7. Emergency preparedness

(1) Emergency preparedness concerns the capability of maintaining protection and safety by managing accidents; mitigating their consequences if these do occur; protecting the health of site personnel and public; and protecting the environment. The licensee shall prepare an emergency plan that covers all activities under its responsibility, to be adhered to in the event of an emergency. The emergency plan shall be coordinated with those of all other bodies having responsibilities in an emergency, including public authorities, and shall be submitted to the Authority for approval.

(2) The licensee shall establish the necessary organizational structure and shall assign responsibilities for managing emergencies. This shall include arrangements for: prompt recognition of emergencies; timely notification and alerting of response personnel; and provision of the necessary information to the authorities, identified as in emergency plan, including timely notification and subsequent provision of information as required.

(3) The emergency plan of the licensee shall include the following:

(a) The designation of individuals for directing on-site activities and for ensuring liaison with off-site organizations;

(b) The conditions under which an emergency shall be declared, a list of job titles and/or functions of individuals empowered to declare it, and a description of suitable means for alerting response personnel and public authorities;

(c) The arrangements for initial and subsequent assessment of the radiological conditions on and off the site;

(d) Provisions for minimizing the exposure of individuals to ionizing radiation and for ensuring medical treatment of casualties;

(e) Assessment of the state of the installation and the actions to be taken on site to limit the extent of radioactive release;

(f) The chain of command and communication, including a description of related facilities and procedures;

(g) An inventory of the emergency equipment to be kept in readiness at specified locations;

(h) The actions to be taken by individuals and organizations involved in the implementation of the plan;

(i) Provisions of criteria for declaring the termination of an emergency.

(4) 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 significant levels of radiation or contamination, with account taken of specific site conditions.

(5) Appropriate emergency arrangements shall be established from the time that nuclear fuel is brought to the site, and complete emergency preparedness as described here shall be ensured before the commencement of operation.

(6) The emergency plan shall be tested in an exercise before the commencement of operation. There shall thereafter at required intervals be exercises of the emergency plan, which may be witnessed by the Authority as deemed necessary. 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.

(7) Site personnel shall be trained in the performance of their duties in an emergency. There shall be a means of informing all employees and all other individuals on the site of the actions to be taken in the event of an emergency.

(8) 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 these are unlikely to be affected by or made unavailable by the postulated accidents.

8. Fire safety

The licensee shall make arrangements for ensuring fire safety on the basis of a fire safety analysis, which shall be periodically updated. Such arrangements shall include:-

(a) application of the principle of defense in depth;

(b) assessment of the impact of plant modifications on fire fighting;

(c) control of combustibles and ignition sources;

(d) inspection, maintenance and testing of fire protection measures;

(e) establishment of a manual fire fighting capability;

(f) training of plant personnel.

9. Physical protection.

(1) The licensee shall take measures for physical security and physical protection as appropriate to prevent or deter unauthorized access to, intrusion into, theft of, surface attack on and internal or external sabotage of safety related systems and nuclear materials.

(2) All reasonable precautions shall be taken to prevent individuals from deliberately carrying out unauthorized actions that could jeopardize safety.

(3) The licensee shall have plans and procedures in place to provide for physical protection of the site in the event of civil disturbance.

10. Feedback of operating experience.

(1) Operating experience at the plant shall be evaluated in a systematic way. Abnormal events with significant safety implications shall be investigated to establish their direct and root causes. The investigation shall, where appropriate, result in clear recommendations to the plant management, which shall take appropriate corrective action without undue delay. Information resulting from such evaluations and investigations shall be fed back to the plant personnel.

(2) The plant management shall obtain and evaluate information on operating experience at other national and international organizations and plants to derive lessons for its own operations.

(3) Operating experience shall be carefully examined by designated competent individuals for any precursors of conditions adverse to safety, so that necessary corrective action can be taken before serious conditions arise.

(4) Licensee/plant management shall maintain liaison as appropriate with the organizations (manufacturer, research organization, and designer) involved in the design, with the aims of feeding back information on operating experience and obtaining advice, if necessary, in the event of equipment failures or abnormal events.

(5) All plant personnel shall be required and encouraged to report all events and shall be encouraged to report on any "near misses" relevant to the safety of the plant.

(6) Data on operating experience shall be collected and retained for use as input for the management of plant aging, for the evaluation of residual plant life, and for probabilistic safety assessment and periodic safety review.

11. Qualification and training of personnel.

(1) The licensee shall define the qualifications and experiences necessary for personnel performing duties that may affect safety. Suitably qualified personnel shall be selected and given the necessary training and instruction to enable them to perform their duties correctly for the different operational states of the plant and in the event of an accident, in accordance with the appropriate operating or emergency procedures. Individuals performing certain functions important to safety shall be required to hold a formal licence issued by the Authority. Licensed and other key persons shall meet qualification and education criteria given in Annex-I to Annex-V.

(2) A suitable program shall be established and maintained for the training of personnel before their assignment to safety related duties. The training shall emphasize the paramount importance of safety in all aspects of plant operation. Relevant documentation on the training program shall be made available to the Authority.

(3) All personnel of the licensee whose duties may affect safety shall be medically examined on appointment and at intervals subsequently as required to ensure their fitness for the duties and responsibilities assigned to them.

(4) The licensee shall ensure that all personnel who may be required to perform safety related duties have a sufficient understanding of the plant and its safety features, and other relevant competences, such as managerial and supervisory skills, to perform their duties properly and with due attention to safety.

(5) The licensee shall ensure that the qualifications and training of external personnel performing safety related duties are adequate for the functions to be performed.

(6) The training program shall include provisions for periodic confirmation of the competence of personnel and for refresher training on a regular basis.

(7) Training instructors shall be technically competent in their assigned areas of responsibility and have the necessary instructional skills.

(8) Adequate facilities shall be provided for classroom training and for individual study. Appropriate educational training material shall be provided to assist trainees in understanding the plant and its systems.

(9) Representative simulator facilities shall be used for the training of operating personnel. Simulator training shall incorporate training for operational states and for accidents.

(10) Performance based programs for initial and continuing training shall be developed and put in place for each major group of personnel. The content of each program should be based on a systematic approach. Training programs shall promote attitudes, which help to ensure that safety issues receive the attention that they warrant.

(11) A program shall be put in place to assess and improve the training programs. In addition, a system shall be in place for timely modification and updating of the training facilities and materials to ensure that these accurately reflect plant conditions.

(12) General Manager is responsible for the qualification of plant staff and shall support the training organization with the necessary resources and facilities. Line managers and supervisors shall be responsible for the competence of their personnel. They shall participate in determining the needs for training, and in ensuring that operating experience is taken into account in the training. Managers and supervisors shall ensure that production needs do not interfere with the conduct of the training program.

(13) Plant staff shall receive instructions in the management of accidents beyond the design basis. The training of operating personnel shall ensure their familiarity with the symptoms of accidents beyond the design basis and with the procedures for accident management.

(14) A program shall be put in place to ensure that operating experience of events at the plant concerned as well as of relevant events at other plants is appropriately factored into the training program. The program shall ensure that training is conducted on the root cause(s) of the events and on the identification and implementation of corrective actions to prevent their recurrence.

12. Commissioning program for the plant.

(1) Specific approval by the Authority shall be required before the start of normal operation. Such approval will be granted on the basis of an appropriate safety analysis report and a commissioning program. The commissioning program

shall provide evidence that the installation as constructed meets the design intent and complies with the safety requirements. Operating procedures shall be validated to the extent practicable as part of the commissioning program, with the participation of the future operating personnel.

(2) The commissioning program shall meet the objectives of the licensee, including safety objectives, and shall be subject to approval by the Authority. The implementation of the commissioning program shall be divided into various stages. Control of progression from one stage to the next shall be conditional upon an evaluation of the results of the commissioning tests by the licensee to ascertain that all objectives and regulatory requirements have been met. Such evaluation/ certification shall be submitted to the Authority for approval to proceed to next stage.

(3) Authorities and responsibilities for the commissioning process shall be clearly defined and delegated to the individuals performing the work. The interfaces between those groups involved in commissioning (such as groups for design, for construction, for commissioning and for operations) shall be clearly defined and properly controlled.

(4) A sufficient number of qualified operating personnel at all levels and in all areas, shall be directly involved in the commissioning process.

(5) The licensee shall ensure that the commissioning program includes all the tests necessary to demonstrate that the plant as installed meets the requirements of the safety analysis report and satisfies the design intent, and consequently can be operated in accordance with the operational limits and conditions. The tests shall be carried out in a logical order. The commissioning program shall also provide the Authority with a means of identifying hold points in the commissioning process. No tests shall be performed which could put the plant into conditions that have not been analyzed. The program shall ensure that "baseline" data on systems and components, which are important for ensuring the safety of the plant and for subsequent safety reviews, are collected and retained.

(6) To confirm the applicability and quality of the operating procedures, these shall be verified to ensure their technical accuracy and validated to ensure their usability with the installed equipment and control systems, as far as possible prior to loading fuel into the core. This process shall continue during the commissioning phase. This verification and validation process shall also apply to procedures for maintenance, surveillance and plant chemistry as appropriate.

(7) From the start of commissioning, adequate work control and modification procedures shall be put in place to ensure that the objectives of commissioning tests remain valid in the process of performance of the commissioning

program. These procedures shall be the same as those intended for the operating phase.

