

# **NUCLEAR REGULATORY AGENCY**

REPUBLIC OF BULGARIA

REPORT  
**2008**





Dear distinguished reader,

You are in possession of the successive Annual report of the Nuclear Regulatory Agency. It is being prepared in fulfilment of the requirements of the Act on the Safe Use of Nuclear Energy and has the objective to inform all interested parties on nuclear safety and radiation protection in Bulgaria as well as on the regulatory activities carried out by the NRA in 2008.

Underlying accent in the report is put on the safety of the Kozloduy NPP. Considering the objective indicators such as capacity factors, non planned reactor scrams, availability of the safety systems, occupational exposure, discharges into the environment - a high level of safety is maintained at the nuclear power plant. What we would like to see in addition to the good operational performance (and which is not related to replacement of equipment, software, etc) is a high safety culture - the pursuit of each and every worker for continuous improvement of safety, the ambition for a permanent affiliation to the best operational practices. Part of our regulatory activities will be focused in this direction in the coming years.

The modernization of units 5 & 6 was completed and an IAEA mission was carried out to review the level of programme implementation. The mission assessed to what extent have the identified safety issues been solved.. Experts from the IAEA, the Kozloduy NPP, external organizations involved in the modernization programme as well as representatives from the Bulgarian regulatory authority took part in the discussions. It was concluded that the content and scope of the measures implemented at the Kozloduy NPP units 5 & 6 are a good example of a large scale successful modernization of WWER-1000 reactors in operation and that the work carried out represents a considerable contribution towards safety improvement.

In 2008, the periodic safety review of the two units started. It is being carried out in accordance with the new legislation and in respect to an application for renewal of the operating licenses. The safety enhancement programme which will result from the review with no doubt will ensure the necessary succession and will focus the efforts of the power plant in a long term perspective.

Throughout the year, the NRA also began the review of the technical design of the Belene NPP. The task is extremely challenging for any regulatory authority and in this respect we are working jointly with Western European technical support organizations (review of the Safety Assessment Report), Bulgarian technical



support organizations (review of selected design solutions) and the IAEA (review of the Probabilistic Safety Analysis). We are convinced that in such a way we shall attain a higher level of objectivity in the assessment as well as a greater transparency in the licensing process.

With regard to the sites with sources of ionizing radiation, the efforts were focused towards ensuring safety and security of the sources and providing for the radiation protection of the personnel. The focal points throughout the year were the implementation of the Programme for Discovering and Collecting Orphan and Unregistered Sources Incorporated into Smoke Detectors and the Programme for Acceptance of RAW from Past Practices. Apparently, additional efforts are necessary for prevention of cases with sources found in scrap metal, as well as for further strengthening of the border control.

Maintaining of an updated and modern legislative system is one of the main tasks of the agency. A lot of efforts were put during the year in the preparation of a draft of an Act on Amendments and Supplements to the ASUNE and on finalizing the first group of regulatory guides on implementation of the Act and the regulations.

In an international perspective, the year was marked by the successful performance of the country at the Fourth review meeting under the Convention on Nuclear Safety, as well as the writing down of the national report and the preparation for the Third review meeting under the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management to be held in 2009. An important point is to avoid reports preparation and participation in the review meetings becoming a routine; to be proactive in identifying conclusions and lessons learned, as well as the challenges to the country nuclear sector.

There is no doubt that the year 2008 was fruitful, filled with a variety of activities and with hard work year. The hard task standing before us is to preserve and enhance our competence and effectiveness in the conditions of a crisis and I do believe that the Agency team can cope successfully with it.

Dr. Sergey Tzotchev  
NRA Chairman



## ADMINISTRATIVE CAPACITY

The state regulation of the safe use of nuclear energy and ionizing radiation and the safe management of radioactive waste and spent nuclear fuel is carried out by the Chairman of the Nuclear Regulatory Agency (NRA). In implementation of his legal responsibilities, the Chairman is supported by two deputy chairmen and administration.

NRA structure, activities and work organization are specified by the Rules of Procedure. The structure is in compliance with the Law on Administration, which provides uniform requirements with regard to the structure of administrations supporting the bodies of the executive power. No changes have taken place in the Rules of procedure and the structure of the Agency in 2008.

The NRA administration is organized in a General and a Specialized Administration divided into five departments, one of which has an on-site division at the Kozloduy NPP. The General Administration technically ensures the activity of the Chairman and provides administrative services to individuals and legal entities. The specialized administration assists the Agency Chairman in performing his regulatory and control functions with regard to nuclear facilities, sources of ionizing radiation, nuclear material and radioactive waste, emergency preparedness, and international cooperation.

### Human resources

In 2008, the main human potential in implementation of the Nuclear Regulatory Agency activities comprises of 102 employees, 84 of which have the statute of civil servants.

In the last years, the workload upon the NRA employees is being constantly increasing. This is due to the start-up of a number of large infrastructural projects such as the construction of a new nuclear power capacity (the Belene project) and the construction of a new repository for disposal of low and intermediate level radioactive waste (RAW), as well as to the constant increase in the number of sites using sources of ionizing radiation which are under NRA licensing and control.

The NRA management applies a systematic approach on purposeful influence upon the employees with the objective to enhance work effectiveness for attaining the strategic goals of the organization. In 2008, NRA efforts were focused mainly in the following directions:

- improvement of the system for planning of activities and human resources needs;
- further development of the system for succession planning;
- enhancement of the system for development of employees professional knowledge, skills and qualification, as well the implementation of an effective policy on enhancement of the qualification;
- effective and efficient utilization of the leadership skills of the management;
- promotion of the team work inside the organization, as well as the responsibility and accountability in tasks planning and implementation, etc.

Despite the abovementioned initiatives, the success in achieving the high organizational objectives to a large extent is due to the high motivation of the personnel. Through the results achieved throughout the year, the NRA employees proved that they are capable, responsible and motivated and that they possess the necessary competence and potential for successful implementation of the important objectives and assignments in their service to the society.

The working team, composed at the NRA, based on values such as transparency, honesty, mutual assistance, justice and confidence and assisted by good working and human relations is a precondition for the future success of the organization.

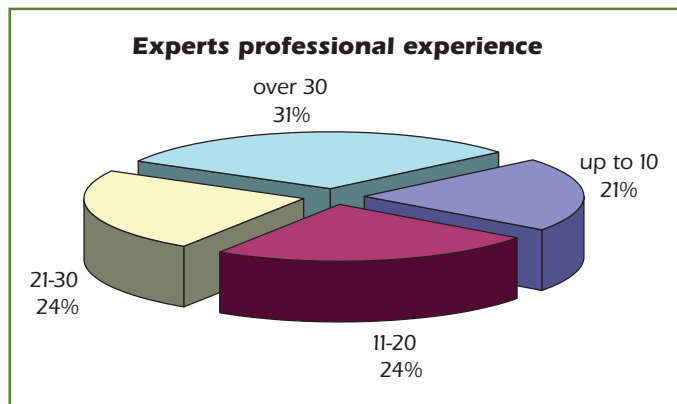




## Knowledge preservation

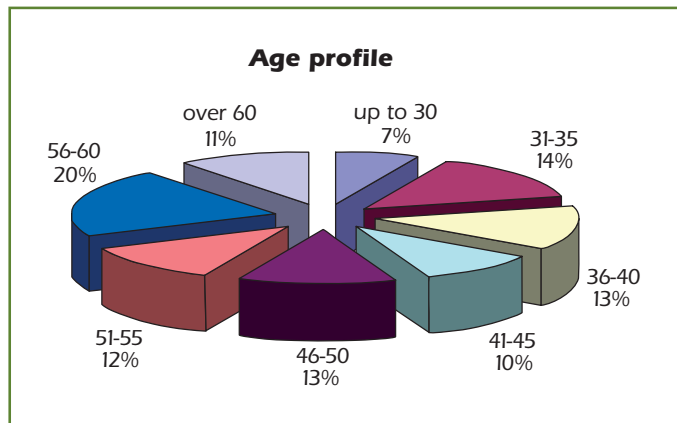
Knowledge preservation represents a milestone in the system for knowledge management in the organization. This is a process of establishing and maintaining a system of knowledge and skills to preserve and treasure beliefs, notions, behaviour and experience and to secure retrieval in the future when necessary. In such a way, well trained, competent, experienced and adequately authorized personnel are maintained available in the organization. The NRA periodically reassesses the risk of loss of knowledge due to retirement or leaving of key personnel, as well as ineffective transfer of the accumulated knowledge and skills inside the organization. Recruitment plans, plans for involvement and retention of key experts, individual plans for career development of the employees, as well as the succession plans for key job positions are being developed on the basis of the risk assessment.

One of the main challenges before the NRA in this respect is the increase in the average age and approaching the age for retirement of employees in key positions. The analyses show that out of the identified NRA key positions (a total of 23), retirement age in the next five years will be reached by seven employees, and in the next 10 years the age of retirement will be reached by 15 employees. These data show that close to a third of the employees in key positions would have to be replaced in the next 5 years. The succession plan developed by the NRA aims at ensuring the preparedness of the necessary personnel with the relevant knowledge and skills to replace each one of the key job positions. As a minimum the process of succession planning includes the following topics:



- review of succession arrangements in the organization;
- advance of the personnel with the required potential, including review of their development, selection of new candidates, preparation of individual training plans, etc.
- review and planning of management personnel training and development;
- development of internal documents related to the process;
- review of the future development of the authority in this direction.

In the last years the efforts of the management have been focused towards optimizing the NRA age profile. In this respect, the appointments of experienced experts with long term experience is balanced with the one of young employees with a career development potential. It has to be noted that 34 % of the job positions are occupied by employees of up to 40 years of age, which gives the possibility for succession of knowledge, skills and accumulated professional experience.



Throughout the year the NRA has been

left by 5 employees, two of them due to retirement, two have been employed in international organizations (EC and IAEA) and one has been transferred to a higher position in the state administration.

Job positions	Up to 30	31-40	41-50	51-60	Over 60	Total
Managerial	-	3	4	12	3	<b>22</b>
Expert	6	21	17	18	3	<b>65</b>
Supporting	1	3	5	4	2	<b>15</b>
Total	7	27	26	34	8	<b>102</b>

## Selection panels for appointment of new staff

The appointment of employees in the NRA is carried out through holding of selection panels for occupying free job positions in compliance with the requirements in the legislative documents: Act on Civil Servant; Code of Labour and the Regulation on Holding Selection Panels for Appointment of Civil Servants. The main demands towards the candidates are to meet the requirements on qualification, professional experience and personal capabilities, to be able to execute any assignment in a professional manner, and to dedicatedly work for the benefit of the society by applying the legislation in a strict and unbiased manner. The holding of appointment selection panels is one of the main instruments for selection of the most appropriate employees for holding the respective job position.

In 2008 five such selection panels were held in the NRA for appointment of civil servants for the following job positions:

- senior internal auditor;
- head of Decommissioning and Radioactive Waste Division;
- chief inspector in the On-site Operative Control of the Kozloduy NPP Division;
- chief inspector in the Licensing of Nuclear Facilities Division;
- senior legal advisor in the Legal Affairs Division.

Regardless of the fact that out of the five selection panels, four of them were closed with an appointment, the NRA takes into account the unfavourable tendency for decreasing interest to work in the state administration. An indicator for this fact is the decrease of the number of applicants for one vacancy. The fact that for the 5 vacancies there were only 7 candidates in total is alerting. As a comparison, in the selection panel for a senior legal adviser in the Legal Affairs Division in 2006 there were 11 candidates for the vacancy and in 2008 only one. The analyses of the causes show that the main contributing factor for the decrease in the number of candidates is the considerably lower level of the salaries in the state administration compared to the relevant job positions in the private sector.

## Training and qualification

To fulfil its important functions before the society, the NRA establishes and maintains a level of competence, which supports regulatory decision making with respect to the safety of nuclear facilities, as well as to facilities and activities involving sources of ionizing radiation. In this respect, the NRA employees possess the necessary qualification, which concerning the nuclear facilities, is in many cases supported by experience in operations and design. A systematic approach is applied towards the training and re-training of personnel to ensure the required qualification and competence of the NRA employees.



The Personnel Training Plan includes training on enhancement of the administrative skills carried out by the Institute of Public Administration and European Integration (IPAEI), as well as enhancement of expert knowledge and skills.

The tradition of employees training by IPAEI continued also in 2008 as a tool for achieving a better qualification in the training of administrative matters as well as foreign languages. The personnel is given the opportunity to improve their professional skills and thus to approximate in their practices the values and standards typical for the good European administrations and finally to bring the state administration to a higher more qualitative level of development.

In accordance with the Annual Training Plan for NRA Administration, a total of 16 employees completed IPAEI training courses in 2008, 4 of which foreign language courses. Six of the newly appointed employees completed training courses in civil service development, two of them being appointed for the first time at managerial positions. The planned financial resources for the carried out courses have been used to a 100 %.

Preparation and training for improvement of experts' knowledge and skills take into consideration the specifics of the different job positions and are based on a Systematic Approach to Training (SAT). To introduce the systematic approach at all stages, a Competency and Training Management System is being developed in the NRA. Recently, Competence Matrix have been developed and fully adapted for all main job positions and in all directions in accordance with the NRA organizational structure. A Software Tool Kit has been developed and is being applied, which will allow statistical data processing to identify the needs for periodical training and definition of priorities.

Special attention is paid to newly appointed employees. Any newcomer undergoes two types of training – general (courses on basic administrative knowledge and skills) and specialized – individual for each specific case, which is carried out through specialized courses and on-the-job by a designated supervisor (mentor). Those employees are given specific tasks with increasing complexity and mistakes are being indicated, the causes are being analyzed and discussed and finally additional training is carried out when necessary.

The NRA assists also the professional development of its employees and as an integral part of the process is the enhancement of qualification. Throughout the year two more civil servants defended successfully their thesis and received a PhD degree. The percentage of employees with higher education – master degree occupying managerial and expert positions (98 %) is also maintained.

## Performance appraisal

Pursuant to Article 76 of the Act on Civil Servant, a process of performance appraisal of NRA employees was performed through evaluation of the fulfilment of job requirements. All stages of the performance appraisal technological process were completed within the passed period. The analyses of the results highlighted an overall fulfilment of the functions by the organization, as well as increased managerial skills of the assessing and controlling managers.

Out of the 88 employees assessed, two received Grade 1 "Extraordinary performance", 13 received Grade 2 "Performance exceeds the requirements", 72 received Grade 3 "Performance meets the requirements" and only one received Grade 4 "Performance does not meet the requirements, improvement is needed". Compared to the previous year the number of employees evaluated with Grade 1 and 2 has increased, which is justified by the increased number of tasks being implemented by the same number of employees, as well as the improved quality of the work done. The assessment has been done objectively and with precision by the direct supervisors on the basis of work plans implementation, individual competencies and job descriptions of each and every employee.



## Financial Resources

The NRA revenue represents income from taxes collected under the Act on the safe use of nuclear energy (ASUNE) and the Tariff of taxes collected by the NRA under the ASUNE.

The Act on the State Budget of the Republic of Bulgaria for 2008 estimated the NRA revenue from state taxes to the amount of BGN 7,000,000. For the period from 1 January 2008 to 31 December 2008, the NRA real revenue from state taxes has amounted to BGN 7,650,146, and the revenue from interest and penalties has amounted to BGN 30,790. The determined by the Act expenses of the NRA budget are to the amount of BGN 8,405,500, and the actually spent amount is BGN 7 169 062.

The NRA 2008 budget allocates a considerably larger amount for operational costs of the authority, the main portion of which (about 70 %) have been spent for contracting of expert services related to the project for construction of a new nuclear power capacity (Belene NPP). About 12 % of the total expenses of the agency are the membership fees in international organizations such as the Joint Institute for Nuclear Research – Dubna and the International Atomic Energy Agency in Vienna, Austria and only 3 % are capital investments.

Throughout the year, the allocated NRA financial resources provided for the valuable and qualitative implementation of the regulatory functions.



## LEGISLATIVE BASIS

### Draft of an Act for Amendments and Supplements to the ASUNE

The Act on Safe Use of Nuclear Energy (ASUNE) is in force as of 2002 and settles the public relations pertaining to the state regulation of safety in the use of nuclear energy and ionizing radiation, the management of radioactive waste and spent fuel.

The necessity of amendments in the ASUNE arose following the ratification of the Convention on Physical Protection of Nuclear Material (promulgated State Gazette No. 16/21.02.2006). A working group was established at the NRA with the task to prepare the necessary amendments and supplements in the Act, including review of the new EU legislation and the new or amended documents of the International Atomic Energy Agency (IAEA). The working group was also entrusted with the task to analyze the experience from application of the Act and to propose appropriate amendments in case such are needed.

The amendments proposed with the draft Act for Amendments and Supplements (AAS) are focused on the following aspects, namely:

- transposition of the changes in fundamental international treaties and binding documents and the new European legislation such as: the Convention on Physical Protection of Nuclear Material; Council Directive 2006/117/Euratom of 20.11.2006 on the supervision and control of shipments of radioactive waste and spent fuel; the Agreement for Application of the Safeguards; the ECURIE Agreement between EURATOM and the EU member states on early exchange of information in case of a radiological emergency; IAEA SF-1 "Safety Fundamentals" and others;
- amendments in the authorisation regime for decommissioning of nuclear facilities and for activities with sources of ionizing radiation;
- inclusion of the proposals of the expert working groups to the management boards of the funds "Decommissioning of nuclear facilities" and "Radioactive waste";
- editorial changes related to new designation of ministries and institutions, as well as precision of the terminology, etc.

The draft Act has been preliminary discussed with the interested ministries, institutions and organizations and in December 2008 was submitted to the Ministry of Foreign Affairs for subsequent co-ordination with the relevant governmental bodies, pursuant to the Rules of Procedure of the Council of Ministers and its Administration, Article 58.

It is expected the draft to be submitted to the National Assembly of the Republic of Bulgaria in the period April-May 2009. Following the adoption of the amendments by the National Assembly, the NRA shall review the secondary legislation related to the ASUNE with the purpose to put it in compliance with the Act. The preliminary assessment shows that changes will be necessary in most of the regulations.

### Regulatory guides

The fundamental requirements on safe use of nuclear energy and sources of ionizing radiation are embedded in the Act on the Safe Use of Nuclear Energy. To ensure the safety of facilities and activities, on an NRA initiative, the Council of Ministers adopted a set of regulations specifying in detail to the licensees and the applicants the safety requirements. The ASUNE and the set of regulations for its enforcement render to the NRA chairman the responsibilities on enforcement of the act, as well as the interpretation and guidance for fulfilment of the legal requirements. One of the available tools to do this is the issuance of regulatory guides.

In many cases, the regulations specify only the fundamental requirements and allow for a wide scope of flexibility in choosing the design solutions and in the decision making. That is why, in some cases, the requirements of the regulations are explained additionally in regulatory guides with the objective to assist the licensees to better understand the regulatory criteria and requirements. The guides are not obligatory in nature and the criteria established are not legally limiting. Guides represent a useful tool for attaining a common approach in substantiation of the design and safety by more than one licensee operating similar types of facilities or carrying out similar activities.

