

# NUCLEAR REGULATORY AGENCY

REPUBLIC OF BULGARIA

2004  
REPORT





The year 2004 passed for the Nuclear Regulatory Agency under the goal for development of approximated secondary legislation in the field of nuclear safety and radiation protection. The NRA experts developed all the secondary legislative acts on application of the Act on Safe Use of the Nuclear Energy. The regulations are consistent with the relevant international conventions and treaties, the European Union and IAEA acts and take into account the good international practice.

The start and the end of the year 2004 were marked by issuing three very important licensing documents. The Kozloduy NPP Units 2 and 1 were granted 5-year licences for operation in condition „E“ (spent fuel storage in at-the-reactor pool) in January and February respectively.

The Agency issued a permit for the second nuclear capacity site selection to the National Electric Company in December. I hope this first step towards construction of a new nuclear power plant in Bulgaria will lead to a design of a modern facility according to the top safety standards.

The NRA augmented its co-operation with the International Atomic Energy Agency and the international organisations with activity in the field of the safe use of nuclear energy through participation in a lot of projects and training courses.

The Bulgarian national report on fulfilment of the obligations on the Convention on Nuclear Safety was submitted to the IAEA according to the adopted schedule. The report represents the progress of Bulgaria related to the safety upgrading of the Kozloduy NPP reactors, changes in the nuclear legislation and recognition of independent and competent regulatory authority. The report will further be presented to the Contracting Parties on the Convention in April 2005 in Vienna.

Participation of NRA experts in the work on finalising the negotiations for accession to the European Union was of a particular importance from an international point of view. The ad hoc formed working group prepared the papers in sector „Nuclear Safety and Radiation Protection“ thus contributing to the preparation and agreement acceleration of the accession documents.

The report of the Nuclear Regulatory Agency is freely distributed in printed and electronic form and is published on the web-site of the Agency - [www.bnsa.bas.bg](http://www.bnsa.bas.bg).

„We can not give up using nuclear energy as we can not give up using electricity, cars, planes, ships, because this energy improves the quality of life both as energy and as application of isotopes in medicine and technology. Something very simple remains - to acquire nuclear culture gradually and to build up trust between specialists and non-specialists.

It is a simple thing, not more than 50 – 100 years will pass and we shall have both nuclear culture and trust. It is important to start after these periods of rising and falling tides of enthusiasm, fear, desperation, ... knowledge, trust.“



Slightly prior to publishing the article „Radiophobia – brief history“ in a Sofia daily newspaper, the nuclear community was shaken by the sudden decease of the NRA Chairman professor Emil Vapirev.

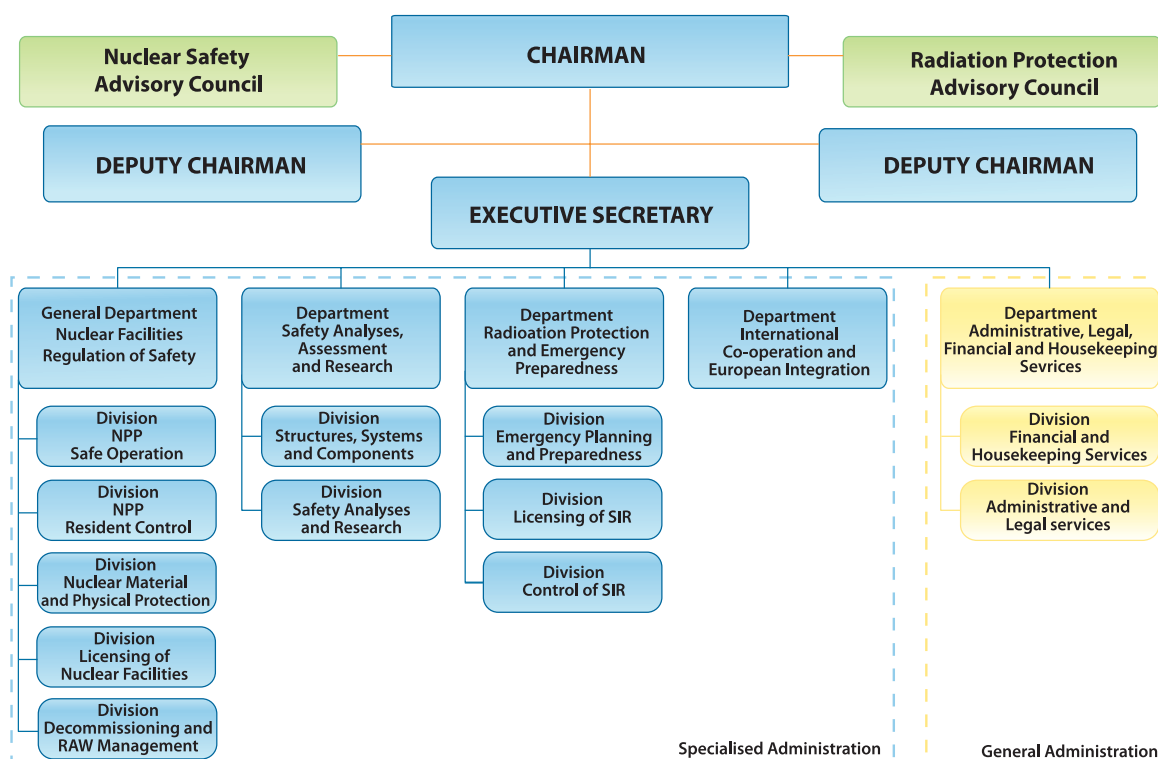
He was an inseparable part of the nuclear power generation development in Bulgaria – from the moment of loading the first assembly at the Kozloduy NPP till the last minute of his life. His remarkable contribution to the safe operation of the Kozloduy NPP Units and to raising the Bulgarian regulatory authority to a new, high level of competence was particularly valuable and should not be forgotten. Professor Vapirev was a great scientist and statesman and incontrovertible international authority. But, first of all, he was an honest man and a good friend whose loss left us in a deep sorrow.