(8) From construction to commissioning, and finally to operation, the plant shall be adequately monitored and maintained in order to protect plant equipment, to support the testing phase and to continue to maintain consistency with the safety analysis report. Records of operations and maintenance shall be kept starting from the initial energization and operation of each plant system, and these shall be retained by the licensee in proper archives for periods as agreed by the Authority.

(9) To confirm that the plant is prepared for the initial core loading, prerequisites for systems, equipment, documentation and personnel shall be established well in advance of the fuel loading. These prerequisites shall be clearly stated and documented on the basis of the safety analysis report and the existing regulatory requirements.

(10) Initial fuel loading shall not be authorized until all pre-operational tests deemed necessary by the licensee and the Authority have been performed and results acceptable to the licensee and Authority have been obtained.

(11) Reactor criticality and initial power raising shall not be authorized until all tests deemed necessary by the licensee and the Authority have been performed
and results acceptable to the licensee and Authority have been obtained.

(12) All the functions of the licensee shall be performed at the appropriate stages during commissioning. These functions shall include responsibilities for: management; training of personnel; the radiation protection program; waste management; management of records; fire safety; physical protection; the emergency plan.

PLANT OPERATIONS

13. Operational limits and conditions.

(1) Operational limits and conditions shall be developed to ensure that the plant is operated in accordance with the design assumptions and intent. These shall reflect the provisions made in the final design and shall be submitted to the Authority for assessment and approval before the commencement of operation. The operational limits and conditions shall include requirements for different operational states, including shutdown. These shall also cover actions to be taken and limitations to be observed by the operating personnel and shall be readily accessible for control room personnel.

(2) The operational limits and conditions shall form an important part of the basis on which the licensee is authorized to operate the plant. Authorized personnel directly responsible for the conduct of operation shall be thoroughly familiar with the intent and content of the operational limits and conditions in order to comply with the provisions contained therein.

(3) The operational limits and conditions shall have the purposes of:-

(a) The prevention of situations which could lead to accidents;
(b) The mitigation of the consequences of any such accidents, if these do occur.

(4) The operational limits and conditions may be classified as:

(a) Safety limits;
(b) Limits on safety system settings;
(c) Limits and conditions for normal operation and for safe transient operational states;
(d) Surveillance requirements.

(5) Operational limits and conditions shall be based on an analysis of the specific nuclear power plant and its environment in accordance with the provisions made in the final design. Each of the operational limits and conditions adopted shall be provided with the basis of a written advice of the reason for its adoption. Necessary amendments shall be made according to the results of tests carried out during commissioning and shall be approved by the Authority.

(6) The operational limits and conditions shall be reviewed over the operating life (including operation beyond design life) of the plant in the light of experience, developments in technology and safety, and changes in the plant, and shall be modified if this is required by the Authority or if it is considered appropriate by the licensee and approved by the Authority.

(7) A program shall be established to ensure that deviations from operational limits and conditions are documented and reported in an appropriate manner, and that appropriate actions are taken in response, including updating the safety analysis report.

(8) After an abnormal event, the plant shall be brought into a safe operational state, which could necessitate shutting down the reactor. In the event that the operation of the plant deviates from one or more of the established operational limits and conditions, the appropriate remedial actions shall be taken immediately, and

the licensee shall undertake review and evaluation of the case and shall notify the Authority in accordance with the established event reporting system.

(9) For each pressurized water nuclear power reactor for which an operating licence has been issued, the licensee shall have the projected values of RT_{PTS}, accepted by the Authority, for each reactor beltline material for the EOL fluence of the materials. (Annex-VII).

14. Operating instructions and procedures.

(1) A comprehensive administrative procedure shall be established which contains the rules for the development, elaboration, validation, acceptance, modification and withdrawal of operating instructions and procedures, which are referred to herein as "procedures".

(2) Operating procedures shall be developed which apply comprehensively for normal, abnormal and emergency conditions, in accordance with the requirements of the Authority and the policy of the licensee. The level of detail for a particular procedure shall be appropriate for the purpose of that procedure. The guidance provided in the procedures shall be clear, concise, and as far as possible verified and validated. The procedures and reference material shall be clearly identified and readily accessible in the control room and other operating locations if necessary, and shall be made available to the Authority, if required. Strict adherence to written operating procedures shall be an essential element of safety policy at the plant.

(3) Procedures shall be developed for normal operation to ensure that the plant is operated within the operational limits and conditions. Either event based or symptom-based procedures shall be developed for abnormal conditions and design basis accidents. Emergency operating procedures or guidance for managing severe accidents (beyond the design basis) shall be developed.

(4) It shall be ensured that operating personnel are knowledgeable of, and have control over, the status of plant systems and equipment for all operational states. Only designated and licensed members of the operating personnel shall control or supervise any changes in the operational states of the plant. No other individual shall interfere in his decisions relevant to safety.

(5) The responsibilities and authorities of the control room operators and of those directing the shutting down of the reactor in the interests of safety shall be set out clearly in writing. Similarly, the responsibilities and authorities for restarting the reactor after an abnormal event leading to a shutdown or to an extended period of maintenance shall be clearly established in writing.

(6) Administrative controls shall be established to ensure that all work to be conducted at the plant is planned and executed in a manner that is consistent with

the requirements for the safe operation of the plant, both for power operation and for shutdown.

(7) The regular review of all instructions and procedures shall be made. Any revision of these documents shall be known by the operating personnel and other holders of the documents. Revisions shall be undertaken in accordance with written procedures and made executive only by individuals authorised to do so. All instructions and procedures and their revisions shall be provided to the Authority, if these relate to safety.

(8) Responsibilities and lines of communication shall clearly be set out in writing for situations in which the operating personnel discover that the status or conditions of plant systems or equipment are not in accordance with operating procedures.

(9) Attention shall be given to ensuring that oral (verbal) instructions are clearly understood.

(10) If there is a need to conduct a non-routine operation, test or experiment, which may affect safety, it shall be the subject of a safety review. The specific operational limits and conditions shall be determined and a special procedure shall be prepared. If, during the non-routine operation, any of the specific operational limits or conditions is violated, corrective action shall be taken immediately and the event shall be reviewed. Experiments shall not be conducted unnecessarily or without adequate justification.

15. Core management and fuel handling.

(1) The licensee shall be responsible and shall make arrangements for all the activities associated with core management and on-site fuel handling in order to ensure the safe use of the fuel in the reactor and safety in its movement and storage on the site. Provisions shall be made to ensure that in each reactor only fuel whose design and enrichment have been approved by the Authority for use with that reactor is loaded.

(2) For core management, the licensee shall prepare and issue specifications and procedures for the procurement, loading, utilization, unloading and testing of fuel and core components. A fuelling program shall be established in accordance with the design intent and assumptions and shall be submitted to the Authority. Following batch refueling, tests (see Annex-IV) shall be performed before and during startup to confirm that the core performance meets the design intent. Core conditions shall be monitored and the fuelling program shall be reviewed and modified as necessary. Criteria shall be established and procedures shall be written

for dealing with failures of fuel rods or control rods so as to minimize the amounts of fission and activation products in the primary coolant or in gaseous effluents.

(3) For fuel and core components, handling procedures shall be documented, which include the movement of un-irradiated and irradiated fuel, storage on the site and preparation for dispatch from the site. The plans for storage of the un-irradiated and irradiated fuel shall be submitted to the Authority for approval, as required.

(4) Detailed auditable accounts shall be maintained as required for the storage, irradiation and movement of all fissile material, including un-irradiated and irradiated fuel.

IMMEDIATE NOTIFICATION REQUIREMENTS FOR OPERATING NUCLEAR POWER REACTORS.

16. General requirements.

(1) Each nuclear power reactor licensee shall notify the Authority:

(a) The declaration of any of the Emergency Classes specified in the licensee's approved Emergency Plan; or

(b) Those non-emergency events specified in regulation of Non-emergency events of this section that occurred within three (3) years of the date of discovery.

(2) If the Emergency Notification System is inoperative, the licensee shall make the required notifications via telephone service, other dedicated systems, or any other method which will ensure that a report is made as soon as practical to the Authority.

(3) The licensee shall notify the Authority immediately after notification of the appropriate state or local agencies and not later than one (1) hour after the time the licensee declares one of the Emergency Classes.

(4) When making a report, the licensee shall identify:

(a) The Emergency Class declared; or

(b) “One (1) hour reports, “Four (4) hour reports,”or “Eight (8) hour reports” as the requiring notification of the non-emergency event.

17. Non-emergency events.-

(1) One (1) hour reports. If not reported as a declaration of an Emergency Class, the licensee shall notify the Authority as soon as practical and in all cases within one (1) hour of the occurrence of any deviation from the plant's Technical Specifications authorized.

(2) Four (4) hour reports. The licensee shall notify the Authority as soon as practical and in all cases, within four (4) hours of the occurrence of any of the following:

(a) The initiation of any nuclear plant shutdown required by the plant's Technical Specifications.

(b) Any event that results or should have resulted in emergency core cooling system (ECCS) discharge into the reactor coolant system as a result of a valid signal except when the actuation results from and is part of a pre-planned sequence during testing or reactor operation.

(c) Any event or condition that results in actuation of the reactor protection system (RPS) when the reactor is critical except when the actuation results from and is part of a pre-planned sequence during testing or reactor operation.