Regulatory guides determine and give advice on possible ways to apply the legislative and regulatory requirements and clarify the details, which are expected to be included by the licensees in the facilities and activities safety substantiation documents. In the best interest of the licensee is to follow strictly the guides, which would allow the NRA personnel to understand better the safety substantiation and will lead to a decrease in the review and assessment period, respectively the time for regulatory decision making. Of course, the licensees have the right to apply other approaches and criteria when they find it more beneficial to safety. In those cases, they have to convince the NRA that all requirements have been taken into account and are strictly complied with, the safety substantiation has been prepared adequately and is correct, and that the selected approach is in the favour of safety. The opinion of the NRA is that regulatory guides should not impose additional burden upon licensees.

In the process of developing regulatory guides, the NRA applies the following principles:

- Substantiation: regulatory guides should be issued only when their existence will lead to enhancement of safety with a strict compliance with the legislative requirements.
- Good practices: the regulatory guides should correspond to the good international practices, taking into account the WENRA reference levels and the applicable IAEA standards and safety guides;
- Consensus: the regulatory guides are discussed with all interested parties prior to their approval in order to ensure their implementation without creating unnecessary obstacles;
- Transparency: the regulatory guides are made available to the general public and with free access for anyone who wishes to become acquainted with them;
- Updating: the regulatory guides are assessed and updated on a regular basis taking into consideration the development of science and technology in an international aspect;
- Expert capacity: In the process of preparation of a given guide the NRA will include its best experts in the respective field. In case of necessity, in the process of preparation and review will be called also external experts.

The programme for drafting of regulatory guides is being kept updated and in accordance with the priorities set, the available resources and expert potential of the NRA. The programme is revised on an annual basis and is updated in accordance with the new proposals, change in priorities, changes in the legislative framework and others. In fulfilment of the programme, drafts of 15 guides in the field of nuclear safety and management of radioactive waste were developed in 2008. The draft guides are in a process of internal co-ordination and their final approval is expected to take place in the period 2009-2010 following the co-ordination process and public discussions.

For the purpose of ensuring widespread distribution and easy access, the regulatory guides are published in paper and in an electronic form at the NRA web page – [www.bnra.bg](http://www.bnra.bg).

## Quality management system

In implementation of its main mission “protection of individuals, public, future generations and the environment from the harmful effects of ionizing radiation”, the Nuclear Regulatory Agency implements and constantly improves its Quality Management System.



The Quality Management System is in compliance with internationally adopted IAEA standards, as well as with the international standard ISO 9001 "Quality Management Systems. Requirements.". The IAEA standards are fundamental to fulfil NRA specific functions and tasks and support the achievement of regulatory effectiveness. The compliance of the QMS with the ISO 9001 standard is a precondition for implementing those functions to higher standards and for the more efficient work of the regulatory authority.

To establish and implement an effective QMS, the approach towards the various NRA activities and the responsibilities of particular units and individuals are determined. The implementation of the processes is periodically reviewed, the necessary financial and human resources are being ensured as well as good working conditions to correctly and timely implement all assignments, training is being provided to enhance the knowledge and skills of the employees, all employees' initiatives to improve work practices are being supported. With the aim of continuous improvement and to identify the corresponding measures, a periodic review of functions implementation (self assessment and audit) is carried out.

Till now, forty four QMS documents have been developed and are in force, which include documents from first, second and third level. Eleven documents were developed and adopted in 2008, which specify requirements towards the processes of management of operations, financing, licensing, emergency planning and management of documentation.

The NRA QMS is an open and evolving system, which timely reflects the changes in the international standards in this field. In respect of the new IAEA safety standards describing the concept of integrated management systems, the NRA has undertaken actions to attain compliance with the new requirements.

## NUCLEAR POWER UNITS OF THE KOZLODUY NPP

Kozloduy NPP units are being operated on the basis of the issued by the NRA long term licenses and in compliance with the limits and conditions for operation.

Units 1 to 4 with WWER-440 type reactors are shut down and there are preparatory activities being carried out for their decommissioning. Preventive and reconstruction activities are being carried out of structures and systems necessary for this operating mode and for the process of decommissioning. The remaining structures and systems are taken out of work and some of them have been filled up with conservation solutions.

The planned maintenance activities on the structures, systems and components (SSC) important for safety of units 5 and 6 have been completed during the Planned Annual Outage (PAO), thus ensuring the necessary operational reliability and safety for the next fuel cycle. The programmes for control of base metal, welded surfaces and primary and secondary pipelines welds have been carried out in scope and quality as specified by the legislative documents.

The performed functional tests of the SSC important for safety carried out prior to units start up and operation after refuelling and periodic tests demonstrated the effectiveness of the physical barriers and the preparedness of the different levels for protection.



On the basis of inspection findings and the reports submitted in fulfilment of the licenses, the NRA general conclusion is that, during Kozloduy NPP units operation in 2008, all physical barriers have been maintained operable and all levels for protection have been available. The specific operational aspects of the separate units are reflected below.

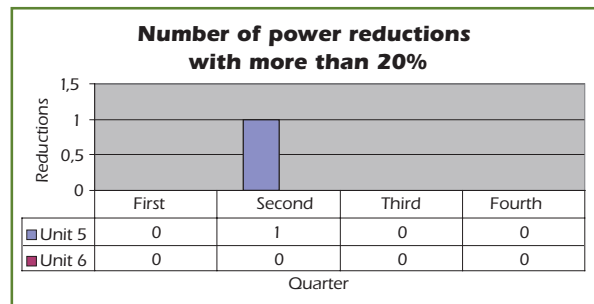
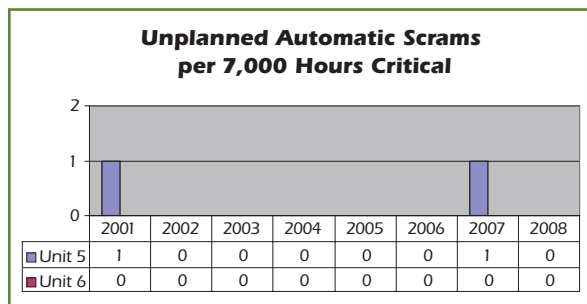


## Units with WWER-440 Type Reactors

Units 1 to 4 are in operational condition E, where the reactors are in cold shut down state and the nuclear fuel is removed from the reactors. The irradiated fuel from units 3 & 4 is stored in the Spent Fuel Pools (SFP) and from units 1 & 2 it has been extracted and transported for storage at the SFSF.

By a Council of Ministers Decree No. 839/20.08.2008, units 1 & 2 which are subject to decommissioning, have been declared as facilities for management of radioactive waste. In this respect, the Kozloduy NPP SF activities plan has been updated and a priority was given to emptying of SFP-1 and SFP-2 from SF. Following the transportation of SF from units 1 & 2 to the SFSF, 36 dummy assemblies, 21 absorbers and one control assembly in a hermetic can were left on the lower rack of SFP-1 and only 53 spent absorbers were left in SFP-2. In accordance with the licenses for operation of Units 1 & 2 in condition "E", the scope and control of the necessary systems for ensuring the storage of SF in the reactor pools has not been changed.

## Units with WWER-1000 Type Reactors

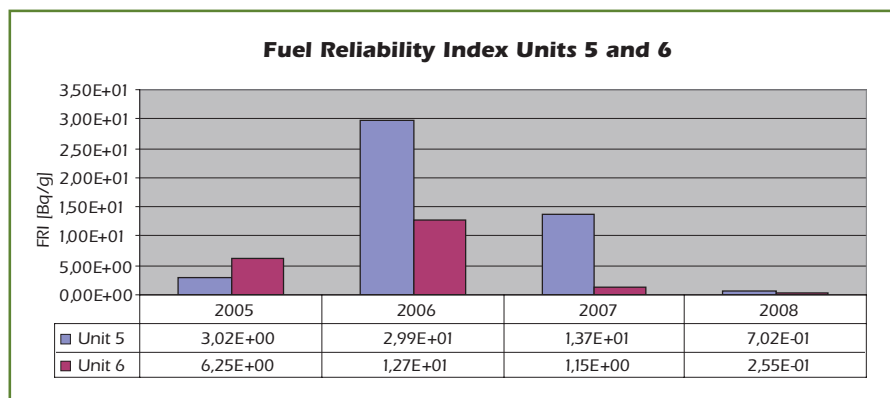


Units 5 & 6 operate in their 15th and 14th fuel cycles respectively. The two units have been operated mostly in their base load at nominal power. The reliable and safe operation of the units is evident from the safety indicators "Number of unplanned scrams per 7000 hours" and "Number of power reductions with more than 20%", shown on the figures below.

With regard to the unplanned reactor scrams, the average value of WANO indicator for reactors of the WWER-1000 type is about one scram in every two years. The indicator values for Unit 5 and Unit 6 are among the best. The date 22 December 2008 marked 12 years since the last unplanned reactor scram at Unit 6.

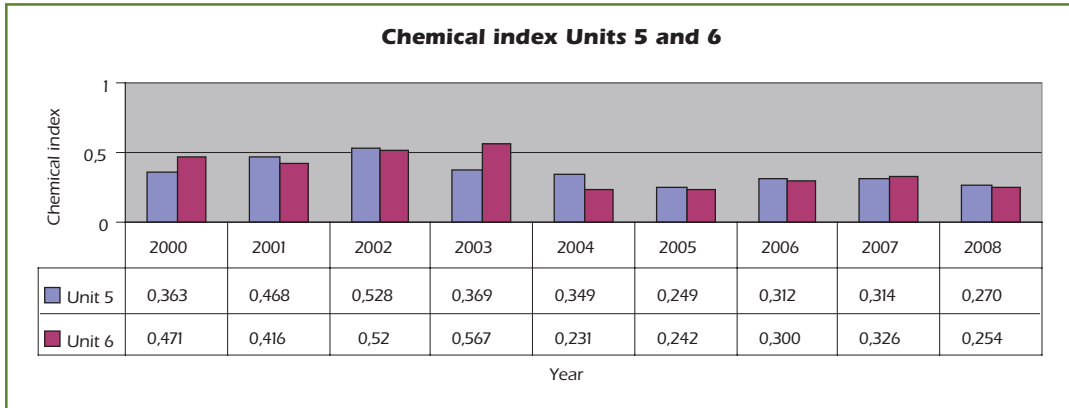
During the Planned annual outages in 2008, the step by step replacement of the fuel assemblies of the units with a new type of fuel assemblies, TBCA, was completed. The reactor cores of both units are entirely loaded with the new type of fuel. The indicator "Nuclear Fuel Reliability" for Units 5 and 6, shown on the chart, reflect the tightness of the fuel elements and demonstrate the good condition of fuel in the past fuel cycles of the units.

The quality of the maintained WCR is evaluated by using a chemical index (ChI) expressing the relation between the actual pH values, electrical conductivity and contained admixtures with the values determined by the respective limits of normal operation. For Units 5 and



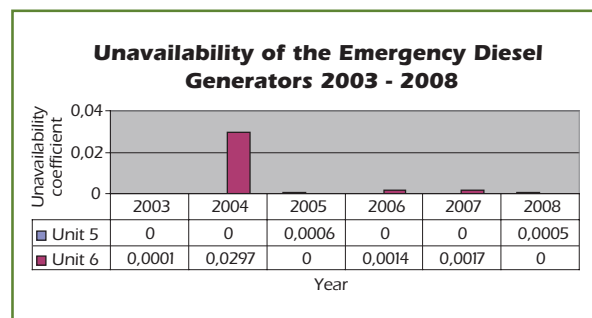
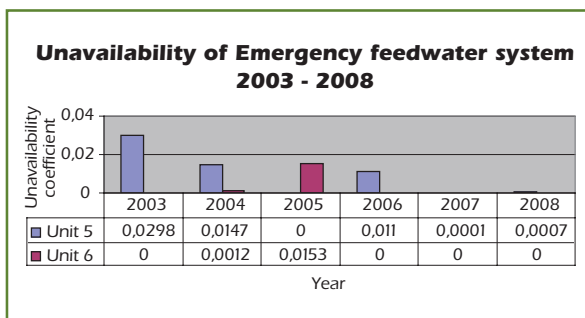
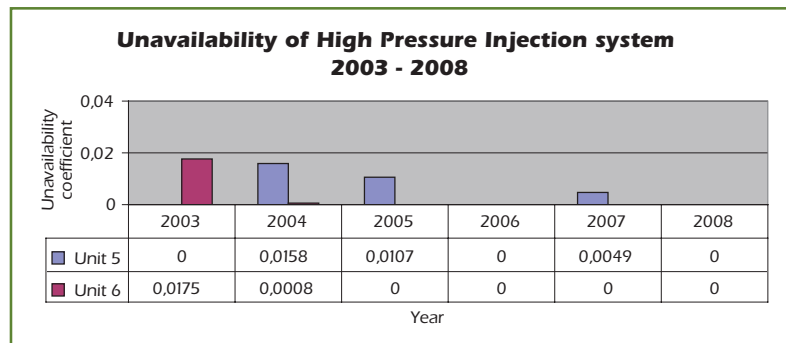


6, this index (maximum permissible value for ChI = 1.0) demonstrates maintaining of an optimal water chemistry regime and achieved low level of corrosion of construction materials of the secondary circuit equipment. The stable tendency of the index is shown on the 2008 chart.



The safety systems unavailability factor is shown on the next charts. The index is calculated as a ratio between the time a safety channel had been inoperable and the total time of expected operability, multiplied by the number of system trains.

Maintaining a high level of preparedness and reliability of these systems ensures the third level of the defence in depth and reduces the probability of core damage at all internal initiating events.



The final 2 measures out of the overall 212 from the Units 5 and 6 Modernization Programme were completed, thus a 100 % implementation of the programme has been achieved.

On a request by the NRA and the Kozloduy NPP, an IAEA follow up expert mission was carried out in the period 10-20 November 2008 to assess the extent of resolving safety issues, as specified by the IAEA



with regard to WWER-1000/320 design plants. The objective of the follow up mission was to complete the independent assessment by the IAEA over the safety improvements as a result of the completed Programme for Modernization of units 5 & 6 of the Kozloduy NPP and over the level of resolving issues. Sixty one safety issues have been assessed (determined as unsolved or partly solved during the previous mission in 2000) in the following general technical areas: classification of structures, systems and components, qualification of equipment, reactor core, integrity of the components, systems, I & C, electrical equipment, containment, internal and external events, accident analysis and PSA including severe accidents.

The level of resolving of identified issues has been discussed with experts from the Kozloduy NPP, experts from external organizations involved in the Programme for Modernization and representatives from the Bulgarian nuclear regulatory authority.

The IAEA team acknowledged as impressive and successful the work done by the Kozloduy NPP management and staff in fulfilment of the Modernization Programme in the past years and especially following the year 2000. Implemented activities completely eliminate any of the formerly identified non-compliances and considerably contribute towards the safety enhancement of the units.

The IAEA team also noticed the great efforts allocated by the Kozloduy NPP in management of the large scale complex activities of great diversity, which had been carried out by different suppliers while financed in the framework of various programmes.

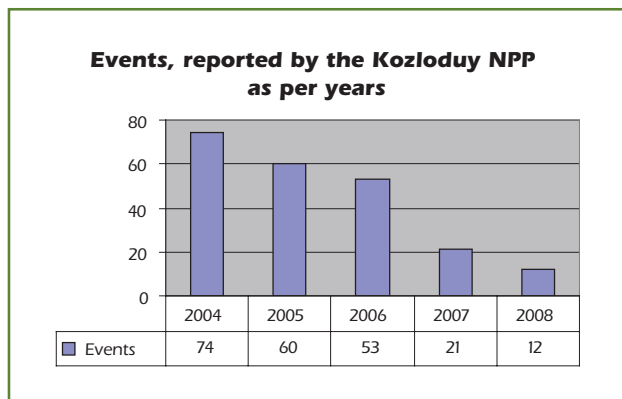
It was highly estimated that the scope of the measures implemented until now at Kozloduy NPP units 5 & 6 is a good example for a huge and successful modernization of operational WWER-1000 units.



## OPERATIONAL EXPERIENCE FEEDBACK

In 2008, pursuant to the Regulation on the Conditions and Order for Notifying the NRA on Events in Nuclear Facilities and Sites with Sources of Ionizing Radiation, the Kozloduy NPP has reported a total of 12 events that have taken place in the power plant.

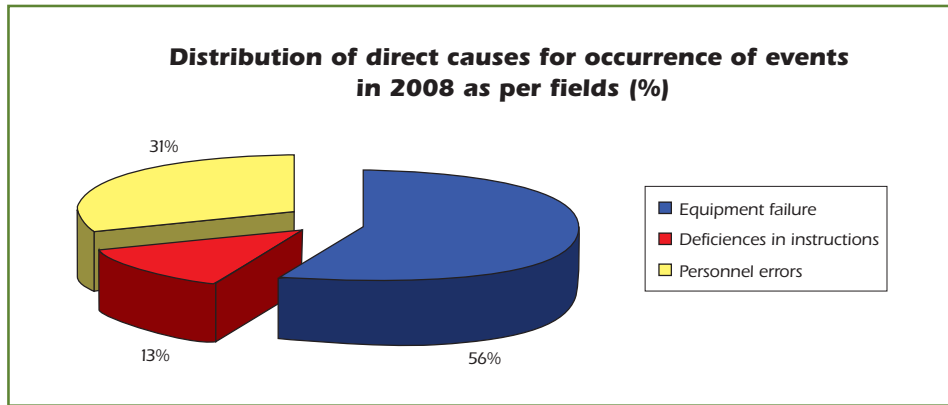
Unit INES		I	II	III	IV	V	VI	Other	Total
Events within the reporting criteria under the regulation	">1"	0	0	0	0	0	0	0	<b>0</b>
	"1"	0	0	0	0	0	0	0	<b>0</b>
	"0"	0	0	0	1	5	2	2	<b>10</b>
	Out of scale	0	0	0	0	1	1	0	<b>2</b>
Outside the reporting criteria		0	0	0	0	0	0	0	<b>0</b>
Total		0	0	0	1	6	3	2	<b>12</b>



As it is evident from the data above, in 2008 no incidents or accidents (events of level 1 or higher on the INES scale) have occurred at the Kozloduy NPP. Keeping the positive trend for reducing the number of reported operational events is also observed. This reduction is significant for the last two years (for 2006 there were 53 events) and can be explained with the shutting down of units 3 & 4, with the results of the Units 5 and 6 Modernization Programme, but also the systematic implementation of the policy for in-depth analysis of the causes for operational events and the undertaken effective corrective measures for preventing recurrence.

The methodology for event analysis at the Kozloduy NPP combines elements from the methodology of assessment of significant events (ASSET) and elements from the methodology for human factor analysis, HPES. The increased analyses of human factors contribute to the proper identification of the root causes and the selection of appropriate corrective measures. A large part of the direct causes of reported events are equipment failure. Over 85 % of the failures on units 5 & 6 have been detected through the system for surveillance (a collection of activities related to the diagnostics of the condition of the equipment, tests, control over the work and others with the objective of detecting hidden defects or weaknesses).

The analysis of the root causes and the selection of the respective corrective measures is carried out according to the approved in the NPP methodologies.



The tendency to study a larger number of events and implement the experience from other plants continued. The WANO and the IAEA-IRS databases continue to be the basic sources of information used.

The analysis of events bring about the conclusion that there is a necessity of improving the quality of the operational documents, as well as the early detection of organizational deficiencies – factors assisting the detection of events of lower level and “near miss events” before they can occur as real events.