<b>January 21</b>	The NRA officially handed in a 5-year licence for operation of Kozloduy NPP Unit 2 in operational mode - condition „E“;
<b>February 20</b>	The Kozloduy NPP Unit 1 was granted a 5-year licence for operation in operational mode - condition „E“;
<b>February 22-25</b>	The NRA hosted the first meeting of a working group to the Forum of regulatory bodies of the countries operating WWER reactors;
<b>April 19-24</b>	An international workshop „Inspection Fundamentals and Principles“ was held at NRA headquarters. It was aimed at assisting the NRA inspectors’ work by demonstrating international good practices;
<b>April 19-24</b>	An international technical meeting ‘Development of Initiating Event Frequency Database for WWER-440 type reactors’ was held at NRA headquarters. It was targeted towards harmonisation of different approaches during development of a database and preparation of a unified database with wide application in the European countries operating WWER-440 reactors;
<b>May 10–12</b>	The 25-th meeting of the EC specialised group on co-ordination of the regulatory activities in the field of nuclear power generation (CONCERT Group) was held in Sofia;
<b>June 4</b>	The IAEA Deputy Director-General Mr. Yuriy Sokolov visited Bulgaria upon an NRA invitation;
<b>July 28</b>	The NRA joined the campaign „Appeal for Help“ for raising funds, necessary for the operation of five Bulgarian children;
<b>August 2</b>	The NRA concluded the development and submitted to the Council of Ministers all the secondary legislative acts envisaged by the Act on Safe Use of Nuclear Energy;
<b>September 4</b>	The Bulgarian national report on fulfilment of the obligations on the Convention on Nuclear Safety was submitted to the IAEA;
<b>October 20</b>	Mr. Sergey Tzotchev, PhD, assumed the office of NRA chairman;
<b>December 21</b>	The NRA issued a permit for a new nuclear capacity site selection.

## ADMINISTRATIVE POTENTIAL

The structure, activity and work organisation of the Nuclear Regulatory Agency and the number of personnel are determined in the Rules of Procedure, according to which the stipulated total number of personnel for the year 2004 is 102 staff positions including the Chairman and two deputy-chairmen. The structure is in compliance with the Act on Administration, which determines unified requirements, related to the structure of administrations assisting the state authorities.

The NRA administration is organised in a Department General and four Departments separated into General and Specialised Administration. The Executive Secretary exercises administrative management of the administration.

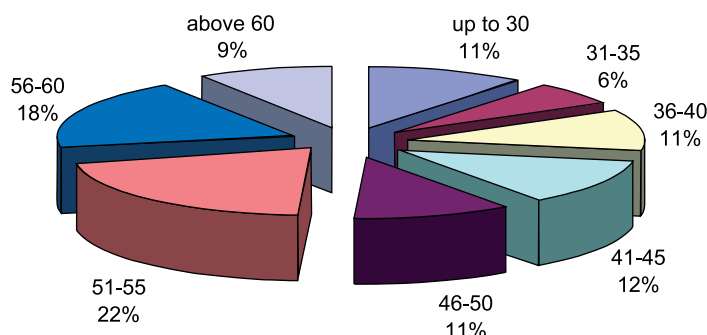


The General administration ensures logistically the activities of the Chairman and carries out activities on the administrative service to citizens and legal entities. The General Administration totals 19 staff positions.

The Specialised Administration is organised into departments, which assist the Agency Chairman in performing his regulatory and control functions related to the activities with nuclear facilities, other sources of ionising radiation and emergency preparedness, nuclear material and radioactive waste.

The Specialised Administration consists of 79 staff positions. Sixty-five experts are directly occupied with safety control and assessment of activities on the use of nuclear energy. Twenty-nine are inspectors on safety of nuclear facilities, including RAW and nuclear fuel management while 6 of the inspectors work perma-

Age profile

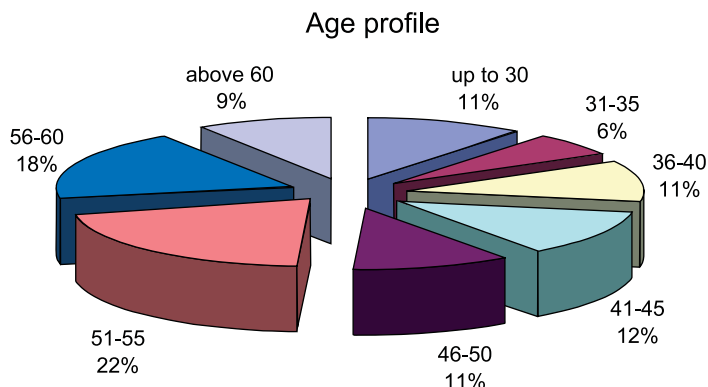


nently at the Kozloduy NPP site. Inspectors, performing control related to the assessment of the documentation submitted by the applicant, are 18. The control related to activities with sources of ionising radiation and emergency preparedness is exercised by 18 inspectors.

The average age of the NRA staff is 45 years. More than 60% of the inspectors have more than 20 years experience in the field of nuclear safety and radiation protection. The comparatively low average age of the staff and the related large experience are some of characteristics of the administration ensuring succession and preservation of nuclear knowledge and competence within the organisation.