(d) Any event or situation, related to the health and safety of the public or onsite personnel, or protection of the environment, for which a news release is planned or notification to other government agencies has been or will be made. Such an event may include an onsite fatality or inadvertent release of radioactively contaminated materials.

(3) Eight (8) hour reports. The licensee shall notify the Authority as soon as practical and in all cases within eight (8) hours of the occurrence of any of the following:

Any event or condition that results in:

(a) The condition of the nuclear power plant, including its principal safety barriers, being seriously degraded; or

(b) The nuclear power plant being in an unanalyzed condition that significantly degrades plant safety.

18. Follow-up notification.

With respect to the telephone notifications made, in addition to making the required initial notification, each licensee, shall during the course of the event:

(a) Immediately report

(i) any further degradation in the level of safety of the plant or other worsening plant conditions, including those that require the declaration of any of the Emergency Classes, if such a declaration has not been previously made, or

(ii) any change from one Emergency Class to another, or

(iii) a termination of the Emergency Class.

(iv) the results of ensuring evaluations or assessments of plant conditions,

(v) the effectiveness of response or protective measures taken, and

(vi) information related to plant behavior that is not understood.

(b) Maintain an open, continuous communication channel with the Authority.

(c) Other requirements are given in Annex-VIII.

LICENSEE EVENT REPORT SYSTEM.

19. Reportable events.

(1) For any event of the type described herein the licensee shall submit a Licensee Event Report (LER) within sixty (60) days after the discovery of the event. Unless otherwise specified herein, the licensee shall report an event if it occurred within three (3) years of the date of discovery regardless of the plant mode or power level, and regardless of the significance of the structure, system, or component that initiated the event.

(2) The licensee shall report:

(a) The death of any person at the nuclear power plant including anywhere within the exclusion zone which is specified in the licence.

(b) The serious illness or injury or death of any person incurred as a result of the operation of nuclear power plant.

(c) The occurrence of an event that has resulted, that is likely to result, or that may result, in the exposure of a person or organ or tissue to radiation in excess of the applicable radiation dose limits.

(d) The misuse, by any person, of any thing that is intended to protect the health or safety of persons or the environment from risks associated with the operation of the nuclear power plant.

(e) The completion of any nuclear plant shutdown required by the plant's Operating Instructions and procedures.

(f) Any operation or condition which was prohibited by the plant's Operating Instructions and procedures except when:

(i) The Operating Instructions and procedures are administrative in nature;

(ii) The event consisted solely of a case of a late surveillance test where the oversight was corrected, the test was performed, and the equipment was found to be capable of performing its specified safety functions; or

(iii) The Operating Instructions and procedures were revised prior to discovery of the event such that the operation or condition was no longer prohibited at the time of discovery of the event.

(g) Any deviation from the plant's Operating Instructions and procedures authorized.

(h) Any event or condition that resulted in:

(i) The condition of the nuclear power plant, including its principal safety barriers, being seriously degraded; or

(ii) The nuclear power plant being in an unanalyzed condition that significantly degraded plant safety.

(i) Any natural phenomenon or other external condition that posed an actual threat to the safety of the nuclear power plant or significantly hampered site personnel in the performance of duties necessary for the safe operation of the nuclear power plant.

(j) Any event or condition that resulted in manual or automatic actuation of any of the systems, except when:

(i) The actuation resulted from and was part of a pre-planned sequence during testing or reactor operation; or

(ii) The actuation was invalid and;

(iii) Occurred while the system was properly removed from service; or

(iv) Occurred after the safety function had been already completed.

(k) A serious process failure; potential serious process failure; a situation or event requiring a reactor shutdown in accordance with a licence condition or a licensing document. (for Candu)

(l) An event that results in an acute and unrecoverable loss of more than one hundred kilograms (100 kg.) of heavy water (for Candu)

(3) The systems to which the requirements apply are:

(a) Reactor protection system (RPS) including: reactor scram or reactor trip

(b) General containment isolation signals affecting containment isolation valves more than one system or multiple main steam isolation valves (MSIVs).

(c) Emergency core cooling systems (ECCS) for pressurized water reactors (PWRs) including: high-head, intermediate-head, and low-head injection systems and the low pressure injection function of residual (decay) heat removal systems.

(d) ECCS for boiling water reactors (BWRs) including:
high-pressure and low-pressure core spray systems; high-pressure coolant injection system; low pressure injection function of the residual heat removal system.

(e) BWR reactor core isolation cooling system; isolation condenser system; and feedwater coolant injection system.

(f) Auxiliary or emergency feedwater system.

(g) Containment heat removal and depressurization systems, including containment spray and fan cooler systems.

(h) Emergency AC electrical power systems, including:

emergency diesel generators (EDGs).

(i) Emergency service water systems that do not normally run and that serve as ultimate heat sinks.

(4) Any event or condition that could have prevented the fulfillment of the safety function of structures or systems that are needed to:

(a) Shut down the reactor and maintain it in a safe shutdown condition;

(b) Remove residual heat;

(c) Control the release of radioactive material; or

(d) Mitigate the consequences of an accident.

(5) Any event where a single cause or condition caused at least one(1) independent train or channel to become inoperable in multiple systems or two (2) independent trains or channels to become inoperable in a single system designed to:

(a) Shut down the reactor and maintain it in a safe shutdown condition;

(b) Remove residual heat;

(c) Control the release of radioactive material; or

(d) Mitigate the consequences of an accident.

(6) Any airborne radioactive release that, when averaged over a time period of one (1) hour, resulted in airborne radionuclide concentrations in an unrestricted area that exceeded twenty (20) times the applicable concentration limits.

Any liquid effluent release that, when averaged over a time period of half (1/2) hour, exceeds twenty (20) times the applicable concentrations specified at the point of entry into the receiving waters (i.e., unrestricted area) for all radio nuclides except tritium and dissolved noble gases.

(7) Any event or condition that as a result of a single cause could have prevented the fulfillment of a safety function for two (2) or more trains or channels in different systems that are needed to:

(a) Shut down the reactor and maintain it in a safe shutdown condition;

(b) Remove residual heat;

(c) Control the release of radioactive material; or

(d) Mitigate the consequences of an accident.

Events may include cases of procedural error, equipment failure, and/or discovery of a design, analysis, fabrication, construction, and/or procedural inadequacy. However, licensees are not required to report an event, if the event results from:

(e) A shared dependency among trains or channels that is a natural or expected consequence of the approved plant design; or

(f) Normal and expected wear or degradation.

(8) Any event that posed an actual threat to the safety of the nuclear power plant or significantly hampered site personnel in the performance of duties necessary for the safe operation of the nuclear power plant including fires, toxic gas releases, or radioactive releases.

20. Contents.

(1) The Licensee Event Report shall contain:

(a) A brief abstract describing the major occurrences during the event, including all component or system failures that contributed to the event and significant corrective action taken or planned to prevent recurrence.

A clear, specific, narrative description of what occurred so that knowledgeable readers conversant with the design of commercial nuclear power plants, but not familiar with the details of a particular plant, can understand the complete event.

(b) The narrative description must include the following specific information as appropriate for the particular event:

(i) Plant operating conditions before the event.

(ii) Status of structures, components, or systems that were inoperable at the start of the event and that contributed to the event.

(iii) Dates and approximate times of occurrences.

(iv) The cause of each component or system failure or personnel error, if known.

(v) The failure mode, mechanism, and effect of each failed component, if known.

(vi) For failures of components with multiple functions, include a list of systems or secondary functions that were also affected.

(vii) For failure that rendered a train of a safety system inoperable, an estimate of the elapsed time from the discovery of the failure until the train was returned to service.

(viii) The method of discovery of each component or system failure or procedural error.

(ix) For each human performance related root cause, the licensee shall discuss the cause(s) and circumstances.

(x) Automatically and manually initiated safety system responses.

(xi) The manufacturer and model number (or other identification) of each component that failed during the event.

(c) An assessment of the safety consequences and implications of the event. This assessment must include:

(i) The availability of systems or components that could have performed the same function as the components and systems that failed during the event, and

(ii) For events that occurred when the reactor was shutdown, the availability of systems or components that are needed to shutdown the reactor and maintain safe shutdown conditions, remove residual heat, control the release of radioactive material, or mitigate the consequences of an accident.

(d) A description of any corrective actions planned as a result of the event, including those to reduce the probability of similar events occurring in the future.

(e) Reference to any previous similar events at the same plant that are known to the licensee.

(f) The name and telephone number of a person within the licensee's organization who is knowledgeable about the event and can provide additional information concerning the event and the plant's characteristics.

21. Radiation protection and radioactive waste management.

(1) The licensee shall establish and implement a program to ensure that, in all operational states, doses due to exposure to ionizing radiation in the plant or due to any planned releases of radioactive material from the plant are kept below prescribed limits and be as low as reasonably achievable. This program shall meet the requirements of regulations on radiation protection and shall be approved by the Authority.

(2) The radiation protection function of the licensee shall have sufficient independence and resources to enforce and advise on radiation protection regulations, standards and procedures, and safe working practices.

(3) The program shall be based on a prior assessment and shall cover:

(a) Classification of areas and access control, including local information on actual dose rates and contamination levels;

(b) Co-operation in establishing operating and maintenance procedures when radiological hazards are anticipated, and providing direct assistance when required;

(c) Instrumentation and equipment for monitoring;

(d) Equipment for personnel protection;

(e) On-site radiological monitoring and surveys;

(f) Decontamination of personnel, equipment and structures;

(g) Environmental radiological surveillance and monitoring;

(h) Control of dispatch of radioactive materials, including transfers and disposal of solid radioactive waste;

(i) Control and monitoring of radioactive liquid and gaseous releases.