In order to enhance the objectivity while making the independent assessment of events by the regulator, a group was formed at the NRA on operational experience analysis comprising of six experts from different professional fields. The main tasks of the analysis group include:

- Making an independent analysis of root causes for significant events and determining the adequacy of the proposed corrective measures;
- Dissemination of the accumulated operational experience to international organizations, and screening foreign operational experience and its dissemination within the country;
- Carrying out special inspections with respect to events in nuclear facilities.

All events reported by the Kozloduy NPP in 2008 (Annex 1) have been reviewed in-depth by the Group. As a result of this process the level of one of the events has been raised from “outside of scale” to level “0” on the INES scale.

## RADIATION PROTECTION IN KOZLODUY NPP

The periodic control over the condition of radiation protection, which is being carried out by the NRA, includes analysis and assessment of the information provided by the Kozloduy NPP to the NRA relating to the gaseous and liquid discharges, personnel exposure, status of the radiation control systems, correspondence to the regulatory requirements for radiation protection of the documents submitted for issuing permits for modifications in the operating licenses.

### Occupational Exposure of Staff

The collective dose from external and internal exposure of the 3077 controlled persons at the Kozloduy NPP in 2008 was 660.82 man.mSv. For the operating staff at units 1 to 6 the collective effective dose was 482.55 man.mSv, i.e. 73% of the total collective effective dose. For the staff of other structural units of the Kozloduy NPP, the collective dose was 98.87 man.mSv (15%), and for external organizations 79.40 man.mSv (12%). There is only one person with an individual dose from internal exposure over the levels of registration - 1 mSv, pursuant to the Regulation 35 of the Ministry of Health of 7 November 2005 on the Conditions and Order of Performing Individual Dose Control of Persons Working with Sources of Ionizing Radiation.

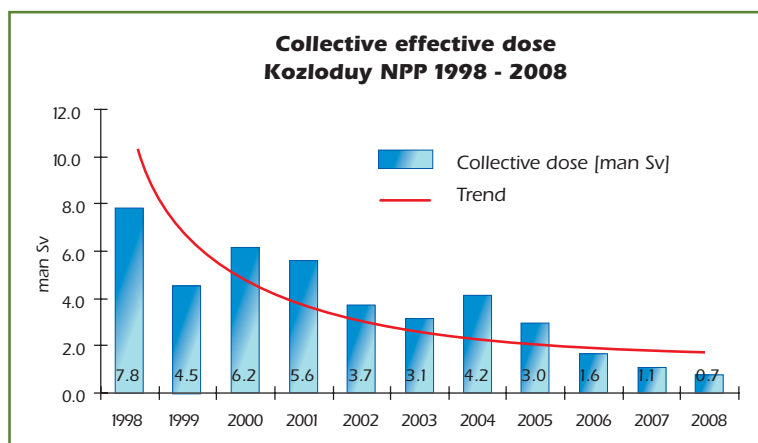
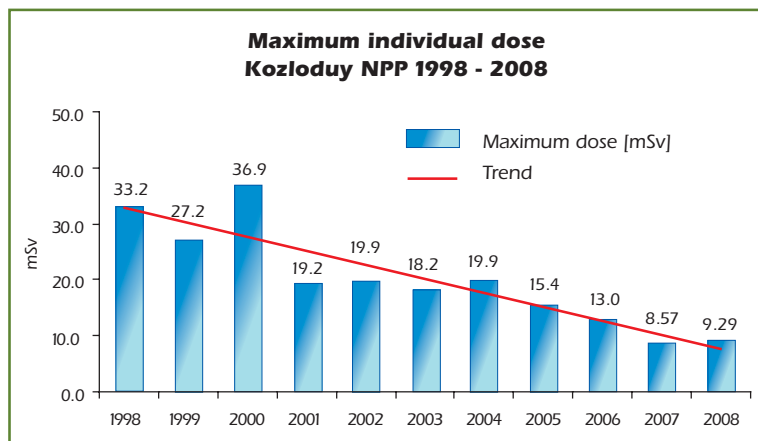
The normalised to the number of reactors collective dose was 0.27 manSv/unit in 2008. This dose is lower than the average value of the indicator of the PWR type, 0.55 manSv/unit, according to the data in the WANO'2007 Performance Indicators Report.

In 2008, the average individual effective dose was 0.21 mSv distributed as follows:

- For PP-1 staff – 0.20 mSv
- For PP-2 staff – 0.41 mSv
- For other structural units of the Kozloduy NPP – 0.17 mSv
- External organizations – 0.07 mSv.

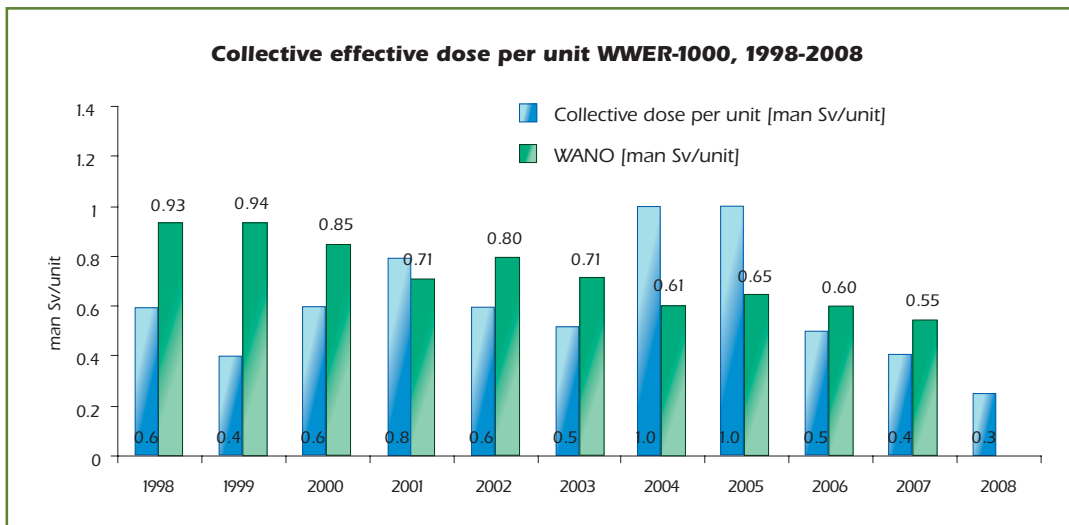
In 2008, the maximum individual dose is of an employee working in the non-destructive testing unit and is 9.29 mSv, which is 18% of the annual limit for occupational exposure as specified by the.

In 2008, the collective effective dose at the Kozloduy NPP is 38% lower than the previous year. The collective dose for external





organizations' staff has decreased three times, which shows that the planning and control of repair activities performed by external organizations has improved.



## Radioactive Releases, Public Exposure, Environmental Monitoring

The discharge limits for radioactive substances to the environment during normal operation of Kozloduy NPP are included in the Units' technical specifications containing the limits and conditions for operation. In 2008, the ventilation stacks of the Kozloduy NPP released into the atmosphere 0.545 TBq radioactive noble gases, 0.001 GBq Iodine-131, and 0.018 GBq long-lived aerosols. These values are significantly lower than the 2007 values and represent 0.01%, 0.002% and 0.036%, respectively, of the new limits introduced in 2007. The total activity of technological discharge and waste effluents into the Danube River during the year is 0.177 GBq, and of tritium is 18.7 TBq and are 0.023% and 10% of the annual limits, respectively.

The organization of radiological monitoring of the environment is regulated by programmes that are approved by the NRA and meet the recommendations of the IAEA and the good international practices. The programmes define the subjects of control, frequency, controlled indicators and methods of analysis. The Kozloduy NPP also carries out model assessment of the public exposure in the area of the NPP as a result of the radioactive discharges to the atmosphere and hydrosphere. Modelling programmes are used for assessment of the additional public exposure, based on the adopted by the European Union CREAM methodology with a conservative exposure assessment, taking into account the hydrologic and meteorological conditions and the demographic data on the Kozloduy NPP area. Subject to control are the gamma background, underground water, atmospheric precipitations, vegetation, and soil. In 2008, a total of 3925 laboratory analysis and measurements of 2399 environmental samples (including atmospheric air, drinking, surface and underground waters, soils, and foods) were carried out. Also 1688 measurements of the radiation gamma background were carried out at the control posts and routes using portable dose measurement devices and permanently installed thermo luminescent dosimeters.

The analysis of the results from the radiation control and from the model assessments of public exposure in the Kozloduy NPP area show that they are in conformity with the national legal requirements.

In 2008, the maximum effective dose to the public from Kozloduy NPP liquid and gaseous discharges was 4.03  $\mu\text{Sv/a}$ , which is much lower than the annual limit of 250  $\mu\text{Sv/a}$ , pursuant to the Regulation on Ensuring

the Safety of Nuclear Facilities. It represents only 0.2 % of the public exposure received through the natural radiation typical for the region – 2.4 mSv/a. The comparison between the data from 2008, data from previous years and data prior to plant commissioning proves the absence of unfavourable trends in the radiological conditions due to Kozloduy NPP operation. The radiation parameters are within the normal range with background values typical of the region.

The NRA carries out regulatory control over the UM system (central heating for the town of Kozloduy). The NRA receives data from the Kozloduy NPP on a monthly basis on the results from the carried out automated and periodical radiation control of the water. The analysis of 2008 radiation control results show that the controlled parameters do not exceed the permissible values, as specified in accordance with the licensing and legislative documents.

## Radiation Situation in the Restricted Area

The restricted area (RA) is under continuous radiological monitoring with the use of automated information systems for remote dose rate measurement, the specific volume activity of air in the premises and of water in the technological circuits.

A specific programmes for radiation protection and for estimated dose budget were developed for the PAO of Units 5 and 6. The implementation of programmes was controlled by the NRA. The necessary timely steps were taken, during the repair activities, for localizing the contaminated areas, performing decontamination, placing limitation barriers and labels and exercising further radiation control. Following the completion of repair works, a comparative analysis of the actually received exposure dose and the dose budget was made as a result of which some measures were suggested for even better planning of the next outage and effective implementation of the ALARA principle. If necessary and at the recommendation of the NRA different specific programmes were developed for radiation protection of particular non-standard operations with an expected increased exposure.

The analysis of the results of the radiation control exercised in the RA of the Kozloduy NPP Units in 2008 shows that the controlled parameters do not exceed the permissible values determined in compliance with the RBNRP. The protective radiation barriers have been properly functioning and have ensured effective protection to the RA staff.



## REGULATORY INSPECTIONS

The NRA continued to carry out regulatory inspections in nuclear facilities in the country in 2008. The quantitative indicators from the inspections are as follows: fifty three regulatory inspections have been carried out, 2854 man hours spent for this purpose. As a result of the inspections 123 comments and recommendations have been made. The specific data on the sites and the resources spent by the NRA during the inspections can be found in Annex 2. Below are described some of the important regulatory inspections at the Kozloduy NPP.

### Operational experience feedback

In May 2008, a NRA commission checked the organization and practices on the use of operational experience feedback in the process of safety management.

Organizational documentation in the Departments "Safety and quality" and "Production" and in Power production – 2 were reviewed for the purpose of determining the distribution of responsibilities and tasks. Clear relations are being established between the departments in the NPP structure on the exchange and processing of the necessary information. The existence of an well developed and working system on dissemination of operational experience on a corporate level and on the level of production divisions has been ascertained. With regard to the activities in the Department "Safety and quality" recommendations have been made for performance of profound analysis and safety assessment. It was decided that a unified document on a corporate level should be developed by the end of 2008 where the system and the whole process of use of the operational experience feedback should be described. A systematic multiplanning activity is being carried out at PP-2 on the use of operational experience feedback, appropriate database on events are being kept, control over the corrective measures is being carried out, and the tendencies in the condition of the safety systems are being controlled. By an order of the Chief Engineer, a working group has been formed with the task of improving the existing system for operational experience. The working group has discussed on activities to improve the internal operational experience – registration of inconsistencies and good practices, designation of responsible persons in every field in case of deteriorating of the tendencies. An analysis of operational events is being carried out, applying a combination of the used until this moment ASSET methodology and the HPES methodology. The attention is focused on the impact of the human factor.

Proposals on the optimization of the process of event analyses have been made, selecting criteria for the choice of type of analyses, criteria for choice of analyses of small events and events – precursors. The system for registration of inconsistencies is in a process of development, every working place being equipped in such a way as to give a possibility for input of data in an electronic form and facilitating the process of its management.

### Installation of a new control safety system

A wide scale activity on the replacement of the controls of the three safety systems at units 5 & 6 has been initiated in the Kozloduy NPP. The replacement shall begin at safety system two of unit 6. In this connection an NRA commission checked the organization and implementation of the installation activities during PAO at unit 6. It was ascertained that the installation works and the preliminary tests have been carried out in accordance with the procedures and deadlines of the schedule. The submitted accounting documentation and the inspected working places demonstrate a good organization and quality. A programme for metrological inspection and a programme for detailed inspection of the design algorithms according to preliminary prepared check lists have been implemented. Training has been carried out for maintenance and operational personnel at the plant manufacturer and on site.

## Facilities with increased risk

The NRA continued to implement the control on the compliance with the requirements of the specialized legislative documents for surveillance and operation of high risk facilities (HRF) – lifting equipment and pressure vessels. One inspection has been carried out every three months. The accounting documentation has been inspected – log books and other data from periodic tests. Activities on the replacement of power lines to the polar cranes on units 5 & 6 have been inspected and inspectors have been present during tests for commissioning of the crane on unit 6. Problems related to the mechanical condition of the polar cranes and the undertaken measures on the maintenance of the geometry of their rails were discussed. A conclusion was reached that the undertaken measures in different directions and of different nature are in a position to improve the operational condition of the cranes.

## Service Water System (UM)

A NRA commission carried out an inspection on the operation of the UM system (central heating for the town of Kozloduy) in both technological and radiation aspects. The operational documentation, the results from the radiochemistry control and the actual condition of the system were inspected. It was ascertained that the envisaged chemical and radiochemical control is being carried out according to the requirements of the specifications in force, programmes, instructions and methodologies. The organization of the control, training of personnel and the implementation of the activities are in accordance with the legislative and licensing documents. A reliable control has been ensured through the available measuring devices and methodologies. A good level of documentation, archiving and reporting of the results from the carried out radiation control have been ascertained. Recommendations have been made for rewriting of operational documentation which should reflect in full the actual state of the UM system and the interaction of the separate structural units having relation to the operation of the system.

## Start up of units 5 & 6

The objective of the inspections carried out prior to start up of units 5 & 6 and following the planned annual outages is to ascertain correspondence between the declared preparedness of the licensee and the actual state of the systems for operation. The results from the implementation of the measures for enhancement of safety were assessed during the inspections, assessments of the past fuel cycles were carried out according to operational data in various fields, the results from the carried out non-destructive testing were assessed as well as the results from pre start up tests of the systems. Control has been implemented on the state of the operational documentation, radiation protection and preparedness of the personnel.

A specific aspect for the new fuel cycles of units 5 & 6 is the complete loading of the reactor core with a new type of nuclear fuel. Numerous calculations on the optimization of the reactor core have been carried out. The Kurchatov Institute has requested a new set of input parameters to repeat the core calculations. The behaviour of the reactor cores and the compliance with the limits for operation were a subject of prolonged discussions with the NPP specialists. Special attention was paid to unit 6 due to the expected comparatively long fuel cycle and the ensuing from this fact peculiarity.

The documents for the carried out repair activities were reviewed. It has been ascertained that there is good planning and organization of the activities carried out. The documentation on the corrosion inspection of the interior surfaces of the controlled equipment has been inspected. Good operational condition of the steam generators has been observed. The contribution of the automated chemical control on the secondary circuit, the rapid detection of contamination of the coolant, and the timely introduction of corrective measures have been assessed positively. The commission have observed good house-keeping in the maintenance of the facilities, premises and the operational documentation as per working places. Recommendations have been made due to sporadic cases on unit 6 for improvement of the operational condition of the equipment in the



containment, mainly fixing of measuring devices.

On the basis of the positive conclusions of the inspection commissions, pursuant to the provisions of the ASUNE, the NRA chairman has approved the operation of the units in the next 15th and 14th fuel cycle respectively.

## Dismantling activities on the Belene site

The organizational and technical measures undertaken by the NEC-PLC for implementation of the conditions of the contractual agreement between NEC-PLC and ASE (Atomstroyexport) related to the preparation of the site for future construction were inspected in the beginning of September 2008.

It was settled that in annex to the Agreement between the NEC and the ASE, the existing buildings, constructions and/or parts of them at the Belene site which will not be integrated in the design of the power plant A92 with reactor installation WWER1000/B-466B and will have to be dismantled prior to the commencement of the construction of the main project have been agreed on. The commission was acquainted with the carried out design, organizational and implementation activity by the ASE in fulfilment of the envisaged preliminary activities. A schedule was submitted on the implementation of the dismantling activities which should be completed by the end of August 2009.

In fulfilment of the preparatory activities, the NEC-PLC has received a permit for construction from the Ministry of public works and development. The activities on the Belene NPP site started on 1 August 2008. A working group was formed following an order by the manager of the Belene NPP Enterprise for the purpose of carrying out control over the quantity, duration and implementation of the activities subject of the annex. Internal instructions for control over the quality of the activities carried out by external organizations at the site were issued. The commission ascertained that an organization has been established on the everyday control over the quantity of dismantled materials, quality of activities, their reprocessing and storing. On behalf of the NEC the activity is being controlled by the architect-engineer of the design. The remaining part of activities carried out on site is related to maintenance of buildings and basic equipment which will be used in the future.

The commission became acquainted with the established order for physical protection of the site and the activities related to the preparation of the infrastructure onsite. The volume and deadlines for design and implementation of the infrastructure sites are determined in a schedule. The implementation of the infrastructure sites is in the framework of the annual maintenance and investment programme of the NEC, supported by the ASE.

The conclusion of the commission is that in the submitted during the inspection plans and schedules, there is no mention of activities on construction of sites part of the nuclear power units and that the implemented activities in no way infringe or curtail the aspects of nuclear safety and radiation protection of the design of a power plant A92 with reactor installation WWER1000/B-466B.

## OPERATIVE CONTROL AT THE KOZLODUY NPP SITE

In the course of their daily inspections, the inspectors of the Department Operative Control at the Kozloduy NPP site carry out control over the compliance with the limits and conditions of safe operation, observation of the regular test schedules and the related results, condition of the systems important for safety and the house-keeping in the premises, and compliance with the provisions of the licenses and permits issued.

The preparation and implementation of activities related to the technical maintenance and planned outages are periodically controlled, control being carried out over the compliance with the requirements for nuclear safety and radiation protection, exposure of the personnel and the functioning of the systems for radiation monitoring.

The daily condition is reported and discussed at meetings with the Deputy Chairman of the NRA.

No deviations from normal operation and from the implementation of the schedules for carrying out specification tests and prophylaxis repairs have been observed in the course of the operative control. The delayed implementation of the schedules is technologically substantiated and for the specification tests is coordinated with the permissible by the specification time period. No systems or facilities commissioned following maintenance have been detected that have not undergone functional tests and that have not confirmed their availability.