The NRA staff is appointed following a competitive examination. When selecting staff, possibilities are looked for creating succession and appointing younger staff with necessary high qualification. The high requirements imposed on the candidates are not only in the field of technical knowledge, but in personal characteristics, such as ability to work in a team, communication skills, intention for career development, etc. This results in building a joint and united team with abilities to fulfil the set tasks regardless of their difficulty.

Ninety-seven staff positions were occupied actually at the end of the year, 81 of them – civil servants and 16 according to the provisions of the Code of Labour. Inspectors and experts with higher education are 97% while more than 50% of them are women. There were no civil servants who have quit their jobs, which is an evidence of the good working conditions, provided by the management. Three persons were appointed following a competitive examination and two persons were re-appointed on a managerial and expert position by an internal competitive selection.



## TRAINING

An annual plan for compulsory and specialised training was developed and submitted to the Minister of State Administration in fulfilment of the Strategy for Training Administration Staff adopted by the Council of Ministers. This plan was developed based upon the personal training plans and detailed analysis of the necessity in training pointed out by the staff, taking into account Agency priorities.

The total number of staff passed compulsory and specialised training in 2004 was 17, three of them were appointed managerial positions. The training was completed with issuing certificates by the Institute on Public Administration and European integration.

## ACCESS TO PUBLIC INFORMATION

A total of 2 applications from citizens for provision of public information, related to issuing permits and licenses were received at the Agency according to the Act on Access to Public Information. The procedure on elaboration of papers and their provision is performed by the Administrative and Legal Service Division and preparation of the required information – by the NRA specialised departments according to the nature of the specific request.

## NEW SECONDARY LEGISLATION

The main priority for NRA during the year of 2004 was the development of secondary legislation for the application of the Act on Safe Use of Nuclear Energy (ASUNE). The systematic approach and the active participation of NRA employees and interinstitutional working groups led to the submission of all planned drafts of the secondary legislation to the Council of Ministers of The Republic of Bulgaria till July 2004.

As a result of the hard work of the regulatory body on development of the new national nuclear legislation till the end of 2004 the Council of Ministers of the Republic of Bulgaria approved 17 Regulations which concluded the process of development of the legal framework in the field of nuclear safety and radiation protection.

The ASUNE and the secondary legislation set up-to-date requirements in the field of nuclear safety and radiation protection. The Regulations correspond to the basic IAEA documents and introduce fully the European Union legislation in the mentioned fields. The Regulations are also consistent with the obligations of the Republic of Bulgaria under international treaties – Convention on Nuclear Safety, Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, Convention on Early Notification of a Nuclear Accident, Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, Convention on the Physical Protection of Nuclear Material, Vienna Convention on Civil Liability for Nuclear Damage.

In the process of development of the secondary legislation the experience of EU member countries like United Kingdom, Finland, Czech Republic, Slovakia was used as well as the results from NRA projects under the PHARE programme.

The new Regulations set rules and requirements towards all aspects of the activities with sources of ionising radiation and operation of nuclear facilities:

- Nuclear safety during construction and operation of nuclear facilities and sites with sources of ionising radiation;
- Radiation protection of the personnel and the public;
- Physical protection of nuclear facilities, nuclear material and radioactive substances;
- Emergency planning and preparedness;
- Radioactive waste and spent nuclear fuel management;
- Radiation protection during medical irradiation.



At the end of the year 2004, the NRA published the first volume of „Collection of normative documents on safe use of nuclear energy“. The second volume is forthcoming. The book is distributed free of charge and is available for all interested persons and organizations.

The whole secondary legislation on the application of the ASUNE (and the Act itself) is also available on the NRA web page – [www.bnsa.bas.bg](http://www.bnsa.bas.bg).

## POWER UNITS OF KOZLODUY NPP

The operation of the power units in Kozloduy NPP is based on the issued by NRA licenses for operation and on observing the operation documents in force – Technical Specifications, operational instructions and procedures. The safety of each unit is granted by implementation of the defence in depth philosophy. It is based on a system of physical barriers on the escape pathway of the ionising radiation and the radioactive substances to the environment and on a system of technical and organizational measures for protecting these barriers and preserving their effectiveness.

During the planned outages in the year 2004, all planned activities on structures, systems and components that provide for the necessary reliability and safety of the units for the next fuel cycle were fully performed. All activities foreseen in the programmes for base metal control, control of the welded surfaces and welds on the equipment and pipelines in primary and secondary circuit were performed. The functional tests of structures, systems and components important to safety before start-up and operation of the units after maintenance and refuelling of the core demonstrate the effectiveness of the physical barriers and the readiness of the levels of protection.

The unified system of safety indicators, introduced in Kozloduy NPP, is used for assessment of the effectiveness and safety of the units by the KNPP personnel. The summarized indicators of this system define the following three key features of the operational safety:

- NPP is operated stable and effectively;
- NPP is operated at low risk;
- NPP is operated with positive safety attitude.

The NRA inspectors on nuclear safety and radiation protection periodically assess the trends of some of the safety indicators and perform regulatory inspections on the correspondence of the activities carried out with the requirements of the normative documents and the conditions of the issued licenses. The general conclusion of the NRA is that during 2004 all physical barriers were maintained operational and all levels of protection – in stand by condition. Presented below are the specific aspects of the operation of the different power units.



## UNITS 1 AND 2

By a decision № 848/19.12.2002 of the Council of Ministers of the Republic of Bulgaria in the end of year 2002 Units 1 and 2 were shut down after their XXIII-rd and XXIV-th fuel cycle accordingly. In 2004 the Units were in condition „E” – the fuel is removed from the core and is placed in the Spent Fuel Pool.