(4) All site personnel shall have individual responsibility for putting into practice the exposure control measures, which shall be specified in the radiation

protection program. Consequently, particular emphasis shall be given to training of these site personnel so that they are aware of radiological hazards and of necessary protective measures.

(5) All site personnel working in a controlled area shall have their occupational exposures assessed in accordance with the licensee requirements. Dose records shall be kept as required and made available to the Authority.

(6) The implementation of the radiation protection program shall be ensured by the appointment of qualified manager health physics. Manager health physics shall advise the plant management and shall have authority to participate in the establishing and enforcing of safety procedures

(7) The radiation protection program shall provide for the medical surveillance of site personnel who may be occupationally exposed to radiation to ascertain their physical fitness and to provide the basis for medical treatment in case of accidental over-exposures. The medical surveillance consists of a preliminary medical examination, followed by required and periodic routine examinations.

(8) The licensee shall verify, by means of surveillance, inspections and audits, that the radiation protection program is being correctly implemented and that its objectives are being met, and shall undertake corrective actions if necessary. The program shall be reviewed and updated in the light of experience and submitted to the Authority.

(9) The licensee shall perform a safety analysis for radioactive discharges, which demonstrates that the assessed radiological impacts and doses to the general public are kept as low as reasonably achievable. The licensee shall submit this analysis to the Authority as required, but in any case before initial fuel loading. Any authorized discharge limits shall be included in the operational limits and conditions.

(10) The licensee shall establish and implement procedures for monitoring and controlling discharges of radioactive effluents. A copy of these procedures shall be made available to the Authority.

(11) The generation of radioactive waste shall be kept to the minimum practicable in terms of both activity and volume, by appropriate operating practices. Treatment and interim storage of radioactive waste shall be strictly controlled in a manner consistent with the requirements for safe final disposal.

(12) The licensee shall establish and implement a program to manage radioactive waste safely. This program shall include collection, segregation, treatment,

conditioning, on-site transport and storage, and dispatch of radioactive wastes and shall be approved by the Authority.

(13) The licensee shall establish and implement a program for monitoring the environment in the vicinity of the plant in order to assess the radiological impacts of radioactive releases on the environment and the program shall be submitted to the Authority before the first fuel load for approval.

22. Maintenance, testing, surveillance and inspection of safety /safety related structures, systems and components.

(1) The licensee shall prepare and implement programs of maintenance, testing, surveillance and inspection of those structures, systems and components, which are important to safety. These programs shall be in place prior to fuel loading. These shall take into account operational limits and conditions as well as any other applicable regulatory requirements and shall be re-evaluated in the light of experience.

(2) The maintenance, testing, surveillance and inspection of all plant structures, systems and components important to safety shall be to such a standard and at such a frequency as to ensure that their levels of reliability and effectiveness remain in accordance with the assumptions and intent of the design throughout the service life of the plant.

(3) The program shall include periodic inspections or tests of systems, structures and components important to safety in order to demonstrate their reliability and to determine whether these are acceptable for continued safe operation of the plant or whether any remedial measures are necessary.

(4) Repairs to structures, systems and components shall be performed as promptly as practicable. Priorities shall be established with account taken first of the relative importance to safety of the defective structure, system or component.

(5) The licensee shall establish procedures for all maintenance, testing, surveillance and inspection tasks. These documents will normally be prepared in co-operation with the designers, the plant and equipment suppliers, and the quality assurance and radiation protection personnel. The documents shall include provisions for keeping exposure of site personnel as low as is reasonably achievable. These procedures shall be prepared, reviewed, validated, issued and modified in accordance with established administrative procedures. The plant management shall ensure that the relevant personnel during these activities carefully follow these instructions

(6) The frequency of preventive and predictive maintenance, testing, surveillance and inspection of individual structures, systems and components shall be determined on the basis of:

(a) The importance to safety of the structures, systems and components;

(b) Their inherent reliability;

(c) Their assessed potential for degradation in operation and their aging characteristics;

(d) Operational experience

(e) Vendors recommendation

(7) A comprehensive work planning and control system shall be implemented to ensure that maintenance, testing, surveillance and inspection work is properly authorized and is carried out in accordance with established procedures. Co-ordination shall be established among different maintenance groups (for mechanical, electrical, instrumentation and control, and civil maintenance), and with operations and support groups (groups for fire protection, radiation protection, physical protection and industrial safety).

(8) The work control system shall ensure that plant equipment is only released from service for maintenance, testing, surveillance or inspection with the authorization of designated operations staff and in compliance with the operational limits and conditions. It shall also ensure that, following maintenance, the plant is not returned to service before completion of a documented check of its configuration and, where appropriate, a functional test.

(9) Following any abnormal event, the licensee shall revalidate the safety functions and functional integrity of any component or system, which may have been challenged by the event. Necessary remedial actions shall include inspection, testing and maintenance as appropriate.

(10) Arrangements shall be made to procure, receive, store and issue parts and materials for use in the plant.

(11) Data on maintenance, testing, surveillance and inspection shall be recorded, stored and analyzed to confirm that performance is in accordance with design assumptions and with expectations on equipment reliability.

(12) The plant management shall ensure the effective performance and control of maintenance activities during planned and forced outages. The tasks and responsibilities of different organizational units and individuals in outages shall be clearly defined in writing.

23. Plant modifications.

(1) Modifications involving plant configuration and the operational limits and conditions, shall conform to the requirements set out in the regulations PAK/ 911. In particular, the capability of performing all safety functions shall not be degraded. Safety and enhancement of safety shall be considered in connection with all actions causing plant modifications.

(2.) The licensee may make changes in the procedures as described in the safety analysis report, and conduct tests or experiments not described in the safety analysis report, without prior Pakistan Nuclear Regulatory Authority approval, unless the proposed change, test or experiment involves a change in the operating instructions and procedures incorporated in the licence or an un-reviewed safety question.

(3) A proposed change, test, or experiment shall be deemed to involve an un-reviewed safety question

(a) if the probability of occurrence or the consequences of an accident or malfunction of equipment important to safety previously evaluated in the safety analysis report may be increased; or

(b) if a possibility for an accident or malfunction of a different type than any evaluated previously in the safety analysis report may be created; or

(c) if the margin of safety as defined in the basis for any operating instructions and procedures is reduced.

(4) The licensee shall maintain records of changes in the facility and of changes in procedures made, to the extent that these changes constitute changes in the facility as described in the safety analysis report or to the extent that these constitute changes in procedures as described in the safety analysis report. The licensee shall also maintain records of tests and experiments carried out. These records must include a written safety evaluation which provides the bases for the determination that the change, test, or experiment does not involve an un-reviewed safety question.

(5) The licensee shall submit, a report containing a brief description of any changes, tests, and experiments, including a summary of the safety evaluation of each. The report shall be submitted annually.

(6) The licensee shall establish a procedure to ensure proper design, review, control and implementation of all permanent and temporary modifications. This procedure shall ensure that the requirements of the plant safety analysis report and applicable regulations are met.

(7) Implementation and testing of plant modifications shall be performed in accordance with the plant's work control system and appropriate testing procedures.

(8) Prior to putting the plant back into operation after modifications, all relevant documents for shift operators necessary for the operation of the plant after the modifications shall be updated and personnel shall be trained as appropriate.

(9) Temporary modifications (including defeat of interlocks, installation of jumpers and lifted leads) shall be clearly identified at the point of application and any relevant control position. Operating personnel shall be clearly informed in writing of these temporary modifications and of their consequences for the operation of the plant, under all operating conditions. A record of temporary modifications shall be available in MCR

(10) Modifications relating to organizational aspects that are relevant to the safe operation of the plant shall be submitted to the Authority for approval.

(11) The licensee management shall establish a procedure for updating documents as soon as possible after modification, installation and testing. Responsibilities for the revision of all documents such as drawings, procedures, safety analysis report, operational limits and conditions, system description, training material including simulator, vendor equipment manuals and spare parts lists shall be clearly assigned.

24. Records and reports.

(1) The licensee shall make arrangements for control of records and reports important to safety.

(2) The arrangements for management of records shall provide for:

(a) Categorization of permanent and non-permanent records;

(b) Stipulation of retention periods, with account taken of the Authority requirements;

(c) Establishment of procedures for updating of records or addition of supplements;

(d) Receipt control, including completeness reviews;

(e) Retrieval, accessibility and disposal arrangements;

(f) Suitability of storage arrangements, including considerations for fire protection and security;

(g) Requirements for duplication of records and storage in separate locations;

(h) Preservation of records, including measures to prevent deterioration;

(i) Periodic review by sampling and inspection.

(3) The management of records shall include records in respect of:

(a) Design specifications:

(b) Safety analyses;

(c) Equipment and material supplied;

(d) As-built installation drawings;

(e) Manufacturers' documentation;

(f) Commissioning documents;

(g) Plant operational data;

(h) Events and incidents;

(i) Amounts and movements of fissile, fertile, radioactive and other special materials;

(j) Data from maintenance, testing, surveillance and inspection;

(k) History of and data on modifications;

(l) Quality assurance;

(m) Qualifications, positions, medical examinations and training of site personnel;

(n) Plant chemistry;

(o) Occupational exposure;

(p) Radiation surveys;

(q) Discharges of effluents;

(r) Environmental monitoring;

(s) Storage and transport of radioactive waste;

(t) Periodic safety reviews;

(u) Decommissioning documents

(4) The document management system shall be such as to ensure that only the latest version of each document is used by personnel. Off-site storage of essential documents, such as the emergency plan, for use in the event of an emergency shall be considered.