A subject to increased control during the past period has been the implementation of the following specific activities, namely:

- unloading of nuclear fuel from reactor pools of units 1 & 2 and implementation of transporting activities with SF from units 1-4 and SFSF;
- implementation of activities related to the preparation for decommissioning of units 1 & 2 (pursuant to the programme for radiological surveillance of the premises and equipment).
- introduction of automated chemical control on primary circuit of units 5 & 6;
- compliance with the requirements and measures in the implementation of programmes and activities on replacement of UCTM – 2 safety system unit 6, including immediate control over activities carried out by external organizations;
- compliance with the requirements and measures in the implementation of programmes and activities on modernization of a polar crane on units 5 & 6, reconstruction of railroad of crane 12 t. at turbine hall in unit 5, maintenance and functional tests of 160 t. crane in SFSF.
- implementation of the volume of maintenance works and tests on pipelines and high risk facilities; participation in the certification of welders and welding technologies of external organizations carrying out activities on site the Kozloduy NPP.

The activities have been carried out according to approved and updated documentation, the necessary internal control being exercised. The deviations noticed are mainly related to the completeness of the documentation of the carried out activities.

In 2008 the inspectors from the division have participated in discussion and /or analysis of the following operational events and deviations, namely:

- decrease in the power of Unit 5 due to infringement of the WCR on secondary circuit;
- infringement of the WCR of suction pipelines of 6 TQ21,22D01;
- unreliable indications of the level of the emergency feedwater tank of unit 5;



- radioactive contamination of small asphalt area close to AB – 2;
- non actuation of pump QF 21D01 during tests of the automatic staggered start up (ASS) second channel;
- non actuation of breaker of pump 5TF 21D02 during tests of 1 programme of automatic staggered start up (ASS) second channel;
- deviation from implementation of a procedure for mixing and purification of boric acid solution in primary circuit in unit 1;
- failure of a breaker in section normal operation (5CPI).

With regard to the house-keeping, activities are being carried out related to lighting, labelling, improvement of the condition of cable lines and others for which considerable human resources and time are necessary. In spite of the carried out activities, there are still sites which necessitate considerable improvement, for example ventilation systems, systems and premises of I & C, AB-3, turbine halls of units 5 & 6, containment of units 5 & 6, warehouse and maintenance premises.

The following internal inspections have been carried out during the period:

- Over AB-3 for eliminating the comments on the house-keeping, operative documentation and conducting the technological process of water treatment;
- inspection over the activity carried out by the operative personnel from section I & C and the documentation of the working place of shift supervisor I & C;
- inspection over the activity carried out by the operative personnel from section Operative radiation and dose control and the documentation of the working place of shift supervisor of Operative radiation and dose control.

## SPENT FUEL STORAGE FACILITY (SFSF)

By 31 December 2008, there were 148 racks with 4361 assemblies stored in the Spent Fuel Storage Facility. The spent nuclear fuel from WWER-440 and WWER-1000 reactors is stored in the SFSF pools in an appropriate water chemistry regime. A basic requirement to ensure safety storage of SNF is to maintain the integrity of protection barriers: cladding of the fuel rods, structure of the fuel storage pools, and structure of the ventilation system facility. For the purposes of maintaining the leak tightness of the fuel assemblies and of the SNF pools, the respective water chemistry regime (WCR) is observed in order to suppress the corrosion processes. The efficiency of the SFSF systems and facilities is maintained in accordance with the requirements of the Technical Specifications and the operating instructions. The functionality of structures, systems and components is regularly inspected in order to identify any hidden defects, preventive maintenance activities are planned for the purpose of ensuring the necessary availability of the facilities.

In accordance with the license conditions, the Kozloduy NPP carries out periodic assessment of the operation pursuant to the Instruction for self assessment of the effectiveness and safety in the operation of the SFSF. The Kozloduy NPP submits to the NRA monthly reports containing specific indicators which serve as assessment of the operational conditions and safety.

The following programmes have been implemented, namely: Programme for moving of hermetic cans with SF in the SFSF and Programmes for transportation of SF from SF pools 1 & 2 to the SFSF.

The level and temperature of water in the SFSF are kept within the range of operational limits for normal use. The quality of the WCR is assessed by a chemical index. The operation of the SFSF is carried out according to the Technical Specifications and instructions in force, and in compliance with the conditions of the operating license issued by the NRA Chairman.

One inspection at the SFSF was carried out by NRA inspectors for inspection over the compliance with the conditions of the operating license. The state of the operational documentation and the compliance with the requirements included in it, the actual condition of the systems and premises as well as the implementation of the updated long term programme for implementation of measures for enhancement the safety of the SFSF were inspected. The state of the documentation corresponds to the instructions in force on the format and management of the operating documentation. There are no deadlines which have been violated on the implementation of the inspected schedules and programmes for carrying out functional tests of the systems and facilities in the SFSF. The results received from these functional tests meet the success criteria. A replacement of the interlock and protection system with a digital one has been done in fulfilment of the long term programme for implementation of measures for safety enhancement. Training of the SFSF personnel has been carried out on the operation and technical maintenance of the system. In practice, with the commissioning of the system is realized the remote control and management of the technological process in the SFSF. Recommendations have been made by the NRA inspectors on updating the instruction for operation with view of reflecting the replacement the interlock and protection system as well as for the preparation of a new revision of the programme for realization of measures for enhancement of SFSF safety, with view of the already implemented and the forthcoming activities.



## IRT-2000 RESEARCH REACTOR

With the Resolution of Council of Ministers No. 332 of 17 May 1999 the operation of IRT-2000 Research Reactor was finally terminated. Based upon a detailed cost-benefit analysis made in 2001, the Council of Ministers adopted a decision on the reconstruction of IRT-2000 into a low-power reactor.

An agreement was signed in January 2008 between the Government of the Republic of Bulgaria and the Government of the Russian federation for co-operation in the field of import to the Russian federation of spent fuel from the research reactor. In fulfilment of the RRRFR programme (Russian Research Reactor Fuel Return Programme) financed by the US Department of Energy for repatriation of Russian nuclear fuel for research reactors, an agreement was signed between the governments of the United States of America and Bulgaria for co-operation in the field of non-proliferation of nuclear material and technologies, for financial assistance in the transportation of the SF to the Russian federation and the supply of new low enriched nuclear fuel. In June 2008 in the presence and under the control of IAEA Department of Safeguards inspectors, inspectors from EURATOM and NRA inspectors and technical experts from the US Department of Energy, the SF was loaded in three containers type Skoda VPVR/M (designed for temporary storage and transportation of SF from research reactors) for shipment to the reprocessing plant of the Mayak Company.



The transportation was carried out following an issued by the NRA permit pursuant to the provisions of the Regulation on the conditions and order for carrying out transportation of radioactive substances, the Regulation on ensuring physical protection of nuclear facilities, nuclear material and radioactive substances and the Convention on physical protection of nuclear material. In July 2008 the containers with SF reached its final destination at the reprocessing plant of the Mayak Company.

Two topical inspections were carried out in 2008, on checking of the system for control and accounting of nuclear material and the information on the Additional protocol and the state of physical protection. The respective recommendations for improvement of the organization of work have been made.

## NUCLEAR MATERIAL ACCOUNTING AND CONTROL

Bulgaria is a country that has no nuclear weapons and has entered into an agreement with the International Atomic Energy Agency for the implementation of the Safeguard System under the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) (effective date: 29 February 1972). According to the Agreement, Bulgaria agrees to perform its obligations under the Safeguards with regard to any source or special fission material. The control on the non-proliferation depends to a large extent on the effective system for verification of nuclear material in a given country. The IAEA exercises such control in Bulgaria through carrying out of inspections and video surveillance. The nuclear facilities that are subject to inspection include: IRT-2000 research reactor, Kozloduy NPP Power Units 1-6, and the spent fuel storage facility at the site of the Kozloduy NPP.

In 2008, 14 inspections were carried out with IAEA inspectors on the compliance with the Safeguards at the Kozloduy NPP and two inspections at the IRT-2000 research reactor – a total of 344 man/hours.

The NRA inspectors carry out the state control over the presence, movement and accounting of nuclear material on the territory of the country. In all nuclear facilities the existing nuclear material corresponds in quantity, enrichment, form and isotope content to the inventory according to the kept accounting documentation.

The Additional Protocol to the agreement between the Republic of Bulgaria and the IAEA for implementation of the Safeguards under the Treaty on the Non-Proliferation of Nuclear Weapons was ratified on 10 October 2000. Under the provisions of the Additional Protocol, the Republic of Bulgaria is obliged to prepare and provide to the IAEA information relating to the country activities in the field of nuclear fuel cycle on an annual basis. The information provided under the Safeguards Implementation Agreement in combination with the Additional Protocol is used by the IAEA for adopting a conclusion on the Republic of Bulgaria's compliance with the NPT.

The 2007 Report by the Republic of Bulgaria under the Additional Protocol was sent to the IAEA in May 2008.

The carried out export in 2008 of equipment from the Belene NPP site was declared to the IAEA in accordance with the provisions of the Additional Protocol.

Inspections on the information and declarations under the Additional protocol were carried out by NRA on the sites of the IRT 2000 of the INRNE-BAS, Belene NPP, Kozloduy NPP and the companies carrying out activities on these sites. Recommendations were given in relation to improvement of the organization and systematization of the declared information.

IAEA inspectors jointly with NRA inspectors carried out one inspection on the Kozloduy NPP site and one on the site of Zvezda-Eleshnitsa plant.

The purpose of inspections under the Additional Protocol made by the IAEA was to find out whether the information about the buildings, premises and their use presented in the 2007 National Declaration corresponded to their actual purpose and use. The conclusion from the inspections made was that no undeclared activity was performed on these sites.

In connection with the EU membership, Bulgaria ratified the Agreement between the Republic of Austria, Kingdom of Belgium, Kingdom of Denmark, Republic of Finland, the Federal Republic of Germany, Greek Republic, Ireland, Italian Republic, the Great Duchy of Luxemburg, Kingdom of the Netherlands, Portuguese republic, Kingdom of Spain, Kingdom of Sweden, the European Community on Atomic Energy (EURATOM) and the International Atomic Energy Agency (IAEA) on the application of art III (1) and (4) of the Treaty on the Non Proliferation of Nuclear Weapons (78/164 EURATOM, respectively IAEA INFCIRC 193), signed on 5 April 1973 in



Brussels as well as the Additional Protocol to the Agreement (1999/188 EURATOM, respectively IAEA INFCIRC 193 add.8) signed on 22 September 1998 in Vienna. Pursuant to the provisions of these documents as well as Regulation 302/2005 on the application of the EURATOM safeguards, the NRA prepared and submitted to EURATOM summarized information on the sites with small quantities of nuclear material, so called “small holders” on the territory of the Republic of Bulgaria.

## RAW MANAGEMENT

One of the main activities in the work of the NRA is the regulation over the management of radioactive waste (RAW) generated as a result of the operation of the NPP and the decommissioning of units 1-4 of the power plant, as well as a result of application of sources in industry, agriculture, medicine and scientific research.

The state regulation of the RAW safe management is carried out by applying the authorisation regime under the ASUNE and controlling the compliance with the requirements and standards for nuclear safety and radiation protection. In the performance of these activities the NRA is guided by the internationally adopted principles of safety in the RAW management and by the requirements of the relevant national laws.

### Management of RAW in the Kozloduy NPP

Liquid and solid RAW are generated as a result of the NPP operation of categories low and intermediate activity RAW. The sorting is carried out on the basis of radiometric characteristics and the type of waste. There are historical solid and liquid RAW that have been accumulated as a result of the operation of the units and which are being stored temporarily in the Auxiliary Buildings (AB) and in specially equipped installations and depots. The conditions for storage of RAW correspond to the requirements for storage and labelling and are controlled by the NRA during the carried out inspections. Recommendations have been made with regard to the radiological characterization of RAW with the purpose of carrying out alpha spectrometric analysis for making a more precise categorization of RAW. The necessary equipment and personnel for this purpose has been provided by the Kozloduy NPP and full scale analysis are being made on selected samples from the stored RAW. The generated low and intermediate level solid RAW are collected on especially designated for this purpose places and are submitted to SE RAW for subsequent processing and storage.

The liquid RAW generated in the course of NPP operation represent liquid radioactive concentrates (evaporation concentrate - EvC) and organic RAW – water suspensions of spent resins and sorbents and small amounts of radioactively contaminated oils. The different liquid RAW follow different technological patterns and are stored separately in tanks at the auxiliary buildings (AB) of the Units.

The amounts of RAW generated in 2008 and the amounts stored at the end of the year in the NPP facilities are illustrated in the table below:

RAW generated in 2008			RAW stored as of 31 December 2008		
Solid [m <sup>3</sup> ]	Metals [tons]	EvC [m <sup>3</sup> ]	Solid [m <sup>3</sup> ]	EvC [m <sup>3</sup> ]	Sorbents [m <sup>3</sup> ]
794	75.6	464.26	1736	6634	865

### Management of RAW at the State Enterprise Radioactive Waste (SE RAW)

The processing and conditioning of radioactive wastes generated from the Kozloduy NPP operation is carried out by the Specialized Department (SD) RAW Kozloduy and of RAW generated as a result of application of sources in industry, agriculture, medicine and scientific research by the Specialized Department "Permanent Repository for RAW" Novi han of the State Enterprise Radioactive Waste (SE RAW).



### SD RAW Kozloduy

The SD RAW-Kozloduy facilities receive solid low- and intermediate level RAW and evaporation concentrates (EvC), which are processed in order to be transformed into a form that can allow their safe storage and subsequent disposal. After the respective processing the received RAW are packed in a special reinforced concrete container (SRCC) and as a result three types of packages are obtained:

- SRCC-1 containing solid RAW which are not placed in a cement matrix
- SRCC-2 where the solid RAW are cemented with “pure” cement
- SRCC-3 where the cement matrix is made using liquid radioactive concentrate.
- In 2008 the NRA approved a new recipe for preparation of the cement matrix on the basis of the submitted results from functional tests.

The following table provides data for the packages produced in the last 5 years with accumulation, by categories.

Package type	2004	2005	2006	2007	2008
SRCC-1	128	186	261	276	290
SRCC-2	10	28	73	132	179
SRCC-3	106	182	284	415	528

The operation of SD RAW Kozloduy is carried out in accordance with the terms of its operating license which was renewed in April 2008. Some activities were performed, in compliance with the license terms, related to the enhancement of safety, through the implementation of two main programmes – “Programme for management of RAW from Lime plant site” and “Programme for the enhancement of the safety of the installation for management of RAW from the Kozloduy”. The key activities are related to the characterization of RAW of the Kozloduy NPP in terms of the radionuclides, important for the long-term safety in their management.

The state of radiation protection is reported monthly to the NRA. In 2008, the radiation parameters at all SD RAW-Kozloduy facilities were below the permissible limits, there were no hazardous radiation effects on the nuclear installation site and the Kozloduy NPP’s site, and no violations or exceeding of the dose limits for occupational exposure of the controlled staff were observed.

A system of indicators for safe operation has been introduced in the SD RAW Kozloduy which are analyzed and accounted for periodically by the NRA. No operational events have been reported by the SD RAW Kozloduy in 2008.

The following permits have been issued in the framework of the license for operation:

- introduction of an amendment in the construction of a “reinforced steel concrete container for transportation and storage of reprocessed RAW” – 10 January 2008.
- introduction of amendments to documents included in Annex 2 of the license (Technical Specifications, emergency plan, instruction for organization and carrying out of technical maintenance, instruction for organization and carrying out of repair activities) – 7 July 2008.
- introduction of an amendment in the construction of a “reinforced steel concrete container for transportation and storage of reprocessed RAW” – 18 August 2008.

The activities on the reconstruction of the storage facility for low level radioactive contaminated soils situated on the Lime plant site were initiated in the framework of the issued license, the activities on removal, sorting, preliminary processing and conditioning of RAW from the cells of the trench facility continued, each separate cell being equipped with additional insulation and an appliance for identification of the presence of

water in the cell as well as construction of external additional hydro insulation for the whole trench storage facility.

### Management of RAW in the SD PRRAW Novi han

The RAW generated as a result of the use of SIR in industry, medicine, agriculture and research activities are managed by the SD PRRAW Novi han. The RAW generated during the last years in the country consists mainly of disused sealed radioactive sources and smoke detectors (SDT) which are usually delivered to the SD PRRAW Novi Han without any preliminary processing and often in their original packaging and working containers. In the framework of the updated programme for enhancement of safety, activities on the reconstruction of the storage unit for liquid RAW, conditioning of tritium sources and the reprocessing of secondary generated liquid RAW began. For the purpose of minimizing the volumes of RAW, the activities of dismantling sources from SDT successfully continued.

In 2008, the following RAW were accepted for storage at the SD PRRAW Novi Han.

Accepted RAW	Number of Sources	Main Radionuclides
Sealed sources	127	Cs-137, Co-60
SDT (packages/sources)	7248/10527	Am-241, Kr-85, Pu isotopes
Other – uranium protections	19	Depleted uranium

Site and environment radiation monitoring programs are being implemented. A system of indicators for the safe operation was implemented. The results of the monitoring show that throughout the year the values of the radiation parameters were within the normal range for the site and do not infringe the legislatively stipulated values. No deviations from the facility's normal operation were observed.

### National repository for disposal of RAW

Two out of the four phases of site selection were completed in 2008, namely development of a disposal concept and planning for site selection and collection of data and characterization of the regions. The third phase is in a process of implementation – characterization of the sites.

The NRA has approved a report for collection of data and analysis of regions, which localizes 12 potential sites for a National repository for RAW (NRRAW) applying the principle of the centralized approach. Through an analyses based on a system of 23 comparison factors, the 12 potential sites were analyzed and classified. On this basis 5 prospective sites were selected on a part of which during the last phase "site characterization" detailed investigations and research will be carried out. Following the completion of these investigations and research it is necessary that the selected by the SE RAW site should be approved by the NRA.

## Regulatory inspections

One inspection was carried out in December at the Kozloduy NPP, Power Production 2 on inspection of the activities on RAW management. The following issues were considered during the inspection: organization of collection, characterization and inventory of liquid and solid RAW as well as the control and accounting of radioactive discharges in the process of RAW management. The activities on preliminary processing and storage of RAW as well as the technical condition and servicing of the existing installations for raw management were also inspected. It was ascertained that there is progress in the organization, planning, implementation and analysis of the activities related to RAW management, as well as that there is good knowledge on the part of the personnel on issues in this field. New operational instructions, accounting documents and routing slips are being developed. There are some weaknesses that have been found with regard to compliance of the



categorization of RAW with the legislative requirements, characterization of RAW and the effectiveness of the organizational structure.

A topical inspection was carried out at the end of 2008 for inspection of the activities of the Kozloduy NPP for preparation for decommissioning of units 1-4 and the implementation of plans and programmes for dismantling of equipment. The issues related to the organization of the activities and the personnel from department "Decommissioning" of Power Production 1 were also discussed. The problems related to the documents substantiating the initiation of the dismantling activities in turbine hall were discussed such as radiological monitoring of the equipment, preparation activities for decommissioning and different programmes on the movement of dismantled materials. The stage of implementation of the projects for new facilities and installations related to decommissioning was inspected. The newly developed Plan for decommissioning was discussed as well as the state of preparedness of the documents necessary for issuing a decommissioning permit.

In 2008, seven inspections were carried out at the specialized divisions of the SE RAW. Five of them were carried out at the SD PRRAW Novi Han, to check on the organization of activities related to receiving RAW at the facility, control and documentation, fulfilment of license conditions, radiation protection of the staff, radiation control of the site, emergency preparedness and response. An inspection was carried out on the activities on repair, technical servicing and maintenance with relation to the preparation for the winter season of the SD PRRAW Novi Han as well as on the operational feedback. The recommendations made in the protocols of findings are being implemented in the respective time periods.