In the beginning of 2004, after review of the specific requirements set by NRA as additional safety measures for long term shut down, new licenses were issued for operation in condition „E” with period of validity of 5 years. The licenses limit the operation of the units only to

storage of irradiated and spent nuclear fuel in the Spent Fuel Pools.

According to the licenses activities for introducing new organization of the operation and for updating the operational documents in force for such operating mode were carried out. A special attachment to the Technical Specifications of Units 1 and 2 concerning operation in condition „E“ is developed – special attention is drawn to the control of the systems ensuring the design and the alternative cooling of the spent nuclear fuel in the Spent Fuel Pools.

New Safety Analysis Reports were developed for the new condition of the units – analyses of the seismic qualification of the systems for filling the pools and emergency instructions. The thermal power of the nuclear fuel in the Spent Fuel Pool 1 and 2 in the year 2004 gradually decreases by an average of 0,3 kW/day.

The water chemistry regime of Units 1 and 2 is kept according to the operational instruction for suppressing the processes of corrosion during long-term shut down condition. Programmes for monitoring of the corrosion are implemented – the results show no corrosion in the tubes of the steam generators, no corrosion on the reactor pressure vessel and some negligible corrosion on the equipment in the secondary circuit.



corrosion on the equipment in the secondary circuit.

The program for decommissioning of these units is updated according to the time limits specified in the licenses. Because of the special statute of these units in the end of 2004 actions for their physical separation from Units 3 and 4 were taken and for control of the access to them.

In 2004 for Units 1 and 2 no deviations were found from the limits and conditions for storage of spent nuclear fuel.

## UNITS 3 AND 4

### Operational safety

In 2004 the electric production from Units 3 and 4 represents 35.41% of the whole production from Kozloduy NPP.

At present Unit 3 is in its XX-th fuel cycle, and Unit 4 – in XIX-th fuel cycle. In the refuelling of these units is used fuel from Units 1 and 2. For both units improved core loading schemes are used for minimization of the irradiation of the reactor pressure vessels. All fuel assemblies used for loading the cores of Units 3 and 4 fulfil the technical requirements and leak-tightness testing.

After the planned annual outages both units were thoroughly inspected by the NRA for confirmation of their readiness for operation during the next fuel cycle.

The number of non-planned shut downs is an indicator for the reliability of the operation and for the quality of the maintenance and repairs on the equipment. During the last years this indicator has a decreasing trend but in 2004 there were three actuations of the reactor protection system (scrams) type I which is more than the previous year. In two of the cases there was a repetition of the cause. The root cause analysis revealed deficiency in the personnel safety culture.

The inspections of the safety systems equipment are according to an approved schedule and observing the requirements from the operational documents. In the framework of the periodic testing during 2004 were registered 20 failures of safety systems equipment. In conclusion there is a negligible increase in the number of failures compared to the previous years (17 in 2003) and also increase in the hours during which one train of a safety system has been inoperable (958 in 2004 compared to 833 in 2003). There are 8 instances of repeated events due to identical failures of circuit-breakers in the system for reliable power supply 0.4 kV. These instances are analysed with the help of external organizations – research institutes and the manufacturer. The implemented corrective measures are found to be effective.

The water chemistry regime of the primary and secondary circuit of the units is kept according to the Technical Specifications and the operational instructions. The necessary corrective measures for minimization of the period of operation with deviation from the water chemistry regime during transients, were taken immediately, which ensures the optimal chemical environment for operation of the equipment. The quality of the water chemistry is assessed by the so-called chemical index that is an integral indicator of WANO for secondary circuit. The average monthly value of the chemical index for Units 3 and 4 for 2004 is 0.33 – which is well under the limit value set to 1.0.

The observation of the licensing conditions, the permits and the Operating Limits and Conditions is one of the indicators for the good safety attitude of the NPP personnel. In one operating event is found a violation of the Operating Limits and Conditions (the trend is positive – in 2003 the cases were 3). In 27 cases there is entering into limiting conditions for operation - that is also a good trend (32 cases in 2003). Inconsistencies between operating documents and the actual state of the equipment are not found. There were no cases in which the personnel has failed to follow the procedures. The events due to human error have decreased from 31% (2003) to 7.44% in 2004. The events due to inadequate or insufficient training or procedures have also decreased. The general conclusion is that the operation of Units 3 and 4 is carried out with positive safety attitude.

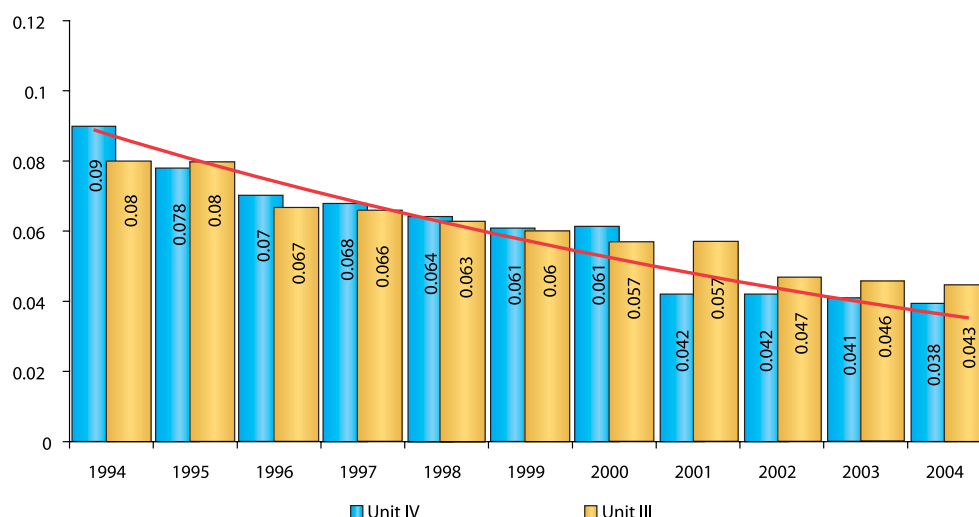
The main indicators that NRA assesses are these related to the operability of the physical barriers, the reactor scram index and the indices for safety systems unavailability. These indicators to a great extent define the preservation of the design basis during operation and are an indication for the extent of prevention of the initiating events evolving into design basis accidents and the design basis accident – into beyond design basis accidents. Many of these indicators are developed on the basis of WANO methodology and this allows international comparison of the trends and of specific values.