(5) Periodic summary reports on matters relating to safety shall be provided by the licensee to the Authority as required. Reports and records relevant to reviews carried out following abnormal events and accidents shall be kept as required and shall be available to the Authority.

25. Periodic safety review.

(1) Systematic safety reassessments of the plant in accordance with the requirements given in the regulations PAK/909 shall be performed by the licensee throughout its operational lifetime, with account taken of operating experience and significant new safety information from all relevant sources.

(2) A comprehensive periodic safety review (PSR) of the plant would fulfill this requirement. The strategy for the review shall be agreed between the licensee and the Authority.

(3) The scope of the PSR shall include all safety aspects of an operating plant, including both on-site and off-site emergency planning, accident management and radiation protection aspects.

(4) It shall be determined by means of the PSR to what extent the existing safety analysis report remains valid. The PSR shall take into account the plant

design, actual conditions of systems, structures and components, equipment qualification, ageing, deterministic safety analysis, probabilistic safety analysis, hazard analysis, safety performance, use of experience from other plants and research findings, organization and administration, procedures, human factors, emergency planning, radiological impact on the environment and global assessment.

(5) In order to complement the deterministic assessment, use of probabilistic safety assessment (PSA) shall be made for input to the PSR to provide insight into the relative contributions to safety of different aspects of the plant.

(6) On the basis of the results of the systematic safety reassessment, the licensee shall implement necessary corrective actions and reasonably practical modifications for compliance with applicable standards.

26. Decommissioning.

(1) The licensee shall put in place arrangements for decommissioning the plant (including funding arrangements), which shall be agreed to by the Authority well in advance of shutdown of the plant.

(2) The licensee shall be aware, over the operating lifetime of the plant, of the needs in respect of eventual decommissioning. Experience in handling contaminated or irradiated structures, systems and components in modification and maintenance activities at the plant shall be recorded in order to facilitate the planning of decommissioning.

(3) For decommissioning, the standards equivalent to those applied to normal operations shall be used in respect of handling fissile material and dealing with the radioactive inventory. The safety analysis report shall be revised to provide the safety justification for the various stages of decommissioning. The safety analysis report shall be scrutinized to derive operational limits and conditions, surveillance and inspections during decommissioning. The measures shall take into account the assessed risk. As a given decommissioning stage is entered, the relevant requirements for operational limits and conditions shall be fulfilled. Records such as descriptions and drawings shall be retained until no further safety function is performed or safety hazard presented.

(4) In case that dismantling of nuclear power plant will be deferred for a significant period of time after final shutdown (i. e. a few decades), consideration shall be given to the problem of the storage of drawings, reports and other information which may be required for the dismantling project.

ANNEX I

Criteria for Appointment of General Manager/Plant Manager of Nuclear Power Plants (NPPs)

(1) The owner/operating organization shall appoint General Manager (GM)/ Plant Manager (PM) of Nuclear Power Plants assurancing of required qualities of his/her safety leadership and conservative decision making so as to implement effective policies that give due priority to safety.

(2) The candidate shall have an overall power plant experience of about twenty five (25) years, including a minimum of fifteen (15) years experience at Nuclear Power Plant and proven managerial and administrative skills.

(3) The candidate shall be experienced as a licensed shift supervisor at the NPP or have participated in commissioning of the NPP or of an NPP of similar design.

Or

The General Manager/ Plant Manager shall have Deputy Plant Manager, who meets the requirements as given in (3) above.

In the absence of Deputy Plant Manager, the senior most licensed Shift Supervisor shall officiate.

(4) The candidate shall have knowledge and skill in the following areas:

(a) Problem analysis and conservative decision making,

(b) Radiological Safety,

(c) Emergency plan and procedures,

(d) Interpersonal / departmental communication,

(e) Administrative policies and procedures

ANNEX II

Criteria for Appointment of Station Health Physicist

(1) Shall be a graduate in engineering or master in science/health physics with a minimum of six (6) years related experience which shall include four (4)

years at a nuclear power plant in supervision of radiation protection, monitoring and control activities.

(2) Shall be familiar with the implementation of legislative and regulatory framework of the Pakistan Nuclear Regulatory Authority on nuclear safety and radiation protection for general public and plant personnel.

(3) Shall be familiar with the Station Emergency plans for accident situation and capable of implementing/ exercising this plan by all organizations concerned. This capability to implement emergency plans shall be in place before the commencement of commercial operations.

(4) Shall be familiar with procedure/principle for radioactive releases. Shall be capable of handling the emergency situations in which any failure or combination of failures leading to significant radiological consequences, the exposure to radiation of site personnel and releases of radioactive materials to the environment be kept as low as reasonably achievable

(5) Shall be familiar with the reporting of incidents significant to safety to the Authority in accordance with the relevant national and international regulations.

(6) Shall be vigilant about the activities of operation, inspection, testing, maintenance & supporting functions, the personnel involved are adequately trained and authorized in accordance with nuclear safety and radiation protection procedures.

(7) Shall be familiar with procedures for radioactive waste treatment and interim storage and safe disposal thereafter.

ANNEX III

Criteria for Shift Supervisor License

1. All licences shall be issued under the Authority of the Chairman or by an officer designated by the Chairman.

2. The licence shall be one of the prerequisites for plant operations, in a specific category of Shift Supervisor.

3. The issuance of licence shall be carried out in three (3) different steps as per clauses 4, 6 and 7 of this annex.

4. Pre-requisites.

Each applicant is required to undergo in-class and field training, to be arranged by the licensee/plant management. After successful completion of in-class training and acquiring the prescribed minimum experience for each category as per clause 6, the candidate will become eligible to appear in the written licensing examination.

5. Licensing Examination.

(1). Each candidate has to qualify written, oral and operating examinations.

(2) The licensee/plant management shall conduct all the written licensing examinations.

(3) Oral and Operating Examination of the individuals, qualifying the written examinations as per clause 7 and recommended by the licensee/plant management, will be conducted by the Authority.

6. Eligibility Criteria.

(1) The candidate shall possess Shift Engineer Licence of the Plant.

(2) The candidate shall have acquired a minimum of ~~three (3) years~~ [*] one (1) year in shift experience after the award of Shift Engineer Licence at the Plant. This experience may include commissioning experience at the Plant.

(3) The candidate shall qualify the written, operating and oral examinations as per clauses 5 and 7.

(4) Separate eligibility criteria will be issued for new plant.

7. Issuance of Licence

(1) The technical knowledge, skills and abilities of a candidate to perform the duties, as per approved operation documents, in a safe manner under all operational and accident states will be determined through written, operating and oral examination. The written examination will comprise of papers listed in sub-clause 7.2.

(2) The courses for licensing examination should cover the following subjects:

(a) Radiation Protection

---

[*] Amended vide SRO 1151 (I)/2008 dated November 3, 2008 in Clause 2 of Regulation 6 in Annex III

(b) Nuclear Safety and Technical Specification/ Operating Policies & Principles

(c) Nuclear Specifics

(d) Conventional Specifics

All papers shall carry equal marks with no less than 50% marks in non-objective (descriptive) examination.

(3) Courses/syllabus for the training/retraining required and the written / examination for each category of licence shall be prepared by the licensee/plant management and duly approved by the Authority.

(4) The candidate will qualify for operating test and oral examination only if all the written test papers are passed separately. The pass marks for the written test shall be 75% in each paper.

(5) The licensee/plant management shall apply to the Authority on the prescribed application form for licensing of operating personnel on the basis of oral and operating examination by the Authority along with the assessment on a separate sheet.

(6) The licensee/plant management shall provide certification of medical (including psychological) fitness of the candidate. Such certificate will also record whether the candidate is or has been on prolonged medical treatment during the last twelve (12) months.

(7) The candidate will normally be allowed only two (2) attempts to clear the operating and oral licensing examinations. In very exceptional cases and on specific recommendations/suggestions of the licensee/plant management, a third chance may be allowed by the Chairman or officer designated by the Chairman.

(8) Upon successfully clearing/passing the written, operating and oral examinations the operating licence will be issued to the candidate by the Chairman or officer designated by the Chairman subject to medical fitness.

8. Retraining of Operation Personnel.

(1) All licensed personnel shall have to undergo a formal retraining at the In-Plant Training Center of the Plant for two (2) periods of one (1) month each during a calendar year.

(2) After retraining such licensed individuals will be examined by the licensee/plant management to assess their continued technical/professional

competence for the assigned job. This assessment along with medical fitness certification shall be sent to the Authority for renewal of the licence.

Validity and Revalidation of Licence

9. Validity.

(1) All licences shall remain normally valid for a period of one (1) year. The licences will be extended for a further period of one (1) year by the Chairman or officer designated by the Chairman, on recommendation of the licensee/plant management and certifying compliance with retraining according to clause 8.

(2) A licence is deemed to be automatically cancelled on one of the following reasons:

(a) Inability of a licensed individual to carry out his duties for medical reasons as recommended by a duly constituted Medical Board.