Two topical inspections were carried out at the SD RAW Kozloduy on the organization of activities on quality management, radiation protection and radiation control. The comments made during the inspections have been complied with and were accounted for at the NRA.



## NUCLEAR FACILITIES AUTHORISATION REGIME

### Permits for modifications in SSC important to safety

Complying with the provisions of the ASUNE a total of 49 permits for modifications of structures, systems and components and in the internal operating rules were issued in 2008. The permits are distributed as follows:

#### **Kozloduy NPP**

- Units 1 and 2 – 4
- Units 3 and 4 – 2
- Units 5 and 6 – 38
- Common plant installations – 2

#### **SE Radioactive Waste**

- SD RAW Kozloduy – 3

#### **Permits for Import, Export and Transport of Nuclear Material**

- Import and export of nuclear material – 5
- Transport of nuclear material for the Kozloduy NPP – 5.

### Permits for construction of nuclear facilities

Following an evaluation of the submitted documents, the technical design of the dry spent fuel storage facility situated on site the Kozloduy NPP was approved in April by an order of the NRA Chairman. A permit No. O-3357 was issued in June 2008 for construction of this facility with a term of validity of 12 months.



The prepared statements related to the realization of technical solutions for modification of structures, systems and components important to nuclear safety and to the introduction of amendments in the Technical Specifications and other technical documentation are presented in Annex 3. The statements include the results from the review and assessment of the submitted documents for correspondence to the legislative acts and where appropriate to the international safety standards published by the IAEA.



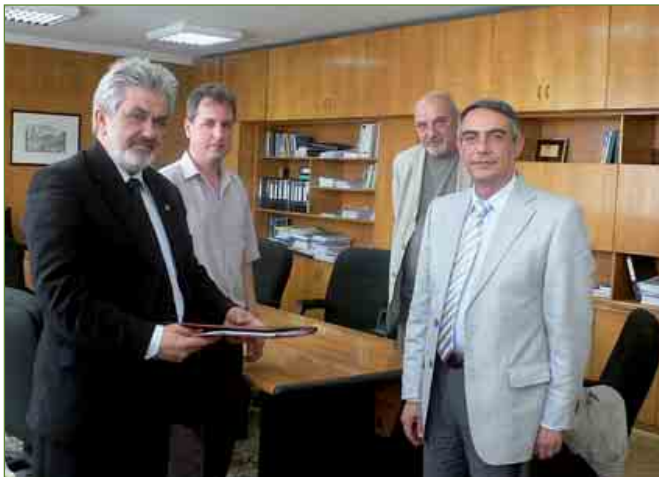


## Licenses

Three licenses were issued throughout the year, namely:

- to SE RAW for management of RAW through its SD RAW Kozloduy, Licence series "E", No. 02452/29.04.2008. This license renews the old license series "E", No. 01740/29.04.2006.
- to Kozloduy NPP for operation of unit 1 in operational regime – condition "E" (storage of spent fuel in the reactor pool) license series "E" No. 02489/24.09.2008. This license renews the old license series "E", No. 00707/20.02.2004.
- to Kozloduy NPP for operation of unit 2 in operational regime – condition "E" (storage of spent fuel in the reactor pool) license series "E" No. 02490/24.09.2008. This license renews the old license series "E", No. 00613/15.01.2004.

## Issued Licenses for Specialized Training



Last year, after reviewing the applications and the enclosed documents, the Chairman of the NRA issued license series "OE" No. 02464/06.06.2008 for specialized training and issuing individual licenses for activities performed with sources of ionizing radiation to the Ministry of Emergency Situations, division "Information and training".

## Individual licenses for Use of Nuclear Energy

Under the ASUNE, following an examination successfully passed in front of the NRA Qualification Examination Commission, the NRA Chairman issues individual licenses to persons performing activities related to ensuring nuclear safety and radiation protection in nuclear facilities. In 2008, nineteen sessions of the Qualification Examination Commission were held and 40 persons were granted individual licenses for the respective operational positions at the Kozloduy NPP as follows:

- 4 for the position of chief shift supervisor of nuclear power plant, Units 5 & 6;
- 6 for the position of shift supervisor of nuclear power unit, Units 1-4;
- 9 for the position of shift supervisor of nuclear power unit, Units 5 and 6;
- 5 for the position of senior reactor operator, Units 1-4;
- 13 for the position of senior reactor operator, Units 5 and 6;
- 1 for the position of controlling physicist, Units 1-4;
- 2 for the position of controlling physicist, Units 5 and 6.



## Current licensing activities

- research reactor IRT-2000, by application INRNE-BAS, the procedure is at the stage of nuclear facility design approval;
- INRNE-BAS – there is an application submitted for the issuing of a license for specialized training and issuing of individual licenses for activities with SIR;
- dry spent fuel storage facility, by application of the Kozloduy NPP – the procedure is at the stage of construction;
- Belene NPP – the procedure is at the stage approval of the technical design;
- Kozloduy NPP – applications have been submitted for renewal of the licenses for operation of units 5 and 6.





## RADIATION PROTECTION AT SITES WITH SOURCES OF IONIZING RADIATION

### Authorisation Regime for Activities with Use of SIR

Pursuant to the ASUNE, all activities related to the use of sources of ionizing radiation (SIR) are subject to authorisation, which is carried out by the NRA under the Regulation for the procedure for issuing of licenses and permits for safe use of nuclear energy. The authorisation regime includes the following:

- issuing of licenses for 4 types of activities: use of SIR, manufacturing of SIR, transport of radioactive substances, servicing of SIR (installation, dismantling, measurement, repair and others);
- issuing of permits for 5 types of activities: construction, installation and preliminary tests at a facility with SIR; single shipment of radioactive substances, temporary storage of radioactive substances; manufacturing of radioactive substances, decommissioning of facilities with radioactive substances.

Licenses are issued for multiple repeated activities for a period of up to 5 years and the permits refer to single activities in specific cases.

The basic requirements towards licensees and permit holders on ensuring radiation protection during activities with SIR are determined in the ASUNE, RBNRP-2004 and the Regulation for radiation protection during activities with SIR. The NRA keeps a public register of the issued licenses and permits.

By 31 December 2008 the total number of licensees and permit holders registered in the NRA was 1392.

In 2008, a total of 153 licenses were issued distributed by types as follows:

- For use of SIR for industrial, medical or scientific purposes and for performing control functions – 130;
- For servicing of SIR for the purposes of technical services, installation, dismantling, measurements, construction and repair works and other services to entities using SIR – 16;
- For transport of radioactive substances – 7.

The licenses for the use of SIR for medical purposes are co-ordinated on an institutional basis with the Minister of Health through the NCRRP.

In 2008, pursuant to Article 21 of the ASUNE, by orders of the NRA chairman, 122 valid licenses were amended and 35 licenses were terminated by request of their holders.

In 2008, 470 permits for activities related to the use of SIR were issued, distributed by types as follows:

- For construction of sites with SIR, installation and preliminary tests – 217;
- For temporary storage of SIR – 34;
- For single transportation of SIR – 3;
- For import of SIR – 201 (125 – for medical purposes, 10 – for scientific purposes, 56 – for industrial purposes, 10 – for controlling purposes);
- For export of SIR – 15.

In 2008, a total of 820 permits for import and 15 for export of SIR were issued by the NRA according to certificate templates pursuant to the Regulation on the Conditions and Order for Registration and Permission of Foreign Trade Transactions which are an inseparable part of the permits, a total of 216 being issued by the NRA for each specific case of import/export of SIR.

The radioactive sources imported in 2008 were intended mainly for medical purposes. They included

technetium generators ( $^{99m}\text{Tc}$  – 485), technetium packages – 166, radiopharmaceuticals for nuclear medicine (a total of 919 packages:  $^{32}\text{P}$ ,  $^{131}\text{I}$ ,  $^{125}\text{I}$ ,  $^{123}\text{I}$ ), sources for brachytherapy ( $^{192}\text{Ir}$  – 2), 48  $^{192}\text{Ir}$  and five  $^{75}\text{Se}$  sources were imported for the purposes of non-destructive testing. For the support of technological control devices 8  $^{137}\text{Cs}$  sources were imported.

In 2008 a total of 103 diagnostic and dental x-ray apparatuses were imported of which 33 second hand.

The total number of registered facilities where SIR are used or stored (except for the sites with smoke detectors) is 1620 distributed among the areas of application as follows:

- Industrial purposes – 169 facilities (77 – non-destructive testing; 77 – technological control devices; 15 – static electricity neutralizers);
- Medical purposes – 1214 sites;
- Scientific purposes (researches, education, agriculture) – 130 sites;
- Control or other application purposes – 107 sites.

The number of facilities using smoke detectors having NRA approval is 44 (the number of radioactive sources incorporated in the detectors is 17070). By a permit of the NRA, smoke detectors incorporating a total of 3903 sources are stored in another 19 sites. Twenty six sites are undergoing a procedure for transfer of the smoke detectors for storage at the SE RAW.

In fulfilment of the special programme for accepting RAW from past practices, in 2008 the SE RAW has received for long term storage in the PRRAW-Novi han a total of 273 sealed sources ( $^{137}\text{Cs}$  – 79,  $^{60}\text{Co}$  - 22, neutron sources with  $^{241}\text{Am}/\text{Be}$  - 7, gamma radiography devices - 7, static electricity neutralizers – 158). Another 9770 sources incorporated in smoke detectors which have been collected at 83 facilities have been received for storage. The activities on submission/reception of spent radioactive sources in the PRRAW – Novi han are carried out pursuant to the Regulation on the conditions and procedure for transfer of radioactive waste to the state enterprise RAW and are controlled by the NRA.

SE RAW jointly with the NRA annually updates the list of facilities and radioactive sources, which are included in the special programme for the respective year. The deadline for completing the activities on accepting RAW from past practices (historical RAW) envisaged in the adopted by the Council of Ministers “Strategy for management of spent fuel and radioactive waste” is the end of 2010.

## Accounting and Control of SIR

Pursuant to the ASUNE and the Regulation for radiation protection during activities with SIR, the licensees and permit holders carry out constant control and keep strict accounting of the used and stored SIR. According to the legislative requirements, the managers of facilities with SIR carry out annually inventory and check on the presence, place and condition of the used or stored SIR and submit to the NRA a protocol of findings (act of the commission carried out the inventory). In all facilities there are responsible persons appointed for radiation protection who keep logbooks on the movement of radioactive sources. In case of missing, theft or some other incident with SIR the licensees inform immediately the NRA.

The NRA maintains a National Register of the Sources of Ionizing Radiation in the Republic of Bulgaria (NRSIR) that is established on the basis of the Code of Conduct on the Safety and Security of Radioactive Sources published by the IAEA in 2004.

The NRSIR includes data on the activity, radionuclide contents, type, technical characteristics and location of the different types of SIR, (radioactive sources of categories 1-5 and generators of ionizing radiation) including data on the licensees and permit holders controlled by the NRA.

The NRA provides information from the NRSIR, regarding the use and storage of SIR in the country, to the specialized state authorities.



By 31 December 2008 there are totally 3793 sealed radioactive sources registered in the NRSIR used in gamma irradiators, gamma radiography devices, devices for technological control or for other purposes. The total number of registered generators of ionizing radiation used for medical, industrial, scientific or controlling purposes is 3087.

Category 1 comprises of sealed high-level sources used in gamma-irradiation installations. Twenty gamma-irradiation installations are installed and used in the country (nine for industrial and scientific purposes, and eleven for medical purposes – telegammatherapy). The number of the sealed sources loaded in them is 322 (196 sources cobalt-60 and 126 sources cesium-137).

Category 2 comprises of activities with sealed high-activity sources used for non-destructive testing and brachytherapy. The total number of gamma radiography devices is 236 of which 109 are used and are regularly reloaded with Iridium-192 and Selenium-75. (The remaining 127 are stored in their factory depleted uranium containers and are not reloaded). The licensees use 85 vehicles for transportation of gamma radiographers in the country.

Category 3 comprises of high activity sealed radioactive sources used in technological control devices (TCD – level meters, density meters, moisture/density meters, etc.). The total number of registered TCD is 479 (the number of sources incorporated in them is 529), which are used and stored in 77 industrial facilities.

Category 4 comprises of static electricity neutralizers (SEN) which are used mainly in the furniture and textile industry. The total number of registered SEN is 115 (the number of sources incorporated therein is 1736). With the approval of NRA, 15 SEN are used at 2 facilities, and the other 100 SEN are stored at 13 sites.

Category 4 also includes other low activity sources used for metrological inspection of devices for measurement and in laboratories and facilities working with different types of control measuring devices.

Category 5 comprises of all types of smoke detectors and radioactive sources used in industrial, public and administrative buildings.

Category 5 includes also other sources with very low activity used for controlling purposes.

The NRA applies a strategy for limitation of the use of smoke detectors (SDT), for their submission for storage to the SE RAW and the systematic search for orphan or unregistered SDT in the country. With the assistance of the Ministry of Interior (National service fire safety and protection, Service for control of dangerous materials) and the State Agency for National Security a programme is being implemented for detection of facilities where SDT are being used or stored without a NRA permit, the respective corrective measures being undertaken and the prospective owners being investigated. Pursuant to the programme, a total of 102 facilities with SDT have been inspected in 2008. According to the information provided by the National service fire safety and protection, 40 new facilities with SDT have been registered at the NRA, which are subject to inspection and subsequent submission of the existing SDT for storage at the SE RAW.

The activities on searching for orphan and unregistered SDT will continue in the future. This is necessary because the exact number of imported and used in the country SDT in the years when no regulatory control has been exercised over them (i.e. before the promulgation of the LUAEPP in 1985) is unknown.

Summarized for the period 2000-2008, a total of 588 facilities with SDT have been taken off the control list following their submission to the SE RAW for storage of about 109 000 sources incorporated in SDT.

The NRSIR keeps account and controls also the facilities with open radioactive sources, which are used mainly in medicine for nuclear diagnostics, metabolic radiotherapy and medical biological examinations. A total of 90 facilities with open radioactive sources have been registered, distributed as follows:

- 1<sup>st</sup> category operations with open radioactive sources – performed at 1 facility;
- 2<sup>nd</sup> category operations with open radioactive sources – performed at 36 facilities;
- 3<sup>rd</sup> category operations with open radioactive sources – performed at 53 facilities.



By 31 December 2008, 3087 ionizing radiation generators are registered, distributed by areas of application as follows:

- Medical x-ray apparatuses for diagnostics and therapy – 2670;
- X-ray devices for non-destructive monitoring – 129;
- Other x-ray apparatuses for industrial and monitoring purposes – 190;
- X-ray fluorescent and spectral analysis apparatuses - 47
- Electronic microscopes – 49;
- Medical linear accelerators for radiation therapy – 2.

The medical x-ray apparatuses are divided by types as follows:

- Conventional x-ray apparatuses for graphic and scope examinations – 1520;
- Computerized tomography – 182;
- Mammography – 193;
- Fluorography – 39;
- Angiographs – 42;
- Lithotripters, densitometers – 32;
- Dental x-ray apparatuses – 626;
- Therapeutic x-ray apparatuses – 36.

In 2008, the NRA participated in the international conference organized by the IAEA on the enforcement of the Code of Conduct on the Safety and Security of Radioactive Sources and the Guide on import and export of radioactive sources. Ninety-two countries, including Bulgaria have declared officially to the IAEA that they adopt these documents for regulatory control over activities involving radioactive sources.

The measures included in the Plan for action on the enforcement of the legislation of the European Union in the field of radiation protection -2007/2008 are being implemented. Drafts for the amendment and supplementing of three regulations have been developed related to the radiation protection in activities with SIR and a draft for amendment and supplementing of the ASUNE. The NRA carried out training of licensees and employees of the MI and the SANS on the enforcement of the new legislation in the field of radiation protection.

## Inspection Activity at Facilities with SIR

In accordance with the ASUNE, the NRA performs:

- Preventive control in the process of issuing licenses, permits and individual licenses;
- Routine control on the compliance with the terms of the issued licenses and permits;
- Follow-up control on the compliance with the recommendations or improvement notices given by the controlling authorities.

The planned inspections at the facilities with SIR are carried out under an established annual plan. The scope and intervals of inspections are differentially determined according to the type (category) of the respective SIR and the level of radiation risk of the performed activities. The facilities with SIR of category 1 are inspected on an annual basis.

The inspections are carried out according to the adopted "Instruction on carrying out inspections in facilities with SIR" the following being examined:





- Compliance with the conditions of the issued licenses and permits, and the requirements for radiation protection in activities with SIR, fulfilment of improvement notices;
- House-keeping, organization of the radiation monitoring and the individual dose control, management of documentation;
- Radiation situation at the facility, availability of means for radiation protection and preparedness for response in case of a radiation accident;
- Qualification and certification of the staff;

The state bodies exercising control over the public health (NCRRP and Regional inspectorates on the protection and control of public health) carry out inspections in facilities with SIR according to a separate programme independently from the NRA.

In accordance with the NRA Annual Inspection Plan, in 2008 inspections were performed at 98 facilities with SIR (topical inspections on radiation protection). Under additionally adopted programmes, 134 more facilities with SIR were inspected. For the purposes of commissioning of new facilities with SIR, 82 acceptance commission inspections were conducted. Seventy nine improvement notices were issued related to radiation protection (74 out of them are for transferring SDT from the respective facilities to the SE RAW for storage). The inspectors have filed 4 reports for established violations of the legislative requirements for radiation protection and respectively have issued 4 penalty acts pursuant to the ASUNE.

A total of 314 inspections have been carried out in facilities with SIR (routine and extraordinary inspections and acceptance commissions) in 2008.

The results of the control over occupational exposure in facilities with SIR show that there are no deviations from the legislative requirements. Individual dose control and medical monitoring of staff are performed at the facilities with SIR in compliance with the legal requirements. No deviations from the standards for occupational exposure were observed at the respective facilities. The average annual individual effective dose of the professionally exposed persons in facilities with SIR is about 1,5 times lower than the limit for the public - 1,0 mSv.

## EMERGENCY PREPAREDNESS AND RESPONSE

Pursuant to the ASUNE, the measures for protection of the population in case of a nuclear or radiation accident are determined by an Off-site Emergency Plan and an On-site Emergency Plans of the respective ministries, institutions, local government and licensees who use nuclear energy and ionizing radiation, manage radioactive waste and spent fuel.

The Regulation on Emergency Planning and Emergency Preparedness in Case of a Nuclear and Radiological Emergencies determines the following: requirements towards emergency plans and maintaining emergency preparedness, obligations and responsibilities of the persons involved in the emergency plans and performing activities in case of an accident, measures for mitigation and liquidation of the consequences from a nuclear and radiation accident, the order for informing the population and the criteria for applying protection measures.

The ASUNE, the Act on Crisis Management, the Disaster Protection Act, the Act on Public Health and the respective regulations for their enforcement determine the principles, criteria, order and conditions for maintaining emergency preparedness and response in case of incidents and accidents with possible radiological consequences. The infrastructure for maintaining emergency preparedness and emergency response corresponds to the requirements and criteria in the European legislation and the IAEA documents in this field. The MES through its General Department "National Service Civil Protection" and the regional divisions manages control and co-ordinate the activities on emergency planning and response in case of a nuclear or radiation accident.