The measures undertaken in the recent years for improvement of the leak-tightness of the Confinement System show effective reduction of the leaks from the Confinement System and fulfill the criterion.

During the Planned Preventive Maintenance 2004, a new Failed Fuel Assembly Detection System was put into operation. The use of the design method /penal/ and the Sipping method for control of the nuclear fuel increase the reliability of the assessment of the fuel leak-tightness. The relatively good Fuel Reliability Indicator confirms the effectiveness of the performed activities as well as the correct operation.



### Confinement System leaks assessed as equivalent diameter [m]



In 2004 is increased the number of unplanned actuations of safety systems – 13 compared to 3 in the previous 2 years. The increase of this indicator can be explained with the actuation of many trains of safety systems during one event related to disconnection of reserve transformer.

With the modernization programmes implementation a trend for reduction of the safety systems unavailability indicator is observed. In many of the cases the values are under the WANO's average values for WWER type reactors. As a good result, the fact can be noted that for the period 2001-2004 the unavailability indicator for the spray system and the system for emergency core flooding is 0 for both units.

### Modernization Programme implementation

The conditions set by the NRA in the licenses for operation of Units 3 and 4 require implementation of the Complex Programme for Safety Increase that has some planned or started but unfinished activities. The investment plans of Kozloduy NPP have foreseen financial resources for fulfillment of specific programmes for Units 3 and 4, related to:

- Continuation of the activities related to Probabilistic Safety Assessment (PSA) (reduction of the fire risk by implementing measures coming from the PSA Level 2 results);
- Continuation of the modernization of the system for localization (the system for hydrogen control and the system for forced filtered ventilation of the Confinement System are implemented);
- Qualification of the nondestructive testing of the components important to safety (implemented in 2004);
- Development and broadening the scope of the symptom-based emergency procedures;
- Future activities related to seismic qualification of the equipment;
- Continuation of the modernization of the Instrumentation & Control equipment (improvement of the quality and the volume of the information for the operators in the Main Control Room during normal and emergency conditions, data storage and graphical visualization of support indications, etc.);
- Implementation of the measures for severe accident management and development of severe accident management guide;
- Activities related to management of the residual lifetime of the units (the technical require-

ments for hydraulic tests for Unit 3 are changed based on deterministic and probabilistic analyses).

The main part of the activities are implemented or in a stage of implementation according to the planned time schedule. With regard to the possible early shut down of Units 3 and 4, the Kozloduy NPP has substantiated that some measures are not necessary and expedient to be implemented before 2007. Such measures are these related to the extension of the lifetime for the reactor pressure vessel and the main coolant pumps above 30 years, supply of expensive diagnostic equipment, change of fixtures, modernization of the controls of the emergency protection system, strengthening some deaerator platforms, etc.

Additional activities are done relating to:

- Improvement of the reliability of the system for reliable power supply category I by changing the reversible motor generator with static invertors;

- Improvement of the reliability of safety systems and systems important to safety according to analyses;

- Installation of system for sipping tests and modernization of the refueling machine, etc.

In the period 01.01.2004 – 31.12.2004 105 technical decisions were developed and approved for Units 1 to 4. 80 of them were implemented and 35 out of 80 are assessed as related to safety and the Chairman of NRA has issued a permit for their realization. 5 more decisions are in a process of licensing.



## UNITS 5 AND 6

### Operational safety

In 2004 the electric production of Units 5 and 6 amounted to 64.59% of the total electric production of Kozloduy NPP.

In the reporting period Unit 5 operated in the framework of two fuel cycles – the end of X-th fuel cycle, planned annual outage and beginning of XI fuel cycle. Unit 6 also works in two fuel cycles – on 28.08.04 ends IX-th fuel cycle, during September- November was the planned annual outage and from 22.11.04 begun X-th fuel cycle.

After inspections of Units 5 and 6 for start up and operation after planned annual outage the NRA Chairman has issued orders for improvement of the main findings and positive assessment of the fulfillment of the conditions for safe start up and power operation of reactor units in Kozloduy NPP for XI and X fuel cycle accordingly. All conditions from the inspection commission statement are implemented in due time.

In 2004 begun the introduction of uranium-gadolinium fuel and the first 12 assemblies were loaded in the reactor core of Unit 6. Their advantages are: deeper burnout (up to 55 MWd/kgU); possibility for four years thermal cycle; flexibility in the loading schemes with different duration of the cycle; less spent nuclear fuel; strengthening the body of the assemblies which avoids their bending in the core. From the core safety point of view the advantages of



the new assemblies are the following:

- Possibility for loading fresh fuel in any chosen co-ordinate of the core;
- Ensuring negative reactivity coefficient by the coolant temperature;
- Keeping the gadolinium moderator in case of accident;
- Impossibility for removing the gadolinium moderator without destroying the assembly increases the safety of the activities involving fresh nuclear fuel.