(b) Permanent physical disability that renders the licensed individual unable to carry out the duties.

(c) Lack of familiarity as a result of being away from operations of the Plant for which licence was issued, for a period of more than one (1) year.

(d) Inability of licensed individual to complete retraining successfully as mentioned in clause 8.

(e) Failure of a licensed individual to perform a minimum of twenty (20) shift duties during a year and participation in one (1) startup. These twenty (20) shift duties should have been performed acting as independent in-charge of the shift.

(3) Upon issuance of notice of gross negligence/incompetence in performance of duties as assessed by the licensee/plant management or by the Chairman or officer designated by the Chairman, a licence shall summarily become invalid. In such cases, the aggrieved party may make appeal within two (2) weeks to the Chairman or officer designated by the Chairman for review of the decision. The licence, however, shall remain suspended until the appeal is disposed off.

10. Revalidation.

(1) Licensed Individuals who are at the Plant but fail to perform twenty shift duties in plant operations as Shift Supervisor have remained away from the plant operation (shift duties) for a period of more than a year but less than two (2) years, can re-acquire operation licence after the following:

(a) Successful completion of retraining as provided in clause 8

(b) Performance of one (1) month shift duty along with a licensed counterpart.

(c) Oral and operating examination by the Authority to ascertain familiarity of the candidate with the current status of the plant and the Plant operating procedures.

(2) Licensed individuals who have remained away from the Plant operation (shift duties) for a period of more than two (2) years shall undergo complete re-examination.

11. Retention of Record

Record of written examination/tests, medical fitness and all retraining exercises shall be retained by the licensee/plant management for ten (10) years or two (2) years after formal withdrawal of the licence, which ever is later.

12. Licensing of the Foreign Nationals

(1) Normally, all categories of licences for the operation of nuclear power plants in Pakistan are given only to the Pakistani Nationals. However, when and where necessary, as determined on case-to-case bases, such Non-Pakistani Nationals desirous of obtaining an operating licence of Shift Supervisor shall be required to comply with requirements as per clause 1 to 8 of this annex.

(2) In special cases, where a licence is to be issued for specific/finite duration to a Foreign National for operation of a nuclear power plant in Pakistan, the Chairman or officer designated by the Chairman may issue a licence subject to the following:

(a) Submission of documentary evidence that the applicant holds a valid operation licence of a comparable facility, issued by the regulatory body in the country where nuclear power plant is in operation, for the same category of licence for which application is made in Pakistan.

(b) Certification of medical (including psychological) fitness of the applicant.

(c) Ability of the applicant to communicate with local plant personnel in a working language of the Pakistan.

(d) Certification by the licensee/plant management regarding applicant's knowledge and competence to operate the Plant.

(e) Successfully qualifying an oral and operating examination conducted by the Authority.

13. Waiver and Exemption.

On application and certification of competency from the licensee/plant management, that issuance of a licence is in the national interest, the Chairman or any officer designated by the Chairman, may waive any or all requirements for a licence if it is satisfied that the candidate has had extensive actual experience of operation of similar or equivalent nuclear power plant, and that safety of the public and the environment will not be jeopardized or compromised by the issuance of licence.

ANNEX IV

Criteria for Shift Engineer Licence

1. All licences shall be issued under the Authority of the Chairman by an officer designated by the Chairman.

2. The licence shall be one of the prerequisites for plant operations, in a specific category of Shift Engineer.

3. The issuance of licence shall be carried out in three (3) different steps as per clause 4, 6 and 7 of this document.

4. Pre-requisites

Each applicant is required to undergo in-class and field training, to be arranged by the licensee/plant management. After successful completion of in-class training and acquiring the prescribed minimum experience for each category as per clause 6, the candidate will become eligible to appear in the written licensing examination.

5. Licensing Examination.

(1) Each candidate has to qualify written, oral and operating examinations.

(2) The licensee/plant management shall conduct all the written licensing examinations.

(3) Oral and Operating Examination of the individuals, qualifying the written examinations as per clause 7 and recommended by the licensee/plant management, will be conducted by the Authority.

6. Eligibility Criteria.

(1) The educational qualification for Shift Engineer Licence is a bachelor degree in engineering from a university recognized by Higher Education Commission in one of the following fields: Electrical, Mechanical, Chemical, Power or Nuclear

(2) The candidate shall possess a minimum of three (3) years of total operation experience at nuclear power plant, which shall include at least one (1) year operation experience at the Plant. This experience may include commissioning experience at the Plant. These periods include in-class and field training arranged by the licensee/plant management.

(3) The candidate shall qualify the written, operating and oral examinations as per clause 5 and 7.

7. Issuance of Licence.

(1) The technical knowledge, skills and abilities of a candidate to perform the duties, as per approved operation documents, in a safe manner under all operational and accident states will be determined through written, operating and oral examination. The written examination will comprise of papers listed in sub-clause 7 (2)

(2) The courses for licensing examination should cover the following subjects:

(a) Radiation Protection

(b) Nuclear Safety and Technical Specification/ Operating Policies & Principles

(c) Nuclear General

(d) Conventional General

All papers shall carry equal marks with no less than 50% marks in non-objective (descriptive) examination.

(3) Courses/syllabus for the training/retraining required and the written / examination for each category of licence shall be prepared by the licensee/plant management and duly approved by the Authority.

(4) The candidate will qualify for operating test and oral examination only if all the written test papers are passed separately. The pass marks for the written test shall be 75% in each paper.

(5) The licensee/plant management shall apply to the Authority on the prescribed application form for licensing of operating personnel on the basis of oral and operating examination by the Authority along with the assessment on a separate sheet.

(6) The licensee/plant management shall provide certification of medical (including psychological) fitness of the candidate. Such certificate will also record whether the candidate is or has been on prolonged medical treatment during the last twelve (12) months.

(7) The candidate will normally be allowed only two (2) attempts to clear the operating and oral licensing examinations. In very exceptional cases and on specific recommendations/suggestions of the licensee/plant management, a third chance may be allowed by the Chairman or officer designated by the Chairman.

(8) Upon successfully clearing/passing the written, operating and oral examinations the operating licence will be issued to the candidate by the Chairman or officer designated by the Chairman subject to medical fitness.

8. Retraining of Operation Personnel.

(1) All licensed personnel shall have to undergo a formal retraining at the In-Plant Training Center of the Plant for two (2) periods of one (1) month each during a calendar year.

(2) After retraining such licensed individuals will be examined by the licensee/plant management to assess their continued technical/professional competence for the assigned job. This assessment along with medical fitness certification shall be sent to the Authority for renewal of the licence.

Validity and Revalidation of Licence

9 Validity.

(1) All licences shall remain normally valid for a period of one (1) year. The licences will be extended for a further period of one (1) year by the Chairman or officer designated by the Chairman, on recommendation of the licensee/plant management and certifying compliance with retraining according to clause 8.

(2) A licence is deemed to be automatically cancelled on one of the following reasons:

(a) Inability of a licensed individual to carry out his duties for medical reasons as recommended by a duly constituted Medical Board.

(b) Permanent physical disability that renders the licensed individual unable to carry out the duties.

(c) Lack of familiarity as a result of being away from operations of the Plant for which licence was issued, for a period of more than one (1) year.

(d) Inability of licensed individual to complete retraining successfully as mentioned in clause 8.

(e) Failure of a licensed individual to perform a minimum of twenty (20) shift duties during a year and participation in one (1) startup.

(3) Upon issuance of notice of gross negligence/incompetence in performance of duties as assessed by the licensee/plant management or by the Chairman or officer designated by the Chairman, a licence shall summarily become invalid. In such cases, the aggrieved party may make appeal within two (2) weeks to the Chairman or officer designated by the Chairman, for review of the decision. The licence, however, shall remain suspended until the appeal is disposed off.

10. Revalidation.

(1) Licensed Individuals who are at the Plant but fail to perform twenty shift duties in plant operations as Shift Engineer or have remained away from the plant operation (shift duties) for a period of more than a year but less than two (2) years, can re-acquire operation licence after the following:

(a) Successful completion of retraining as provided in clause 8

(b) Performance of one (1) month shift duty along with a licensed counterpart.

(c) Oral and operating examination by the Authority to ascertain familiarity of the candidate with the current status of the plant and the Plant operating procedures.

(2) Licensed individuals who have remained away from the Plant operation (shift duties) for a period of more than two (2) years shall undergo complete re-examination.

11. Retention of Record.

Record of written examination/tests, medical fitness and all retraining exercises shall be retained by the licensee/plant management for ten (10) years or two (2) years after formal withdrawal of the licence, which ever is later.

12. Licensing of the Foreign Nationals.

(1) Normally, all categories of licences for the operation of nuclear power plants in Pakistan are given only to Pakistani Nationals. However, when and where necessary, as determined on case to case bases, such Non-Pakistani Nationals desirous of obtaining an operating licence of Shift Engineer shall be required to comply with requirements as per clause 1 to 8 of this annex.

(2) In special cases, where a licence is to be issued for specific/finite duration to a Foreign National for operation of a nuclear power plant in the Pakistan, the Chairman or officer designated by the Chairman, may issue a licence subject to the following:

(a) Submission of documentary evidence that the applicant holds a valid operation licence of a comparable facility, issued by the regulatory body in the country where nuclear power plant is in operation, for the same category of licence for which application is made in Pakistan.