The off-site emergency plan and the on-site emergency plans are periodically updated. The updated off-site emergency plan of the Kozloduy NPP was adopted by a CM decision No. 678/29.10.2008 which is part of the National plan for carrying out salvage and immediate emergency repair works. The internal emergency plan of the NRA "Requirements and order for emergency planning, maintaining of emergency preparedness and response in case of a nuclear and radiation accident" was updated in 2008.

The human, technical and material resources for emergency response and ensuring radiation protection of the population in case of a nuclear and radiation accident is ensured at a national, institutional and local level. A communication information system is maintained for informing the population. Organization has been established and the necessary technical means and equipment have been provided for notification and early warning, radiation monitoring, radiation protection for the population and the emergency teams, performing engineering restoration works and urgent medical help in case of a nuclear and radiation accident. Emergency centres and a National situational centre are being maintained for management of emergency situations in the country.

Training and exercises are being carried out periodically at institutional, national and international level for inspection on the preparedness for action and response in case of a nuclear and radiation accident. National exercises were held in 2008 regarding the Kozloduy NPP and the SD PRRAW Novi han. The NRA took part in the exercise ConvEx-2b-2008 organized by the IAEA and related to the international exchange of information in case of a nuclear or radiation accident. The NRA took part also in the international exercise SESIM - 2008 for response in case of possible incidents with weapons of mass destruction.

The NRA means for communication with the Kozloduy NPP, the IAEA and the system ECURIE for prompt notification in case of a radiation accident are tested on a regular basis. The communication with the EU (the ECURIE system) is tested daily according to the established order.

In 2008 the NRA took part in international working groups and meetings of the EU for development of new documents in the field of radiation protection, emergency planning and response in case of radiation accidents (working group on Emergency Preparedness and Action Levels, working group on Radiation Protection, draft TMT handbook on Triage, Monitoring and Treatment of People Exposed to Ionising Radiation Following a Malevolent Act). The NRA and SANS took part in the work of the European commission on issues of chemical, biological, radiological and nuclear threat. The NRA participates in the created by the MES working group on protection of the critical infrastructure in connection with the preparation of an EU Directive on these issues.



In 2008 the MES jointly with the NRA entered into force a “Manual on the requirements for risk assessment and main requirements towards the volume and content of expertise on potentially dangerous sites”.

In 2008 was concluded the implementation of a project financed by the EU under the PHARE programme on the installation of a system for forecast of the consequences and assisting decision making in case of a nuclear accident (RODOS system). Successful functional tests have been carried out of the RODOS system (computer equipment, software product, channels for transfer of data). The NRA organized two courses and carried out training of employees from interested institutions on the RODOS system.

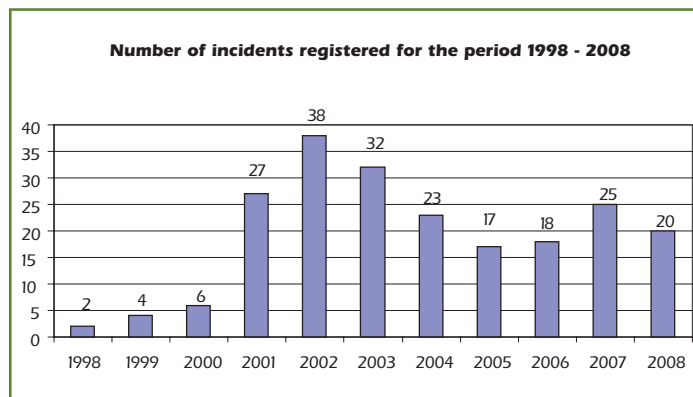
The software “EPA DOSE” was installed at the NRA Emergency centre in 2008, developed for the purpose of emergency planning and response (modelling programme for assessment of the radiation consequences and protection measures for the population in case of a radiological accident in the Kozloduy NPP). The software “Assessment of the risk from emergency events with sources of ionizing radiation to the population and the environment” also was installed.

A Guide on operative assessment of the radiological consequences and decision making for applying protection measures in case of a nuclear or radiation accident in an NPP outside the territory of the country entered into force. Fourteen NPPs are being covered, situated at the territories of Romania, Ukraine, Slovakia and Czech Republic (the guide is based on the software product “ESTE” implemented in Slovakia and Austria).

The NRA maintains a database on the registered in the country incidents and accidents with radioactive sources (module “Incidents with sources” to the integrated computerized information system of the NRA). The NRA regularly publishes at its web page information on the incidents with radioactive sources in the country.

In 2008 the NRA organized courses and carried out training on the application of the new legislation in the field of emergency planning and response for employees of the MI, SANS, General Department “Border Police” and State Agency Customs as well as for companies working with scrap metal (about 270 persons took part in the training).

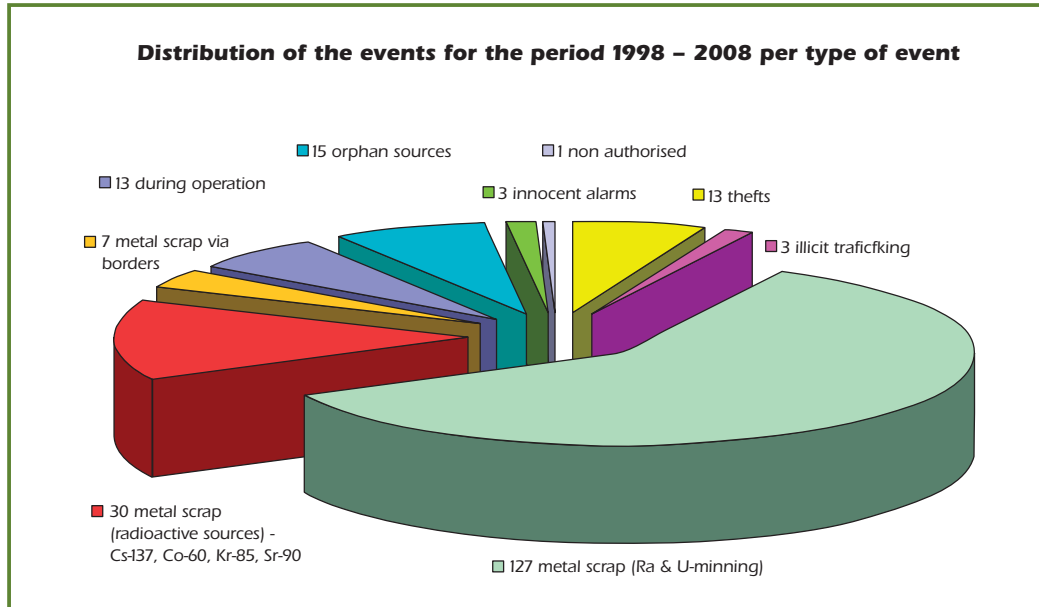
The distribution by years of the registered incidents with radioactive sources and materials that have occurred over the period 1998 – 2008 (a total of 212 events) is shown on the figure.



The figure below shows the distribution of events according to their characteristics. About 80 % of the cases (a total of 164) pertain to scrap metal where materials with increased radioactivity have been found. These are usually (127 cases) appliances or parts covered with luminous fluorescent paint /containing Radium-226/. Twenty incidents with radioactive sources have been registered in 2008, 19 of which are related to scrap metal.

Interdepartmental emergency teams, organized according to the specific case by employees from the competent state authorities of the NRA, the Ministry of Health, the Ministry of Interior, the General Department “National Service Civil Protection” and the SE RAW are formed for the liquidation of the incidents. The

radioactive sources and materials discovered are being isolated, transported and delivered for safe storage at the SE RAW. No radiation consequences for the population and the environment have been registered in any one case during the period 1998-2008.



The NRA jointly with the Ministry of Interior, General Department “National Service Civil Protection” and the SE RAW work systematically and in a planned manner for mitigation of incidents and accidents involving radioactive sources. The Strategy that the competent state authorities in this field apply includes the following elements, namely:

- Enhancement of the legislative basis and the regulatory infrastructure for management and control of radioactive sources, ensuring of radiation protection, emergency preparedness and response in case of emergency events;
- Enhancement of the system for accounting, control and tracing of radioactive sources until their disposal;
- Increasing the control and physical protection at risk sites with radioactive sources;
- Tracing of orphan, lost or stolen sources, including of the unknown owners of radioactive sources;
- Exercising strict border control for detecting goods and materials with increased radioactivity in case of illegal import/export and illicit traffic of nuclear and radioactive materials;
- Preventive control in companies working with scrap metal and maintaining preparedness for response in case of incidents with radioactive scrap;





- Imposing enforcement measures to persons who breach the legislative requirements for safe use and storage of radioactive sources;
- Applying the good practice and experience of the EU Member States for providing security and ensuring safety of radioactive sources and for prevention of incidents and accidents, including such with scrap metal;
- Operative exchange of information between the interested institutions and organizations, public relations and international co-operation.

In 2008 the NRA and General Department "Border Police" in fulfilment of the agreement for co-operation signed by them, inspected jointly 37 border control check points. The NRA, the Ministry of Interior, the General Department "National Service Civil Protection" and the SE RAW implement effectively the established procedures for response in case of detection of illegal import/export and illicit traffic of radioactive materials and orphan radioactive sources.



The NRA participated in the preparation of the International Conference on Control and Management of Inadvertent Radioactive Material in Scrap Metal, which will be held in 2009 in Spain.

The infrastructure established in the country for response to radiation incidents and accidents corresponds to the international standards and criteria in this field. The Bulgarian competent authorities comply with the requirements of the EU and the IAEA recommendations for maintaining emergency preparedness and emergency response.

## INTERNATIONAL COOPERATION

In 2008 the NRA continued implementing the international cooperation of the Republic of Bulgaria in the field of safe use of nuclear energy, ionizing radiation and in the management of radioactive waste and spent nuclear fuel, in the context of the requirements ensuing from the international obligations of the country in these fields, the necessity of improving of the regulatory process in the nuclear field and the EU membership.

In this connection the NRA interacted with the International Atomic Energy Agency, with the relevant structures of the EU, with the foreign nuclear safety and radiation protection regulators within the European Nuclear Regulators Association (WENRA) and with the Joint Institute of Nuclear Research – Dubna.

### International Atomic Energy Agency

The implementation of the Programme of the IAEA Technical Cooperation Department for 2007/2008 was concluded in 2008 where Bulgaria took part with 6 national projects:

BUL 3/003 – Enhancement of Radioactive Waste Management (continuation of Programme 2005/2006);

BUL 4/013 – Strengthening the National Nuclear Power Infrastructure (continuation of Programme 2005/2006);

BUL 4/014 – Refurbishment of the Research Reactor (continuation of Programme 2005/2006);

BUL 9/021 – Strengthening the Capacity of the Nuclear Safety Regulatory Authority (continuation of Programme 2005/2006);

BUL/6/007 – Clinical Application of Advanced Conformal Radiotherapy by Introduction of Intensity Modulated Radiation Therapy (IMRT) (new);

BUL/6/008 – Routine Application of Highly Specialized Total Body Irradiation Prior to Bone Marrow Transplantation (new).



The implementation of the Programme for 2007/2008 can be regarded as successful as far as 4 of the projects were completed in full and the activities therein were realized using the whole planned budget. Projects BUL/4/014 and BUL/6/008 remained with some funds to be utilized which following a coordination with the IAEA the same will be utilized in the beginning of 2009.

The seminars, training courses, technical meetings, conferences and other scientific forums organized by the IAEA in 2008 were attended by 167 Bulgarian scientists and specialists from

the NRA, the Kozloduy NPP, the INRNE, RAW SE, the NCRRP, the MEE, the NEC-PLC, Risk Engineering, Enpro Consult, State Agency National Security, Institute on Vegetable Crops, University of Forestry, University Hospital Queen Giovanna, National Oncological Hospital, Nuclear Medicine Central Laboratory, and other scientific institutes, medical units and departments.



In 2008 the joint activities of the member states from the region with the Europe division of the Department of Technical Cooperation of the IAEA continued on the development and final adoption of the document "Regional Profile" which had started in the previous year. The objectives which this document has to achieve are as follows: to be used as a planning tool at regional level for the period 2009-2013, to outline the main priorities in the already defined areas for co-operation between the member states of the Europe region and the IAEA, to establish clear criteria for assessment of national and regional project proposals. During a joint meeting held in February 2008, the document "Regional Profile for Europe Region for Technical Co-operation for the period 2009-2013 was unanimously approved and will be used in the preparation of project proposals by the member states for the next two cycles of the Department for Technical Co-operation of the IAEA (2009-2011 and 2012-2013) as well as for their assessment on the part of the IAEA Secretariat.

In 2008 the Board of Governors of the IAEA adopted the Programme for Technical Co-operation for the period 2009-2011. The following four Bulgarian national projects are included in it, namely:

BUL/0/009 Managing Workforce Flow and Risk of Nuclear Knowledge Loss

BUL/5/012 Developing and Validating Molecular Nuclear Technologies for Rapid Diagnostics of Foot and Mouth Disease and Genotyping of Indigenous Cattle Breeds

BUL/6/009 Introducing Quality Control Techniques and Optimizing Positron Emission Tomography Radiopharmaceutical Production to Improve Patient Care

BUL/9/022 Further Upgrading the Bulgarian Nuclear Regulatory Agency for Nuclear and Radiation Safety

The projects cover a wide range of activities in a national plan – from nuclear power to the application of nuclear technologies in medicine and agriculture, which is also in accordance with the IAEA recommendations for diverse interaction with the member states. The project for strengthening the activity of the regulatory authority continues to be implemented also in the new cycle of the Programme for technical co-operation. The planned activities are in the field of development of guides for implementation of the NRA regulations, improving the system for training of inspectors and their capabilities for carrying out safety assessments. With view of the forthcoming construction of a new nuclear power capacity in our country and the related to this activity licensing process, the efforts are focused on rendering expert assistance to the NRA in the assessment of safety of the Belene NPP project. Bulgaria also submitted two proposals for regional projects in the field of nuclear applications in agriculture, namely: Supporting Early Warning and Surveillance of Avian Influenza Infection in Wild and Domestic Birds and Assessing Genetic Markers for Bird Resistance and Evaluation of Natural and Mutant Genetic Diversity in Horticultures Using Nuclear and Molecular Techniques. Bulgaria will also be main co-ordinator of the activities on these two projects.

A delegation of the Republic of Bulgaria headed by the Chairman of the NRA took part in the 52nd Regular Session of the General Conference of the IAEA which was held from 29 September to 3 October 2008 in Vienna. The members of our delegation participated in the scientific forum of the Conference "Future role of the IAEA", and also in the session of the Member States of the Europe region receiving technical assistance, the session of the senior regulators, as well as in bilateral meetings. In the framework of the General Conference on a motion by the Bulgarian side, a meeting was carried out with experts from the division of Nuclear Installation Safety of the IAEA for clarification of some issues related to the implementation of an IAEA expert mission on Kozloduy NPP units 5 & 6 planned for November 2008.

## Convention on Nuclear safety



The fourth review meeting of the national reports ensuing from the fulfilment of the obligations under the Convention on Nuclear Safety was held from 14 to 25 April 2008 at the IAEA Headquarters in Vienna. Fifty five contracting parties out of 61 that have signed the Convention took part in the meeting.

The Bulgarian national report presented in full what was achieved by our country in fulfillment of the obligations under the Convention on Nuclear Safety, the priority being given to the following issues, namely:

- development of the nuclear sector following the third review under the CNS in 2005;
- completion of the programme for modernization of Kozloduy NPP units 5 & 6;
- shut down of units 3 & 4 of the Kozloduy NPP;
- basic characteristics of the Belene NPP project and the requirements towards it.

During the discussion over the Bulgarian report, the following activities were ascertained as good practices, namely: interaction with international organizations in the field of regulatory activities, the policy of the Bulgarian regulatory authority for periodic review of the legislation pertaining to the peaceful utilization of nuclear energy as well as the involvement of the NPP personnel in the safety assessment of the modifications.

For the following fifth review in 2011 Bulgaria shall have to report on the implementation of the following planned measures in fulfillment of the requirements of the CNS, namely: development of guides for the enforcement of the secondary legislation in the regulatory activity, the application in practice of the risk informed approach in the regulatory activity, optimization of the monitoring and maintenance activities in the Kozloduy NPP through the use of risk informed approach, the preparation and assessment of the periodic safety review of units 5 & 6 of Kozloduy NPP, updating of the probabilistic safety analyses and the manual for management of severe accidents on the results of the modernization of units 5 & 6 and the international participation in the construction of a new nuclear power capacity.





## Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (Joint Convention)

The preparation of the third review of the national reports of the contracting parties under the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management began in 2008.

Experts from the NRA, MEE, MEW, SE "RAW", Kozloduy NPP and INRNE-BAS drafted the Bulgarian national report, which was approved by the Council of Ministers decision No. 644 dated 13 October 2008. The same decision also determined the content of the Bulgarian delegation for the organizational meeting on the preparation of the review, as well as the content of the delegation for the proper review meeting. In the beginning of October in accordance with the set deadlines the national report was submitted to the IAEA. The report is published at the NRA web page [www.bnra.bg](http://www.bnra.bg).

A delegation from the NRA took part in the organizational meeting on the preparation of the third review held also in October. The meeting decided on the designation of managers for the third review, the distribution of the member states into groups, the responsible officials of the different groups and decisions were taken on other issues related to the conducting of the review.

The review meeting of the national reports pursuant to the Joint Convention itself will be held in May 2009 at the IAEA Headquarters. The Bulgarian delegation for the third review meeting headed by the NRA chairman will include also representatives from the NRA, MEE, Kozloduy NPP, SE "RAW" and the Permanent mission of the Republic of Bulgaria in Vienna.

## EU Structures

The main activities on the interaction with the EU structures throughout the year were focused towards the work of the High level group (HLG) of the EU, the preparation for introduction and the entry into force of EURATOM Directive 2006/117 of the EU and the preparation for reporting by Bulgaria pursuant to art 37 of the EURATOM treaty.

Four regular and one extraordinary meetings of the EU High level group were held in 2008. The main objective was the adoption of a consolidated structure for a draft EU directive establishing a community framework for nuclear safety. In the framework of the discussions over the topic the greater part of the members of the group including Bulgaria came to the conclusion that the drafting of a directive with detailed technical requirements and characteristics is impossible as far as they are subject of national legislation (e.g. incorporation of WENRA reference levels on nuclear safety) or have already been reflected in internationally recognized standards on nuclear safety (e.g. IAEA safety series). This approach was adopted by the EU and by the end of the year a new revision of the directive was submitted for co-ordination, which to a greater extent reflects the proposals submitted by the members of the group. Bulgaria was represented in the group at a level chairman and deputy chairman of the NRA.

The EU entered into force Directive 2006/117/EURATOM on accounting and control over the transportation of radioactive waste (RAW) and spent fuel (SF). The directive repeals Directive 92/3/EURATOM and determines the requirements in carrying out international transport within the Community as well as during import, export or transit transportation through the Community of radioactive waste or spent fuel. This directive introduces a new "Standard document for monitoring and control over the transportation of RAW and SF", and for the purpose of its application in Bulgaria the NRA chairman issued an order for its adoption pursuant to art. 116 par. 1 of the Regulation on the conditions and order for carrying out transport of radioactive substances, approved by a Council of Ministers decree No. 156 dated 13 July 2005. (promulgated in State Gazette No. 60 dated 22

July 2005) The new requirements of the Directive have been transposed in the proposal for amendment of the ASUNE.