The programme for monitoring and control of the reactor core of Unit 5 continues. Since 1998 the substantiation of the safe operation taking into account the deformations

in fuel assemblies is routine and is included in the neutron-physics characteristics of each unit and for every fuel cycle. In relation to defining one possible cause – low frequency vibrations of the reactor internals, equipment for control of the reactor internals is put into operation. Experimental data from its operation was received during IX-th fuel cycle for Unit 6 and during X-th fuel cycle for Unit 5.

The analysis of the results from periodic check-ups of the safety systems of Unit 5 shows 41 remarks related to different deviations from the requirements for conducting the check-ups that may be classified in the following groups:

- Deviations due to existing defect in the equipment and the measuring devices – 17, which is 42% of the total number. All defects were removed and the efficiency of the corresponding components is verified;
- Operators errors of omission during test procedures – 12, which is 29% of the total number and are due to omitted steps from the procedures for testing or during writing the reports from the tests. The omitted or incorrectly performed tests are repeated and the personnel are debriefed.
- Deviations without clear causes – 12, which is 29% of the total number. These are mainly due to lack of notifications for the equipment status, which is related to the peculiarities of the registration of events in the new computerized information system.

The number of non-planned reactor shut downs is an indicator which characterizes the intensity of the transients that decrease the residual lifetime of the main equipment. In recent years the trend is for reducing the number of non-planned shutdowns. In 2004 there were 3 non-planned shut downs for Unit 5. One of the shut downs was automatic with closure of main steam valve of Turbine Generator-9 because of actuation of protection system (reactor scram). The other two were made by the personnel and were for elimination of faults in the system for clean up of the coolant from the primary circuit, and because of deviation in the water chemistry in the secondary circuit.

The indicator for the number of Reactor Protection System actuations (reactor scrams) shows the intensity of reaching limiting parameters requiring reactor shut down. In 2004 there were no reactor scrams for Units 5 and 6. On 22.12.2004 8 years without reactor scrams for Unit 6 were completed.

The assessment of the water chemistry of the steam generators is made according to

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unified methodology of WANO for calculation of the Chemical Index (CI). The data for the CI is collected for the period of power operation of the units. The comparison of the average annual CI values – 0.349 for Unit 5 and 0.231 for Unit 6 with the maximum allowed ( $CI_{max} = 1.0$ ) shows even and well maintained water chemistry regime for the secondary circuit during 2004. The stable values of the CI are related to the implementation of precise analyser for dissolved oxygen in 1995, implementation of new methodology for extended complex calculation of the index in 1999 and the new standards in force since 2004. The relatively high annual average CI for Unit 5 for 2004 is due to an event involving violation of the water chemistry regime and the increased leaks of cooling water from the condensers to the main condensate.

The main criterion for leak-tightness of the fuel rods is the level of the specific activity of the primary coolant during operation on power. The radionuclides  $I^{131}$  and  $I^{135}$  and sum by iodine  $\Sigma I^{131+135}$  are used for base points for calculations. The limit for safe operation of WWER-1000 according to the specific activity of the primary coolant is  $AI^{131+135} = 1.85 \times 10^8$  Bq/kg and for normal operation -  $AI^{131+135} = 3.7 \cdot 10^7$  Bq/kg. A specific safety indicator – Nuclear Fuel Reliability – is calculated monthly according to approved methodology. It is part of a strategic indicator for the defence in depth. The values of the indicator for 2004 are below the average for the previous years.

For assessment of the leak-tightness of primary circuit in relation to possible leaks from primary to secondary circuit there is control of the specific activity of the Steam Generators' blow down. For base points are used the radionuclides I-131, K-42 and Na-24. The specific activity of the base radionuclides in the primary coolant and in the SG's blow down is defined by gamma-spectrometry. The leak rate is assessed by calculations. The safe operation limit is 5 l/h and specific activity by I-131 less than  $7.4 \times 10^2$  Bq/kg for every Steam Generator.

In the beginning of the X-th fuel cycle of Unit 5 increase in the specific activity of the monitored radionuclides in SG 4 is found. The leak is about 0.050 l/h by specific activity of K-42. The criterion of 0.500 l/h for more frequent control or the safe operation limit is not reached. No development of the defect is found. From the beginning of the XIth fuel cycle there are no leaks in any SG.

There is no increase in the specific activity of the monitored radionuclides for Unit 6.

The control of the pre-stressed condition of the containments of Units 5 and 6 during the period of operation is made by a system for automatic control. The results from the tests show that the containments can sustain all design modes including Design Basis Accident. Unit 5 containment is 95.4% pre-stressed and Unit 6 – 92.5%. The minimum allowed pre-stressed condition is 85%.

Functional tests of the systems for localization of the accidents are made after the annual maintenance of the units. The integral leak from the containment for Unit 5 is 0.239%/day and for Unit 6 – 0.208%/day. That is less than the design limit of 0.3%/day.

## **Implementation of the modernization programmes**

In 2004, 190 technical decisions were developed, 10 of them temporary and 180 permanent. 77 technical decisions were assessed as related to safety and the Chairman of NRA has issued permits for their realization. 32 technical decisions were developed as a result from the measures of the modernization programme. By the end of 2004 the overall implementation of the program was 74%. 143 measures were completely implemented. According to the time schedule and licensing conditions for operation of Units 5 and 6 the programme should be fully implemented by the end of 2006. By the end of 2005 is planned the completion of the activities on the main technological systems and replacement of the electrical and I&C equipment. For 2006 is planned the completion of the final research including the updated Safety Analysis Reports of the units.