(b) Certification of medical (including psychological) fitness of the applicant.

(c) Ability of the applicant to communicate with local plant personnel in a working language of Pakistan.

(d) Certification by the licensee/plant management regarding applicant's knowledge and competence to operate the Plant.

(e) Successfully qualifying an oral and operating examination conducted by the Authority.

13. Waiver and Exemption.

On application and certification of competency from the licensee/plant management, that issuance of a licence is in the national interest, the Chairman or any officer designated by the Chairman, may waive any or all requirements for a licence if it is satisfied that the candidate has had extensive actual experience of operation of similar or equivalent nuclear power plant, and that safety of the public and the environment will not be jeopardized or compromised by the issuance of licence.

ANNEX V

Criteria for Reactor Operator Licence

1. All licences shall be issued under the Authority of the Chairman by an officer designated by the Chairman.

2. The licence shall be one of the prerequisites for plant operations, in a specific category of "Reactor Operator".

3. The issuance of licence shall be carried out in three (3) different steps as per clauses 4, 5 and 6 of this document.

4. Pre-requisites

Each applicant is required to undergo in-class and field training, to be arranged by the licensee/plant management. After successful completion of in-class training and acquiring the prescribed minimum experience for each category as per clause 6, the candidate will become eligible to appear in the written licensing examination.

5. Licensing Examination

(1) Each candidate has to qualify written, oral and operating examinations.

(2) The licensee/plant management shall conduct all the written licensing examinations.

(3) Oral and Operating Examination of the individuals, qualifying the written examinations as per clause 7 and recommended by the licensee/plant management, will be conducted by the Authority.

6. Eligibility Criteria

(1) The minimum educational qualification for Reactor Operator Licence is a three (3) year diploma from a recognized Polytechnic Institute in any one of the following fields of technology: Electrical, Mechanical, Power or Chemical.

(2) The candidate shall possess an experience of shift operation at nuclear power plant for a minimum period of three (3) years, which shall include at least one (1) year operation experience at the Plant. These periods include in class and field training arranged by the licensee/plant management.

(3) The candidate shall qualify the written, operating and oral examinations as per clause 5 and 7.

7. Issuance of Licence

(1) The technical knowledge, skills and abilities of a candidate to perform the duties, as per approved operation documents, in a safe manner under all operational and accident states will be determined through written, operating and oral examination. The written examination will comprise of papers listed in sub-clause 7 (2).

(2) The courses for licensing examination should cover the following subjects:

(a) Radiation Protection

(b) Nuclear Safety and Technical Specification/ Operating Policies & Principles

(c) Nuclear General

(d) Conventional General

All papers shall carry equal marks with no less than 50% marks in non-objective (descriptive) examination.

(3) Courses/syllabus for the training/retraining required and the written / examination for licence shall be prepared by the licensee/plant management and duly approved by the Authority.

(4) The candidate will qualify for operating test and oral examination only if all the written test papers are passed separately. The pass marks for the written test shall be 75% in each paper.

(5) The licensee/plant management shall apply to the Authority on the prescribed application form for licensing of operating personnel on the basis of oral and operating examination by the Authority along with the assessment on a separate sheet.

(6) The licensee/plant management shall provide certification of medical (including psychological) fitness of the candidate. Such certificate will also record whether the candidate is or has been on prolonged medical treatment during the last twelve (12) months.

(7) The candidate will normally be allowed only two (2) attempts to clear the operating and oral licensing examinations. In very exceptional cases and on specific recommendations/suggestions of the licensee/plant management, a third chance may be allowed by the Chairman or officer designated by the Chairman subject to medical fitness.

(8) Upon successfully clearing/passing the written, operating and oral examinations the operating licence will be issued to the candidate by the Chairman or officer designated by the Chairman.

8. Retraining of Operation Personnel

(1) All licensed personnel shall have to undergo a formal retraining at the In-Plant Training Center of the Plant for two (2) periods of one (1) month each during a calendar year.

(2) After retraining such licensed individuals will be examined by the licensee/plant management to assess their continued technical/professional competence for the assigned job. This assessment along with medical fitness certification shall be sent to the Authority for renewal of the licence.

VALIDITY AND REVALIDATION OF LICENCE

9. Validity

(1) All licences shall remain valid normally for a period of one (1) year. The licences will be extended for a further period of one (1) year by the Chairman or officer designated by the Chairman, on recommendation of the licensee/plant management and certifying compliance with retraining according to clause 8.

(2) A licence shall be deemed to be automatically cancelled on one of the following reasons:

(a) Inability of a licensed individual to carry out his duties for medical reasons as recommended by a duly constituted Medical Board.

(b) Permanent physical disability that renders the licensed individual unable to carry out the duties.

(c) Lack of familiarity as a result of being away from operations of the Plant for which licence was issued, for a period of more than one (1) year.

(d) Inability of licensed individual to complete retraining successfully as mentioned in clause 8.

(e) Failure of a licensed individual to perform a minimum of twenty (20) shift duties during a year and participation in one (1) startup.

(3) Upon issuance of notice of gross negligence/incompetence in performance of duties as assessed by the licensee/plant management or by the Chairman or officer designated by the Chairman, a licence shall summarily become invalid. In such cases, the aggrieved party may make appeal within two (2) weeks to the Chairman or officer designated by the Chairman, for review of the decision. The licence, however, shall remain suspended until the appeal is disposed off.

10. Revalidation

(1) Licensed Individuals who are at the Plant but fail to perform twenty shift duties in plant operations as Reactor Operator or have remained away from the plant operation (shift duties) for a period of more than a year but less than two (2) years, can re-acquire operation licence after the following:

(a) Successful completion of retraining as provided in 8

(b) Performance of one (1) month shift duty along with a licensed counterpart.

(c) Oral and operating examination by the Authority to ascertain familiarity of the candidate with the current status of the plant and the Plant operating procedures.

(2) Licensed individuals who have remained away from the Plant operation (shift duties) for a period of more than two (2) years shall undergo complete re-examination.

11. Retention of Record

Record of written examination/tests, medical fitness and all retraining exercises shall be retained by the licensee/plant management for ten (10) years or two (2) years after formal withdrawal of the licence, which ever is later.

12. Licensing of the Foreign Nationals

(1) Normally, all categories of licences for the operation of nuclear power plants in Pakistan are given only to Pakistani Nationals. However, when and where necessary, as determined on case to case bases, such Non-Pakistani Nationals desirous of obtaining an operating licence of Reactor Operator shall be required to comply with requirements as per 1 to 8 of this annex.

(2) In special cases, where a licence is to be issued for specific/finite duration to a Foreign National for operation of a nuclear power plant in Pakistan, the Chairman, or officer designated by the Chairman, may issue a licence subject to the following:

(a) Submission of documentary evidence that the applicant holds a valid operation licence of a comparable facility, issued by the regulatory body in the country where nuclear power plant is in operation, for the same category of licence for which application is made in Pakistan.

(b) Certification of medical (including psychological) fitness of the applicant.

(c) Ability of the applicant to communicate with local plant personnel in a working language of Pakistan.

(d) Certification by the licensee/plant management regarding applicant's knowledge and competence to operate the Plant.

(e) Successfully qualifying an oral and operating examination conducted by the Authority.

12. Waiver and Exemption

On application and certification of competency from the licensee/plant management, that issuance of a licence is in the national interest, the Chairman or any officer designated by the Chairman may waive any or all requirements for a licence if it is satisfied that the candidate has had extensive actual experience of operation of similar or equivalent nuclear power plant, and that safety of the public

and the environment will not be jeopardized or compromised by the issuance of licence.

ANNEX VI

Regulatory requirements for Refueling of LWR Reactors that do not require on-power Refueling.

1. The licensee shall submit the following documents to the Authority two (2) months before the scheduled shutdown for refueling outage:

(1) A refueling safety analysis report which shall include prediction of core condition after completing refueling and comparison of core prediction results with the technical specifications of the plant.

(2) Administrative procedure(s) describing the following

(a) Overall organizational set-up for the refueling outage including outside organizations;

(b) Responsibilities and authorities of various divisions/sections of the licensee's organization for the refueling outage;

(c) Responsibilities and authorities of outside organizations involved in activities during refueling outage;

(d) Interfaces and communication lines within the licensee and with other organizations;

(e) Licensee's control measures on the activities to be performed by outside organizations.

(3) Training program for personnel involved in activities during refueling outage but are not part of plant organization regarding access control, radiation protection, work control, reporting of event, and other relevant administrative requirements;

(4) Detailed refueling plan and schedule for the activities to be conducted during refueling outage including the following:

(a) Handling and transportation of fuel and other core components and their inspections;

(b) Maintenance, modification and subsequent testing of structures, systems and components important to safety;

(c) In-Service Inspections of structures, systems and components important to safety;

(d) Surveillance tests of structures, systems and components important to safety;

(e) Tests during fuel unloading and loading;

(f) Criticality tests and subsequent tests at low power and power ascension;

(5) Dose estimation for the refueling outage, bases for the estimation, and the methodology adopted/procedure followed for dose estimation;

(6) Estimation for radioactive wastes generation during the refueling outage including gaseous, liquid and solid wastes, methodology adopted/procedure followed for the estimation, and capability/resources to handle, store and dispose-off the radioactive waste safely;

(7) Establishing personnel and process qualification requirements for personnel engaged and processes involved in various activities during the refueling outage.