A meeting was held in August 2008 on a motion by the NRA, between experts from the NRA, MEE and SE "RAW" and representatives from the EC – General Directorate "Transport and Energy" for discussions of the recommendations, methods and order for reporting on the part of Bulgaria in accordance with the requirements of art. 37 of the EURATOM treaty. According to this article the member states have to submit to the EC in advance each plan for discharge into the environment of radioactive waste. These data give the possibility to determine whether the implementation of such a plan can cause radioactive contamination in the environment of another member state. An obligation arises herein for the NRA in the process of licensing to take into consideration the provisions of art. 37 and thus become one of the conditions for issuing or amendment of a permit or a license in connection with the operation or decommissioning of nuclear power plants.

The first meeting of the scientific technical committee of the EC was held in January in Brussels. The objective of this scientific technical committee is to consult the EC on issues related to the development of the nuclear programme of the Union, presenting official expert opinion which would give the possibility for decision making and also making the necessary choice. Bulgaria is represented at the scientific technical committee at the level of deputy chairman of the NRA.

## PHARE Programme of the European Union

The implementation of three projects under the PHARE programme to which the NRA was the end user was successfully completed in 2008.

- **2004/016-815.01.02 for providing assistance to the NRA in the review of the Updated Safety Report on Units 6 and 6 of the Kozloduy NPP and the assessment of compliance with the international standards;**

A consultant to the NRA on this project was a consortium led by the Finnish company TVO Nuclear Services. In the framework of the project implemented for a period of 21 months was developed a methodology for regulatory review of the reports in compliance with the best practices in the EU countries and the International Atomic Energy Agency. The methodology is documented in 9 manuals for review and practically tested in the process of assessment of the reports. As a result of the implementation of the project were reached all general and specific objectives including development of recommendations and proposals for assistance to the NRA in the process of regulatory decision making and improvement of the quality of the reports.

- **2004/016-815.01.03 for providing assistance to the NRA in the development of a capacity in the field of elaborating regulatory guidelines, safety assessment, staff training and quality management.**

The project was implemented by a consortium led by AMEC NNC (UK) with the participation of DGP International (UK), Risk engineering Ltd. (BG) and TVO NS (FI). Five guides were developed for the period of implementation of the project in the field of regulation of nuclear safety as follows:

1. Protection from internal fires in nuclear facilities;
2. System for management of facilities and activities;
3. Use of probabilistic analyses in the management of safety in nuclear power plants;
4. Designing of nuclear power plants;
5. Operation of nuclear power plants.

Training of NRA experts was carried out in the framework of the project in the field of safety assessment as well as in the use of software tools for probabilistic analyses (RISK SPECTRUM) for core kinetics and fuel



performance, for consequence assessments and Source term, programme code PC\_CREAM and FISPIN and for severe accidents, programme package MAAP. In separately formulated tasks from the project were developed a software based tool for organization of training and competence for the purposes of the NRA as well as a system of indicators which would allow the agency to assess its performance in different fields of its activity.

- **2005/017-519.01.01 on providing support to the NRA in the aspect of establishing regulatory requirements on the basis of assessment of the probabilistic safety analysis (PSA) of the Kozloduy NPP Units 5 and 6.**

The project was implemented by a consortium led by RISKAUDIT IRSN/GRS International with the participation of Radiation and Nuclear Safety Authority (STUK) (FI), Gesellschaft fuer Anlagen und Reaktorsicherheit (GRS) (DE), Institute de protection et de surete nucleaire (IRSN) (FR), Institute for Nuclear Research and Nuclear Energy of the Bulgarian Academy of Sciences and the Technical Research Centre (VTT) (FI). For the time period of implementation of the project were reviewed and assessed the reports from the probabilistic safety analysis (PSA) level 1 (for full power condition, low power and shut down reactor) for correspondence to the requirements of the European regulators, the internationally recognized practices and the Bulgarian legislation.



The reports from the expertise were timely sent to the Kozloduy NPP with view of eliminating deficiencies and improvement of the PSA in the course of its updating which is planned to be completed in 2009. In the process of review and assessment of the PSA reports, in parallel was developed a guide for regulatory review of PSA level 1. A couple of training sessions were carried out for the NRA personnel in some more characteristic fields of the regulatory review with presentation of specific practices of different European countries in this respect.

In 2008 the NRA started the implementation of three projects in the field of radiation protection, financed by the PHARE programme, namely:

- **Project BG 2006/018-411.01.03 Improvement of the regulatory infrastructure in the field of radiation protection and application of good European practice for safe management of highly radioactive sources of ionizing radiation**
- **Project BG 2006/018-411.01.02 Improvement of the regulatory infrastructure in the field of transport of radioactive materials including prevention of illicit trafficking**
- **Project BG 2006/018-411.01.04 Development of the Bulgarian legislation in the field of "NORM" and "TENORM"**

The deadline for completion of activities under these three projects is the end of 2009.

## Joint Institute for Nuclear Research (JINR) - DUBNA

In 2008, Bulgaria continued its work as a member of the Committee of Plenipotentiaries of JINR Member States and at the meetings of the Financial Committee. Bulgarian scientists participated in the sessions of the JINR Research Council and in the meetings of the Programme Advisory Committees.

Throughout the year 18 scientists and specialists from Bulgaria were sent to the JINR laboratories on a three-month term contract. 62 scientists and specialists were sent on short business trips to Dubna where they participated in experiments, joint assignments and agreements, and scientific events. 13 short business trips of Russian specialists were organized to Bulgarian institutes and universities.

In 2008, under the bilateral agreement between the Republic of Bulgaria and the JINR, scientists of the BAS institutes and Bulgarian universities proposed 25 projects with priority financing on topics from the JINR topical plan which were approved by the Commission for Cooperation. Their total cost amounts to 41 700 US Dollars. Following a proposal by Bulgarian scientists working at the JINR, the Committee also approved 21 projects to be financed through grants of the Plenipotentiary representative to the amount of 37 400 US dollars.

In 2007, the Commission for Cooperation held 3 meetings chaired by the Deputy Chairman of the NRA. The participants at the meetings discussed issues on the projects for priority financing, the plan for three-month and short business trips, proposals for long-term work, extension of working contracts and other current issues related to the cooperation between Bulgaria and the JINR. Issues regarding the participation in the meetings of the Committee of Plenipotentiaries of JINR Member States, the Financial Committee and the sessions of the Scientific Council were also discussed.

From 14 to 16 May 2008 the university centre "Bachinovo" of the South western University Neophit Rilsky - Blagoevgrad was host to the Summer school on nuclear physics for students physicists from all universities in the country which was held in the framework of the "Presentation of the Joint Institute for Nuclear Research –Dubna in Bulgaria". The Nuclear Regulatory Agency was promoter of the event to which as co-organizers joined the Institute for Nuclear Research and Nuclear Energy of the BAS and the South western University Neophit Rilsky – Blagoevgrad. The JINR professors A. B. Belushkin, A.G. Popeko and V. V. Korenkov were guest lecturers at the school.

## European Nuclear Regulators Association (WENRA)

The Western European Nuclear Regulators Association (WENRA) was established in 1999 as a non-government organization having as its members the chairpersons and governing officials of the regulatory authorities in the field of nuclear safety of the European countries operating nuclear power plants. The main objectives of WENRA are to develop a common approach to nuclear safety and to build a network of managers of the European regulatory authorities for exchange of experience and discussing issues of importance to the nuclear safety. Further information on the WENRA policy and activity is available on the website of the organization at: [www.wenera.org](http://www.wenera.org).

The Nuclear Regulatory Agency has been a member of WENRA since March 2003 and it takes active part in harmonization activities. In order to harmonize the safety approaches of the European countries, WENRA created two working groups – one on nuclear power plant safety (Reactor Harmonization Working Group), and the second one on safety of decommissioning and management of radioactive waste and spent fuel (Working Group on Waste and Decommissioning). The purpose of their creation is to achieve constant improvement of safety and to minimize the differences among the Member States.



In the framework of the current mandate of the group on NPP safety, in January was published an updated version of the reference levels for safety for NPP in operation. In 2008 work started on the establishment of objectives and principles of safety applicable to new NPPs, which will continue, also in the next year. A preparation of a pilot research on these issues was initiated for this purpose, which is expected to be completed prior to the annual meeting of the Association in November 2009.

The Group on safety in decommissioning and management of RAW and SF continued throughout the year its work on the report for preparation of reference levels for safety in decommissioning and storage of RAW and SF. The final version should be completed also in 2009. Interest towards the work of the group on these issues has been shown also by the IAEA and the NEA/OECD.

## Forum of WWER Regulators

The NRA continued its active participation in the operation of the Forum of Regulators of the countries operating reactors of the WWER type. The annual meeting of the chairpersons of the regulatory bodies was held in Kyiv, Ukraine, from 7 to 9 July. The participants at the high-level meeting discussed and considered the future directions and activities for enhancing the safety of the WWER reactors. The Forum assessed as successful the work of the three working groups and supported the extension of their activities in accordance with the given authorities. It was decided that Ukraine with the help of the GRS would develop a version of a web page for the Forum.

Bulgaria took over the presidency of the Forum at the meeting and will host the next meeting in 2009. It is planned that this will be the first meeting of heads of regulatory authorities that would include a visit to a nuclear power plant (Kozloduy NPP).

The NRA chairs the Working Group on Operational al Experience Feedback. On a motion by the group were developed Terms of reference for the creation of an Internet based Operating Experience Exchange Network – OEEN. The main objective of the Network is the development and use of tools for more effective and efficient use of the accumulated operational experience. The Network will be a place where information on specific for the WWER reactors events, problems, design decisions and others will be exchanged.

The NRA continued its active participation in the Working Group on the Use of PSA by the Regulators. In May 2008 the working meeting of the group was held in the GRS headquarters in Berlin, the focal point of the activities being put on the legislative basis and the national policy on PSA utilization in regulatory practices as well as the comparison of the submitted national reports with requirements developed by WENRA with regard to PSA utilization. In addition the results submitted in the reports with regard to analyzed initiators were reviewed and compared as well as applications of PSA in regulatory practices and the role of the human factor in the performance of the analysis.

The NRA took active part also in the newly formed group on management of safety. At the group meeting at the end of the year, hosted by Finland, the development of a database continued regarding the regulatory requirements towards organizational aspects of the licensees and the respective good practices. The last closing meeting of the group will be held in 2009 in Bulgaria.

## Bilateral Cooperation

### Germany

The co-operation between the GRS and the NRA (contract for co-operation INT 9161 in the field of nuclear safety and radiation protection) continued in 2008 regarding the review of the probabilistic safety analysis report, level 2 for the Kozloduy NPP Units 5 and 6. A working meeting was held in April 2008 with the participation of experts from the GRS, the NRA, Risk Engineering and the Kozloduy NPP.

Four working groups were formed covering the basic issues of PSA level 2, like the interface between PSA level 1 and PSA level 2, scope of the probabilistic modelling, determining of tree diagrams of events for the confinement, characterization of the source of radioactivity, strain analysis of the confinement and analysis with MELCOR. The problematic issues in the reports on PSA level 2 were determined and discussed and the measures and corrective actions were clarified which have to be carried out in the process of updating this report, taking into account the experience of the GRS in this specific for the nuclear safety field. As a result of the work carried out on the review of the PSA level 2 report for Kozloduy NPP units 5 & 6, a technical report Screening review of the PSA level 2 for Kozloduy NPP units 5 & 6 was developed and submitted to the NRA. The technical report was timely sent to the Kozloduy NPP with view of eliminating the deficiencies and improving the PSA level 2 during its updating.

In the framework of the planned new cycle of co-operation between the GRS and the NRA under the project I0801512 (INT Ost) "Scientific Technical Co-operation with TSO's and Nuclear Regulatory Authorities for Nuclear safety in NPPs and for Evaluation of Nuclear Risk in Eastern Europe and Other Countries" future joint activities are planned, to be more specific in carrying out a follow up inspection on the updated PSA level 2 report for Kozloduy NPP units 5 & 6 (with the option for review of some basic sections of PSA level 1 (version 2009) having considerable impact with regard to the results from PSA level 2), as well as some activities related to decommissioning of nuclear facilities and storage of radioactive waste.

### **Lithuania**

In June 2008 an NRA delegation headed by the chairman visited Lithuania upon an invitation from the Lithuanian regulatory authority on nuclear safety and radiation protection (VATESI). The visit had the purpose to discuss issues for more effective co-operation between the regulatory authorities of both countries. During the meetings at VATESI, the Lithuanian side presented their practices in the regulatory process and the forthcoming activities in connection with the construction of a new nuclear power capacity in the region. In this respect the Bulgarian side presented the proceedings in the licensing process of the Belene NPP and the possibility was discussed for Lithuanian specialists from VATESI to participate jointly with their Bulgarian colleagues in the safety assessment of the Belene project. It was ascertained that on matters of control of nuclear safety the approaches of Bulgaria and Lithuania are similar which is useful in the course of exchange of information. The exchange of specialists between the two regulatory authorities in the process of safety assessment of the new nuclear power capacities will give a possibility for improvement of national practices and application of uniform, internationally adopted safety standards.

### **Russia**

In September 2008 in the framework of the 52nd General Conference of the IAEA, a meeting was held with the delegation of the Russian federation, led by Mr. Semyon Levi, Deputy Minister of the natural resources and the environment. The Russian side put forward the question for co-operation between Rostekhnadzor and the NRA in the licensing process of Belene NPP, which was assessed by the Bulgarian side as useful co-operation, hence there was a unanimous decision to continue the discussions in this direction. Some technical aspects for implementation of direct transport of nuclear fuel by way of sea were discussed as well.

### **Romania**

Also in September 2008 in Vienna a meeting with the managers of the Romanian regulatory authority CNCAN was held. Issues pertaining to the future co-operation between the two regulatory authorities were discussed at the meeting, participation in joint regional initiatives and the transportation of spent fuel from the Kozloduy NPP. The CNCAN representatives expressed their support for the construction of the Belene NPP and as far as they are also in a process of construction of Cherna voda NPP unit 3, they proposed that the two regulatory authorities should co-operate in the control over the construction of the new nuclear power



capacities and to exchange information for the purpose of transparency and openness. The possibility for signing a bilateral agreement between the CNCAN and the NRA for co-operation in the transport of spent fuel, quality management, nuclear security, Safeguards and radiation protection was discussed as well.

### **Macedonia**

A meeting with the Macedonian delegation was held also during the 52nd General Conference of the IAEA, where matters of the future co-operation between the regulatory authorities of both countries were discussed. Interest was expressed by the Macedonian side for studying the Bulgarian experience in the field of radiation protection and the control over sources of ionizing radiation. It was agreed that a meeting should be held at a later stage for clarifying and specifying the co-operation.

## **National INIS centre**

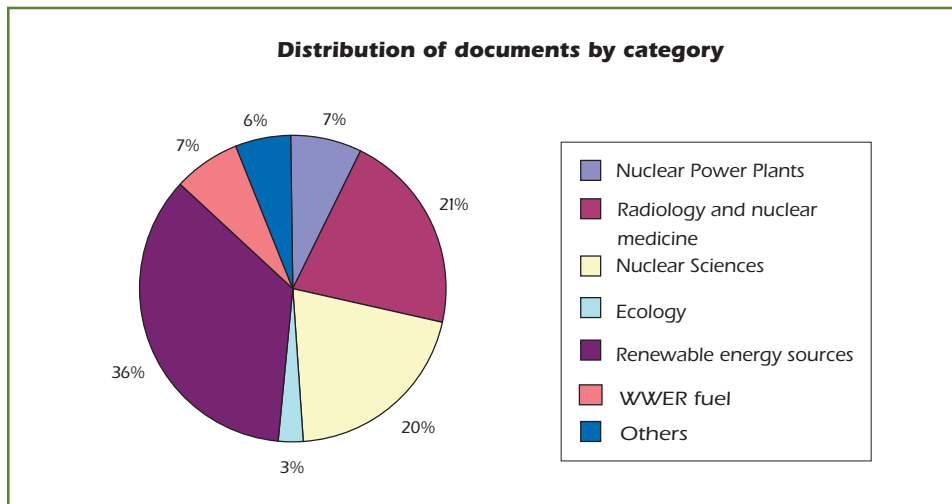
Bulgaria has been a member of the International Nuclear Information System (INIS) since its establishment in 1971.

The Bulgarian National INIS Centre is responsible for entering into the database documents published in Bulgaria and reports from conferences or other events held in our country. The Center provides information to users in the country on all issues relating to the peaceful use of nuclear energy and some economic and environmental aspects of conventional power industry.

Over 400 records were reviewed and categorized for INIS in 2008, of them 175 were abstracted and indexed. The abstracted and indexed conventional literature (91 records) included articles from the following journals: Energy, Roentgenology and Radiology, Science, Bulgarian Journal of Physics, Comptes rendus de l'Academie bulgare des Sciences, Bulgarian Nuclear Society Transactions. 85 records from the so called non-conventional or difficult to access literature were abstracted and indexed throughout the year. These were the reports from Energy Forum 2007 and 7-th International Conference on WWER Fuel Performance, Modelling and Experimental Support which were held in Bulgaria; the full texts of all records were entered into the INIS database.

The coordination of the work of all the centres worldwide is done by the IAEA Secretariat and is accounted for and planned at the advisory meetings of the national liaison officers.

The 34 advisory meeting was held in Vienna from 3 to 5 November 2008, where the report on the INIS activities for the period 2007-2008 was presented. By October 2008 the total number of entries into the INIS database had amounted to 3 001 200. The digitalization of unconventional documents from the database, which are in microfiches, continues. In 2008 all Bulgarian documents were digitalized and a disc with the full collection was sent to the Bulgarian INIS Centre. The pilot project of the INIS Secretariat for free access to the Internet database in which initially only 6 member states were included was presented during the meeting. It is planned that the other member states will be included also in a step by step manner from the beginning of 2009. Until this moment free access to the database in Bulgaria have only the Bulgarian INIS Centre and the following universities and scientific institutes, namely: Sofia University – Faculties of Physics, Chemistry and Biology, Plovdiv University – Faculty of Physics, Technical University – Sofia and the Institute for Nuclear Research and Nuclear Energy – BAS.



The following information services were provided:

- Reference and processing of requests for informational search and providing bibliographical information from the INIS databases to Bulgarian users;
- Providing 57 full texts from the INIS database to Bulgarian users;
- Providing 6 full texts from Bulgarian sources to other national INIS centers;
- Providing specialized literature, most of which IAEA publications and several scientific journals and technical magazines in Bulgarian and Russian, for temporary use by Bulgarian users.

Information on the INIS system and the services provided by the National Center is available for users on the website of the National Center which is part of the NRA website.





## PUBLIC RELATIONS



One of the objectives of the regulatory authority in the process of communication with the public is to transmit in credible manner information and messages and to assist towards their proper understanding by the mass media and the subsequent retransmission to the general public. In accordance with this notion in 2008 began the development of a new web page of the NRA. The new web page is being prepared on the basis of the requirements of the ASUNE, with regard to the submission of objective information on the state of nuclear safety and radiation protection. The web page has been constructed pursuant

to the provisions of the Act on electronic management and the Regulation on electronic administrative services, which entered into force on 13 June 2008, as well as the Act on access of information. The web page possesses the basic principles of public communication – transparency, credibility, completeness and clarity of the publications. The information on the new web page of the NRA is addressed to the main licensees of the Agency as well as to the general public.