During the annual maintenance in 2004 the following measures from the modernization

programme were implemented:

- Replacement of the indicators „Sapphire“ type;
- Replacement of the „Titan“ complex;
- Replacement of the „Hindukush“ and CM-2M systems;
- Replacement of the thermal isolation of the equipment and pipelines in the containment system;
- Improvement of the reliability of the Steam Generators safety valves;
- Introduction of system for fast discovery and localization of leaks from primary circuit;
- Improvement of the reliability of relay protection and automation of the main electrical scheme;
- Improvement of the reliability of the circuit-breakers 6 kV;
- Limitation of fire spreading through ventilation ducts;
- Ensuring permanent control of the stator coils of 6 kV pump electrical motors during stand by;
- Replacement of circuit-breaker KAG-24 (KAG-24);
- Improvement of the reliability of the generator's excitation;
- Installation of one additional Diesel Generator on each unit for common consumers;
- Replacement of tubes in the turbine condensers with stainless steel ones;
- Introduction of an information system for maintaining the water chemistry regime in the secondary circuit.

Diagnostic computer systems are implemented. These give information to the operators for the condition of the systems and components in the primary circuit and timely and proper decisions concerning the permissible operating condition of the units can be taken based on this information.

The new electrical systems and components that are installed and put into operation corre-



spond to the international standards and practices and use state-of-the-art technology implemented already in other NPPs.

All measures from the modernization programme related to safety are implemented only after written approval by NRA, based on detailed assessment of the safety of the modification and of the technical decision for its implementation. For safety substantiation, the NRA assesses the submitted documents, the use of national and international standards and compliance with the NRA requirements.

The common objective of the regulatory inspections and the enforcement measures is to ensure safe performance of all activities by the operator and compliance with the requirements, norms and regulations on nuclear safety and radiation protection. To meet this objective, the NRA annual inspection plan includes the areas of regulatory control deriving from the ASUNE and the conditions of the licenses and permits. The planning of the inspection activities, takes into account the operational status of the nuclear facilities, the results of past regulatory control and planned modifications, thus binding to the operators planned activities is ensured.

The NRA pays a priority attention to the regulatory inspections. The understanding is that for the actual carrying out of the inspections, about 20-25% of the working time of the inspectors from the headquarters, responsible for the control over the corresponding nuclear facility shall be allocated. The supervision of current safety issues, of limits and conditions for safe operation, of the status of systems important to safety and housekeeping is covered by the daily (routine) inspections of the division for NPP resident control. The NPP current status is daily reported and discussed at a NRA Vice Chairman level with the participation of experts from the General Department „Nuclear Facilities Regulation of Safety“. In cases of significant problems, systematic (daily) contacts are carried out with the license and permit holders for discussion of the matters in open dialogue. The discussions are held in an operative way, either at the plant site or at the NRA headquarters on a motion by one of the sides.

The tendency in the development of the annual inspection plans is to inspect each topical area at least once in every 2 years. At the same time, the planning of topical inspections considers the status of resolving of problems from previous inspections, changes resulting from the implementation of new safety documents and the intentions of the operating organization. The topical inspections clarify the status of a specific area of supervision in terms of the organization formed, internal documents development and application, provision for material and human resources, documentation of the results and evaluation of the effectiveness of the implemented activities. In case that deficiencies in several topical areas of supervision are found, a complex inspection is conducted for defining the interconnections between the different issues.

The performance of complex inspections for identifying the plant preparedness for start up and operation after an annual outage is one of the conditions of the operation license. Subjects of these inspections are:

- Implementation of the outage maintenance and repair program;
- Results of non-destructive examinations and of functional tests of systems important to safety;
- Implementation of planned safety improvement measures;
- Implementation of corrective actions as a result of operational events and operational experience feedback;
- Safe loading of the reactor core;
- Status of structures, systems and components important to safety and housekeeping.

In accordance with the plan for 2004, 10 regulatory inspections of units 1 to 6 of Kozloduy NPP were carried out. The topical areas, the spent resources and the prescriptions made are shown in the table below.



No	Unit	Period	Spent time (man-hours/ number of inspectors)	Topical area	Number of perscriptions
1	1,2	13-15.01.04	240/10	Preparedness of units 1 and 2 for continuous storing of spent fuel after shut down	12
2	5	05-06.02.04	64/4	Investigation of the reasons for deviation in the water chemistry of the II circuit	4
3	5,6	18-19.03.04	64/4	Discussion of problematic issues concerning the modernization program	5
4	1-6	19-20.05.04	96/6	Control over the implementation of the license and permit conditions	13
5	5	17-20.06.04	360/10	Inspection of the unit 5 preparedness for start up after annual outage	9
6	4	28.06-01.07	288/9	Inspection of the unit 4 preparedness for start up after annual outage	11
7	3	25-27.08.04	216/9	Inspection of the unit 3 preparedness for start up after annual outage	15
8	6	17-20.11.04	448/14	Inspection of the unit 6 preparedness for start up after annual outage	11
9	1,2	24-26.11.04	256/8	RAW management at units 1 and 2 and auxiliary building -1	17
10	1-6	07-09.12.04	274/11	Nuclear safety and radiation protection at the plant	15

Further below are discussed the results of some of the specified topical inspections.