2. Any subsequent change in these documents shall also be submitted to the Authority immediately.

3. Requirements for verification of key activities during refueling outage shall be established. The personnel conducting the verification functions shall be independent of those responsible for performing the activity.

4. The licensee shall provide any other document and information as required by the Authority to facilitate inspections and assessments activities of the Authority.

5. After refueling of the plant, the licensee shall submit an application for making the reactor critical to the Authority one (1) week before the expected criticality date. The application shall contain the following:

(1) Report on implementation of the refueling plan;

(2) Report on major problems encountered and events occurred during refueling outage, their causes and the corrective action taken/planned;

(3) Refueling outage activities, which may affect safety, if any, that could not be completed along with the reason and any safety implication due to this;

(4) Assessment report on the doses received by the workers during refueling outage and a comparison with the dose estimated for the outage.

6. The licensee shall not make the reactor critical without the Authority approval.

7. The licensee shall submit completion report on refueling shutdown activities within four (4) months of making the reactor critical following refueling outage. The report shall include the following:

(1) An overall summary of refueling activities

(2) Details of implementation of the refueling plan;

(3) Results of criticality tests and subsequent tests at low power and power ascension;

(4) Test/inspection reports of important activities;

(5). Details of doses received during the refueling outage including overall dose, doses received by individuals, doses received in specific activities in high radiation areas, overexposure of individual, if any, and comparison with the estimated doses for the outage;

(a) Details of radioactive waste generated and released during the refueling outage and comparison with the estimation made for the outage;

(b) Description of the activities that were not completed along with the reason and safety implications of such non-completed activities.

(c) Details of major problems encountered and events occurred during the outage, their root causes, and the corrective actions taken/planned to rectify the situation and avoid recurrence.

(d) Conclusion.

ANNEX VII

Fracture Toughness Requirements for Protection against Pressurized Thermal Shock Events.

1. For each pressurized water nuclear power reactor, the licensee shall have projected values of RT_{PTS}, accepted by the Authority, for each reactor vessel beltline material for the EOL fluence of the material. The assessment must specify the bases for the projected value of RT_{PTS} for each vessel beltline material, including the assumptions regarding core loading patterns, and must specify the copper and nickel contents and the fluence value used in the calculation for each beltline material. This assessment must be updated whenever there is a significant change in projected

values of RT_{PTS}, or upon request for a change in the expiration date for operation of the facility.

2. The pressurized thermal shock (PTS) screening criterion is 270 F for plates, forgings, and axial weld materials, and 300 F for circumferential weld materials. For the purpose of comparison with this criterion, the value of RT_{PTS} for the reactor vessel must be evaluated, for each weld and plate, or forging, in the reactor vessel beltline. RT_{PTS} must be determined for each vessel beltline material using the EOL fluence for that material.

3. For each pressurized water nuclear power reactor for which the value of RT_{PTS} for any material in the beltline is projected to exceed the PTS screening criterion using the EOL fluence, the licensee shall implement those flux reduction programs that are reasonably practicable to avoid exceeding the PTS screening criterion set forth. The schedule for implementation of flux reduction measures may take into account the schedule for submittal and anticipated approval by the Authority, of detailed plant-specific analyses, submitted to demonstrate acceptable risk with RT_{PTS} above the screening limit due to plant modifications, new information or new analysis techniques.

4. For each pressurized water nuclear power reactor for which the analysis that no reasonably practicable flux reduction program shall prevent RT_{PTS} from exceeding the PTS screening criterion using the EOL fluence, the licensee shall submit a safety analysis to determine what, if any, modifications to equipment, systems, and operation are necessary to prevent potential failure of the reactor vessel as a result of postulated PTS events if continued operation beyond the screening criterion is allowed. In the analysis, the licensee may determine the properties of the reactor vessel materials based on available information, research results, and plant surveillance data, and may use probabilistic fracture mechanics techniques. This analysis must be submitted at least three (3) years before RT_{PTS} is projected to exceed the PTS screening criterion.

5. After consideration of the licensee's analyses, including effects of proposed corrective actions, if any, the Authority, may, on a case-by-case basis, approve operation of the facility with RT_{PTS} in excess of the PTS screening criterion. The Authority will consider factors significantly affecting the potential for failure of the reactor vessel in reaching a decision.

6. If the Authority concludes, that operation of the facility with RT_{PTS} in excess of the PTS screening criterion cannot be approved on the basis of the licensee's analyses submitted, the licensee shall request and receive approval by the Authority, prior to any operation beyond the criterion. The request must be based upon modifications to equipment, systems, and operation of the facility in addition to

those previously proposed in the submitted analyses that would reduce the potential for failure of the reactor vessel due to PTS events, or upon further analyses based upon new information or improved methodology.

7. If the limiting RT_{PTS} value of the plant is projected to exceed the screening criteria cannot be satisfied, the reactor vessel beltline may be given a thermal annealing treatment to recover the fracture toughness of the material. The reactor vessel may continue to be operated only for that service period within which the predicted fracture toughness of the vessel beltline materials satisfy the requirements, with RT_{PTS} accounting for the effects of annealing and subsequent irradiation.

ANNEX VIII

Performance and Status of Licensed Personnel

1. A licensee shall file a report within twenty one (21) days of the occurrence of certain situations or events relating to the performance or status of personnel who have been licensed by the Authority, in response to any of the following situations or events:

(1) a termination of the employment of a licensed person in the position for which the person is licensed by the Authority.

(2) a failure, by a licensed person, to pass a re-qualification test referred to in the license or a failure of a licensed person to take any re-qualification test referred to in the license.

The report shall contain following:

(a) the full name and position of the licensed person;

(b) The date of any termination of employment of a licensed person in a position for which the person has been licensed;

(c) for any situation where a licensed person failed a re-qualification test referred to in the license, or failed to take any re-qualification test referred to in the license, the type and date of the test that the person failed or did not take; and

(d) the name and address of the sender of the report, the date of completion of the report and the signature of the designated representative of the licensee.

Reports of problems identified by research findings or revised analyses

2. A licensee shall, within twenty one (21) days of becoming aware, through research findings or new or revised safety analyses, of a problem or potential problem that represents a hazard or potential hazard to the health and safety of persons, security or the environment, or that is different in nature, greater in probability, or greater in magnitude than was previously analyzed. The problems, or potential problems, shall include the following occurrences:

(1) when a final safety analysis report for a nuclear power plant contains an assumption, input, analytical method or safety analysis result that is, or that may be, invalid;

(2) when a limit defined in the nuclear power plant licensing documents, or in annexure to these documents, is or may be inadequate to assure safety;

(3) when an analysis, from which a limit in a licensing document was derived, may be invalid or uncertain such that the margin of safety may be less than predicted;

(4) when the defined specifications of a safety system or of a safety-related system of a nuclear power plant are or may be invalid;

(5) when a nuclear power plant licensing document contains an error that, if accepted, relied or acted upon as being valid, could give rise to increased risks to the health and safety of persons, security or the environment; and

(6) when the measures that are in place for the purpose of protecting the environment from the operating impacts of a nuclear power plant are, or may be, inadequate.

The report shall include the following information:

(a) the identification of the nuclear power plant and any reactor unit(s) that is or may be affected by the problem or potential problem;

(b) the identification of any structure, system, component or function of the nuclear power plant that is or may be affected by the problem or potential problem;

(c) a description of the problem or potential problem, and its actual or potential safety-significance;

(d) a summary of the research or analysis that led to awareness of the problem or potential problem;

(e) an evaluation of the degree of any impairment of a safety system or safety-related system;

(f) a description of the corrective actions that have been taken, or that are proposed to be taken, to address the problem or potential problem; and

(g) the name and address of the sender of the report, the date of completion of the report and the signature of the designated representative of the licensee.

ANNEX IX

List of Regulatory Guides for Regulations on the Safety of Nuclear Power Plant Operation

PAK/1401	Staffing of nuclear power plants and the recruitment, training and authorisation of operation personnel
PAK/1402	In-service inspection for nuclear power plants
PAK/1403	Operational limits and conditions for nuclear power plants
PAK/1404	Commissioning procedures for nuclear power plants
PAK/1405	Radiation protection during operation of nuclear power plants
PAK/1406	Preparedness of the licensee for emergencies at nuclear power plants
PAK/1407	Maintenance of nuclear power plants
PAK/1408	Surveillance of items important to safety in nuclear power plants
PAK/1409	Management of nuclear power plants for safe operation
PAK/1410	Core management and fuel handling for nuclear power plants
PAK/1411	Operational management of radioactive effluents and wastes arising in nuclear power plants
PAK/1423	Guidance on being operator at the controls of a nuclear power plant
PAK/1427	Medical evaluation of nuclear power plant personnel requiring operating licenses
PAK/1428	Nuclear power plant simulators for use in operator training.
PAK/1433	Ultrasonic testing of reactor vessel welds during pre-service and in-service examination.

Copies of regulatory guides can be obtained from

PAKISTAN NUCLEAR REGULATORY AUTHORITY, P.O. Box 1912, Islamabad, Pakistan.

Sd/-
JAWAD A. HASHIMI,
Member.

PRINTED BY THE MANAGER, PRINTING CORPORATION OF PAKISTAN PRESS, ISLAMABAD
PUBLISHED BY THE DEPUTY CONTROLLER, STATIONERY & FORMS, UNIVERSITY ROAD, KARA(