The relations with the mass media are of great importance to the public communication of the NRA. Press releases are submitted to them timely on current issues related to nuclear safety and radiation protection. Other current news and forthcoming events are regularly published on the NRA web page.

Following a policy of openness and transparency and for the purpose of improving communication with the mass media, the NRA organizes an annual meeting with journalists. Representatives from the newspapers Trud, Pari, Standard, Duma, Monitor, Klasa, Kozloduy today, Novinar, the magazines “Utilities” and Energy monitor and from the electronic mass media, BTV, BNT, Nova television, BTA, Econ. bg, E-vestnik.bg took part in it in 2008. The journalists were acquainted with the activities of the NRA in the past year. In addition for the purpose of training, presentations were given on the topics “The natural gamma background as a factor for external and internal exposure of the population” and “International nuclear events scale in nuclear facilities and with SIR – INES”.





The mass media put the accent on the following topic when making the coverage of the meeting, namely: beginning of the construction of the Belene NPP, renewal of operating licenses of Kozloduy NPP units 5 & 6 in 2009, management of funds from the Fund for decommissioning of nuclear facilities and the construction of a repository for low and intermediate level radioactive waste.

One more tradition was kept in 2008. Students from the 10th grade of the secondary school Ivan Vazov visited the Nuclear Regulatory Agency. They had a meeting with the chairman of the NRA and experts from the department "Radiation protection and emergency preparedness" which acquainted the students with the utilization of SIR in medicine, industry and agriculture.





## LIST OF REPORTED BY THE KOZLODUY NPP OPERATIONAL EVENTS IN 2008

Date	Unit	Description	Prelimin. INES	Report N°	INES
08.02.08	NPP	Blackout of 6 & 8 sections from the emergency power supply, actuation of DG-31 and staggered start up of I safety system during substitution of start up transformer 3 with start up transformer 2 due to cracked isolator of the line breaker of start up transformer 3	0	01/2008	0
11.03.08	6	Failure of electromagnetic air valve 6QG11S41	0	02/2008	0
27.03.08	6	Deterioration of WCR of suction pipelines 6TQ21,22D01	0	03/2008	0
04.04.08	4	Failure of staggered start up I safety system to start up after switching on of DG -41 from normal operation switchboard (B) during scheduled tests due to failure of a time relay	0	04/2008	0
10.04.08	5	Decrease in power of unit 5 due to deterioration of the WCR in the secondary circuit	outside	05/2008	outside
15.04.08	5	Failure of breaker of pump 5QF21D02 to actuate during testing of I programme staggered start up II channel safety system	outside	06/2008	0
24.04.08	5	Increased measurements of level meters in 5TQ10,20,30B01	outside	07/2008	0
23.07.08	5	Disconnecting of III channel of safety system from regime of preparedness for elimination of a defect on regulator 5VF60S05	0	08/2008	0
11.09.08	5	Discontinuing of the implementation of specification inspections in the II safety channel	outside	09/2008	outside
13.11.08	6	Failure of 6QF21D01 to actuate upon a signal by the staggered start up	outside	10/2008	0*
24.11.08	NPP	Radioactive contamination of a tarmac section east of AB-2 in front of ventilator П-I C-II, due to a leak from a drain valve of special transport platform	0	11/2008	0
18.12.08	5	Failure of pump TQ32D01 to actuate from staggered start up	0	12/2008	0

\* Event INES level has been increased from outside of scale to level "0" by the NRA.



## Annex 2

## INSPECTIONS IN NUCLEAR FACILITIES IN 2008

Nº	site	period	Time spent (man/hours- number of inspectors)	topics	Number of recomm
1.	Belene site	19.02.2008 z.	16/2	Inspection on the Additional protocol	4
2.	Kozloduy NPP	20 - 21.02.2008 z.	32/2	Inspection on the Additional protocol	
3.	NCRRP	20 - 21.02.2008 z.	64/4	Fulfillment of the conditions of the license for specialized training by the NCRRP	5
4.	IRT-2000	06.03.2008 z.	8/1	Joint inspections with the IAEA	
5.	Kozloduy NPP	20 - 21.03.2008 z.	48/3	Modernization of polar crane at unit 6	1
6.	IRT-2000	27.03.2008 z.	16/2	System for control and accounting of nuclear material and information on the Additional Protocol	
7.	IRT-2000	02 - 03.04 2008 z.	32/2	Inspections on physical protection	
8.	Kozloduy NPP	16 - 18.04.2008 z.	168/7	Training and qualification of the personnel	9
9.	Head office of SE RAW	23 - 24.04.2008	48/4	Quality management at the head office of SE RAW	3
10.	Kozloduy NPP	08 - 10.05.2008 z.	48/2	Feedback from operational experience	10
11.	Kozloduy NPP	20 - 22.05.2008 z.	192/8	Preparedness for PAO at PP-2	2
12.	SD RAW Kozloduy	27 - 29.05.2008	48/4	Organization of the system for quality management	3
13.	Kozloduy NPP	08 - 09.06.2008 z.	16/1	Inspection on the conditions of the permit for acceptance of fresh nuclear fuel Inspection of documentation prior to shipment of SF	





14.	IRT-2000	10 - 15.06.2008 z.	48/1	Inspection with the IAEA during loading of SF for shipment to the Russian Federation	
15.	NEC-PLC Belene Enterprise	26 - 27.06.2008 z.	48/3	Organization within the NEC-PLC for implementation of the conditions of the permit for designing of Belene NPP	7
16.	Kozloduy NPP	18 - 20.06.2008 z.	128/4	Radiation control of service water	4
17.	Kozloduy NPP and IRT-2000	05 - 06.07.2008 z.	32/2	Export of SF from WWER and IRT. Inspection of documentation prior to shipment.	
18.	Kozloduy NPP	14 - 17.07.2008 z.	256/8	Preparedness for start up of Unit 5	5
19.	NEC-PLC Belene NPP	16 - 17.09.2008 z.	64/4	Preparatory activities at the Belene NPP site	4
20.	NEC-PLC Belene NPP	08 - 09.07.2008 z.	32/2	Technical surveillance at high risk facilities on site	3
21.	Kozloduy NPP	10 - 12.09.2008 z.	72/3	Technical surveillance at high risk facilities during PAO at unit 6	1
22.	NEC-PLC Belene NPP	16 - 17.09.2008 z.	64/4	Preparatory activities at the Belene NPP site	6
23.	Kozloduy NPP	18 - 19.09.2008 z.	80/5	Test following the modernization of UCTM II system at unit 6	4
24.	SD RAW Kozloduy	23 - 25.09.2008 z.	48/3	Radiation protection and radiation control	5
25.	Kozloduy NPP	29.09 - 03.10.08	480/12	Preparedness for start up of unit 6	6
26.	Kozloduy NPP	07.10.2008 z.	16/1	Inspection on the conditions of the permit for supply of fresh nuclear fuel	
27.	Kozloduy NPP	22 - 23.10.2008 z.	48/3	Recommendation by the EU for control over the radioactive discharges into the environment by the Kozloduy NPP	1
28.	Eleshnitsa	23.10.2008 z.	16/2	Joint inspections with the IAEA on the Additional Protocol	

29.	Kozloduy NPP	14 броя	272/1	Joint inspections with the IAEA on Safeguards and the Additional Protocol	
30.	SD PRRAW Novi han	10.04.2008 г.	24/2	Acceptance of RAW at the facility	5
		21.05.2008 г.	24/3	Fulfillment of license conditions	5
		17.06.2008 г.	24/2	Radiation protection and control	4
		03.09.2008 г.	24/2	Emergency planning and preparedness	3
		30.10.2008 г.	24/2	Preparation for operation under winter conditions of the SD PRRAW Novi han, operational feedback	3
31.	Kozloduy NPP	06 - 07.11.2008 г.	48/3	Modernization of polar crane at unit 5	1
32.	Kozloduy NPP	04.11.2008 г.	16/1	Export of SF – inspection of the documentation prior to shipment	
33.	Military Medical Academy	21.11.2008 г.	24/3	Fulfillment of the license conditions for specialized training by the Military Medical Academy	6
34.	Kozloduy NPP	26 - 28.11.2008 г.	72/3	Indicators for safety assessment	5
35.	Kozloduy NPP	09 - 10.12.2008 г.	48/6	Decommissioning of units 1-4	3
36.	Kozloduy NPP	11 - 12.12.2008 г.	48/7	RAW management at PP-2	5
Total		53	2854/134		123



**Prepared statements related to the implementation of technical decisions for modification of structures, systems and components important for nuclear safety and related to introduction of amendments in the technical specifications and other technical documentation**

**1. 1.Kozloduy NPP units 1 & 2**

- 1.1. Change in the pattern for power supply to direct current panel 22 of unit 2.
- 1.2. Establishment of correspondence with the levels for regulatory release from control prior to dismantling of structures and components under a license for operation in condition "E".

**2. 1.Kozloduy NPP units 3 & 4**

- 2.1. Technical decisions for disconnecting of a signal end of information boards on panels at MCR-3 and MCR-4;
- 2.2. Ensuring of a reliable power supply to system for visualization of fire detection in PP-1;
- 2.3. Modernization of fire detection installations at main reactor building and turbine hall of units 3 & 4 through expanding of the existing ESSER system.

**3. 1.Kozloduy NPP units 5 & 6**

- 3.1. Realization of a project for water station No. 6 to the automated information system for radiation control of discharge and waste water;
- 3.2. Reclassification of deaerators 7kg/cm<sup>2</sup> and their links in accordance with the documentation in the nuclear legislation in force.
- 3.3. Separation of the binary input of digital protections 7SJ62 disconnecting through installation of a support relay in cell-I of motor control sector 5BV, 5BW, 5BX of unit 5;
- 3.4. Dismantling of redundant elements from cabinet type RTZO (HG10, HG20-24, HG30-34) with one alternated current supply at unit 6;
- 3.5. Introduction of a system for visual indication of safety parameters at units 5 & 6 pursuant to measure 14121 from the Programme for modernization;
- 3.6. Replacement of 30 cable penetrations at unit 5;
- 3.7. Replacement of sensors Sapphire for measuring differential pressure at MCP at unit 5;
- 3.8. Replacement of systems for power supply to control rods at unit 5;
- 3.9. Separation of the binary input of digital protections 7SJ62 disconnecting through installation of a support relay in cell-I of motor control sector 6BV, 6BW, 6BX of unit 6 – the statement is affirmative;
- 3.10. Dismantling of redundant elements from cabinet type RTZO (HG10-14, HG20-24, HG30-34) with one alternated current supply at unit 5;
- 3.11. Changes ensuing from implementation of a technical decision to assess the reliability of throttles 5YP21,22,23E03,04; 5YP20E01 for warming up of safety valve of the primary circuit 5YP21,22,23S01,03,04;
- 3.12. Decrease in pressure during hydro tests on primary circuit from 24.5 to 19.6 MPa and increase in the time period between hydro tests for strain from 4 to 8 years at unit 5;

- 3.13. Implementation of measure 49111 "Introduction of a system for constant operative monitoring and maintaining of basic parameters of WCR at primary circuit on units 5 & 6;
- 3.14. Installing of break valves on collector pipelines of system 5QF;
- 3.15. Installing of fittings for blow down of pressure pipelines for cooling of the bearings of pumps 5TQ11(21,31)D01; 5TQ12(22,32)D01; and heat exchangers at their front seals and for realization of fire fighting of compartment D105 in 5GV, 5GW, 5GX;
- 3.16. Improvement of the vibration condition of pipelines from the system for emergency feed water of steam generators 5TX of unit 5;
- 3.17. Improvement of the vibration condition of pipelines from the system for emergency feed water of steam generators 5TX of unit 6;
- 3.18. Replacement of 18 cable penetrations at unit 6;
- 3.19. Replacement of breakers 0,4 kV type A3700, reconstruction of indoor switchgear board type KTPSI, motor control sector 5CV01, 5CV02, 5CV03, 5DV01 at unit 5;
- 3.20. Improvement in the structure of the CCTV bar of the refueling machine at unit 5;
- 3.21. Installing of a wide range temperature control on the reactor pressure vessel at unit 5;
- 3.22. Replacement of breakers 0,4 kV type A3700, reconstruction of indoor switchgear board type KTPSI, motor control sector 5CE;
- 3.23. Replacement of breakers 0,4 kV type A3700, reconstruction of indoor switchgear board type KTPSI, motor control sector 5CX01, 5CX02, 5CX03, 5DX01;
- 3.24. Replacement of ceilings, air conditioning and lighting installation at MCR-5;
- 3.25. Replacement of breakers 0,4 kV type A3700, reconstruction of indoor switchgear board type KTPSI, motor control sector 6CE;
- 3.26. Replacement of breakers 0,4 kV type A3700, reconstruction of indoor switchgear board type KTPSI, motor control sector 6CW01, 6CW02, 6CW03, 6DW01;
- 3.27. Modernization of the power supply of polar crane with circular movement 320/405/160/2x70x43m;
- 3.28. assess the reliability of throttles 5YP21,22,23E03,04; 5YP20E01 for warming up of safety valve of the primary circuit 5YP21,22,23S01,03,04;
- 3.29. Implementation of fire fighting of compartment D105 in 6GV, 6GW, 6GX according to the recommendations from measure 21111 of the Programme for modernization;
- 3.30. Replacement of UCTM – II SS of unit 6 and introduction of amendments in the Technical specification for safe operation;
- 3.31. Enhancement of the reliability and correctness of measurement channels for flow rate in reactor building at unit 6;
- 3.32. Installing of fittings for blow down of pressure pipelines for cooling of the bearings of pumps 6TQ11(21,31)D01; 6TQ12(22,32)D01; and heat exchangers at their front seals;
- 3.33. Modification of algorithms for steam generator dump valve controller to condenser. Automated system for turbine control when two turbo feed pumps are switched off at unit 6;
- 3.34. Amendment in the patterns for radiation control of system TS20 at unit 6;
- 3.35. Improvement of the operational function of the system for power supply of control rods at unit 6 with the objective of making similar the designs of units 5 & 6;
- 3.36. Installing of a wide range temperature control on the reactor pressure vessel at unit 6;
- 3.37. Decrease in pressure during hydro tests on primary circuit from 24.5 to 19.6 MPa and increase in the time period between hydro tests for strain from 4 to 8 years at unit 6;



- 3.38. Transition to maintaining AMETA-WCR at secondary circuit during operation of unit 6 at full power;
- 3.39. Making similar of redundancy breakers and breaker power supply transformer 5BU29, type ZAK 1 in motor control sector 6Kv type NXAIR P;
- 3.40. Preliminary installation activities on replacement of UCTM – I and III SS at unit 6;

#### **4. General for the power plant**

- 4.1. Ensuring of reliable power supply to the system for visualization of fire detection at PP-1, assessed as third category.

#### **5. SFSF**

- 5.1. Replacement of glass bricks on the facades of the SFSF.

## LIST OF ABBREVIATIONS

<b>AB</b>	Auxiliary Building
<b>ALARA</b>	As Low As Reasonably Achievable
<b>ASUNE</b>	Act on the Safe Use of Nuclear Energy
<b>AWP</b>	Alarm-Warning Protection
<b>BAS</b>	Bulgarian Academy of Sciences
<b>BCP</b>	Border Checkpoint
<b>CDS</b>	Complete Distribution System
<b>CE CPS</b>	Control Elements of the Control and Protection System
<b>CMD</b>	Council of Ministers Decree
<b>CMDA</b>	Control-Measuring Devices and Automation
<b>CPUAE</b>	Committee on the Peaceful Use of Atomic Energy
<b>CUAEPF</b>	Committee on the Use of Atomic Energy for Peaceful Purposes
<b>EC</b>	European Commission
<b>EU</b>	European Union
<b>EvC</b>	Evaporation Concentrate
<b>EWT</b>	Emergency Water Tank
<b>HPD</b>	High-Pressure Deaerator
<b>HPES</b>	Human Performance Enhancement System
<b>HPIP</b>	High Pressure Injection Pump
<b>IAEA</b>	International Atomic Energy Agency
<b>INES</b>	IAEA/NEA International Nuclear Event Scale
<b>INIS</b>	International Nuclear Information System
<b>INRNE</b>	Institute for Nuclear Researches and Nuclear Energy
<b>IRCS</b>	Internal-Reactor Control System
<b>IRPC</b>	International Radiation Protection Committee
<b>IRS</b>	Incident Reporting System
<b>ISAR</b>	Interim Safety Analysis Report
<b>JINR</b>	Joint Institute of Nuclear Research – Dubna
<b>MD</b>	Ministry of Defense
<b>MEE</b>	Ministry of Economy and Energy
<b>MES</b>	Ministry of Emergency Situations
<b>MEW</b>	Ministry of Environment and Water
<b>MH</b>	Ministry of Health
<b>MI</b>	Ministry of Interior
<b>NCRRP</b>	National Center for Radiobiology and Radiation Protection of the MH
<b>NEC</b>	National Electrical Company
<b>NEPS</b>	National Electric Power System
<b>NPP</b>	Nuclear Power Plant
<b>NRA</b>	Nuclear Regulatory Agency
<b>NRRAW</b>	National Repository for Disposal of RAW



<b>NRSIR</b>	National Register of SIR of the Republic of Bulgaria
<b>NSEC</b>	Nuclear Scientific Experimental Center
<b>PAO</b>	Planned Annual Outage
<b>PP-1</b>	Power Productions 1, including Units 1 and 4
<b>PP-2</b>	Power Productions 2, including Units 5 and 6
<b>RA</b>	Restricted Area
<b>RAW</b>	Radioactive Waste
<b>RAWPF</b>	RAW Processing Facility
<b>RBNRP</b>	Regulation on the Basic Norms of Radiation Protection
<b>RCL</b>	Radio-Chemical Laboratory
<b>RNG</b>	Radioactive Noble Gases
<b>RR</b>	Research Reactor (IRT)
<b>RSS</b>	Reactor Scram System
<b>SANS</b>	State Agency of National Security
<b>SAR</b>	Safety Analysis Report
<b>SD</b>	Specialized Department
<b>SDA</b>	Steam Dump to the Atmosphere
<b>SDT</b>	Smoke Detectors
<b>SE RAW</b>	State Enterprise Radioactive Waste
<b>SEN</b>	Static Electricity Neutralizer
<b>SF</b>	Spent Fuel
<b>SFP</b>	Spent Fuel Pool
<b>SFSF</b>	Spent Fuel Storage Facility
<b>SIR</b>	Sources of Ionizing Radiation
<b>SLS</b>	Staggered Load System
<b>SRCC</b>	Special Reinforced-Concrete Container
<b>SS</b>	Safety System
<b>SSC</b>	Structures, Systems and Components
<b>TCD</b>	Technological Control Devices
<b>TDFP</b>	Turbine Driven Feedwater pump
<b>TG</b>	Turbine Generator
<b>TS</b>	Technical Specifications (for Operation)
<b>UCTM</b>	Unified Complex Of Technical Means
<b>WANO</b>	World Association of Nuclear Operators
<b>WCR</b>	Water Chemistry Regime
<b>WENRA</b>	Western European Nuclear Regulator's Association
<b>WWER</b>	Water Water Energy Reactor



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