The issuance of a license to units 1 and 2 for operation in condition „E“, with spent fuel stored in the spent fuel pool, has been preceded by a regulatory inspection on the following subjects:

- Status of the units and of the spent fuel pools - 1,2;
- Conditions for spent fuel storing – control of level, temperature, dose rate, water chemistry;
- Physical protection and transportation of spent fuel – procedures, routes, status of refueling equipment, emergency operating instructions and actions, spent fuel location charts;
- Implementation of conditions of previous permits for storage in the spent fuel pools;
- Organization of the operation in condition „E“;
- Implementation of measures and programs for maintaining the safety of the spent fuel;
- Maintenance of the equipment, systems and components for continuous spent fuel storage;
- Radiation protection and implementation of decommissioning measures;
- Status of the operational documentation and housekeeping.

One of the specific license conditions requires the removal of the spent fuel from the pool upper racks by the end of 2005. For ensuring the safe operation of units 1 and 2 in condition „E“, a specific addendum to the technical specifications has been required and developed, which provides for supervision of the conditions for spent fuel storage and the availability of the systems important to safety.

During the regulatory inspection of the status of RAW management at units 1 and 2, the following has been checked: organizational matters, staffing, activities for RAW minimization, RAW collection, segregation, transport control, storage, pretreatment, accounting for, documentation management, status of RAW management equipment and development plans. Weaknesses

have been identified in the organization of the activities, the status of systems and equipment and the operational control.

The plant status of nuclear safety and radiation protection was inspected by a NRA commission in the following topical areas:

- System for personnel training and qualification;
- Quality assurance system – documentation, personnel, management of changes, use of contractors, suppliers, contracts, audits;
- Operational events – efficiency of the corrective actions related to failures of electrical equipment;
- Radiation protection in the RAW treatment facility and the SFSF;
- Implementation of the license conditions for operation of the SFSF.

Weaknesses have been identified in the training centre of Kozloduy NPP with regard to the tutors and training process. Measures for improvement of the efficiency of the activities should be taken for compliance of the personnel training and qualification with the requirements of the new safety regulations.

As a result of the enactment of new regulations and issuance of licenses for operation, an update of the documentation of the quality assurance system as well as of the plant documentation as a whole is carried out. Programs for the structural subdivisions are developed and approved. During an inspection, weaknesses in the organization of the quality management were identified, as well as the availability of a large number and volume, quality assurance documents with repeated requirements.

As a result of the event analysis, connected with recurrent failures of breakers Record Plus, deficiencies were identified caused by inefficient control during implementation of design changes and weaknesses in the configuration management.

The NRA commission has identified that the Kozloduy NPP staff does not properly understand some of the license conditions for operation of the SFSF and the power units. This could cause a delay in the terms of implementation of several conditions of the SFSF license for operation. A need for changes was identified to be introduced in the schedule for annual outage, in order to revise the scope and frequency of maintenance and repair activities of the systems and components that perform safety functions.



## EVENT ANALYSIS AND IMPLEMENTATION OF CORRECTIVE ACTIONS

The maintenance of defense-in-depth, physical barrier operability and availability of all levels of defense are the essential factors defining the safety status of a nuclear power plant. The identification of hidden weaknesses throughout event analysis, the application of effective programs and stringent control criteria, the continuous improvement of personnel qualification and quality of operational documentation are among the tools used for maintaining the safety.

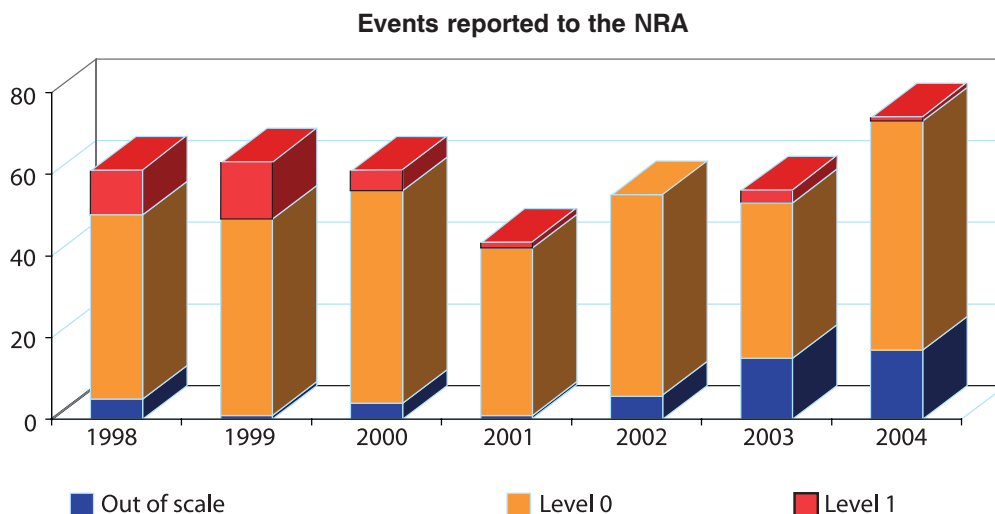
During the last years, the number of reported events and deviations is kept at a relatively high level due to the extended reporting criteria on one hand, and the personnel consciousness of the significance of the activities on event analysis and operational experience feedback, on the other. The Regulation on the Conditions and Procedure for Notification the Nuclear Regulatory Agency about Events in Nuclear Facilities and Sites with Sources of Ionising Radiation defines more stringent requirements both to the events to be reported, their reporting and analysis, and to the whole system for feedback from own and international experience.

The data on the number of events shall be considered together with their rating according to the International Nuclear Event Scale (INES). The number of events reported to the NRA in 2004 is 74; 17 of them are out of the scale, 56 are rated as level „0“, and one of them is rated as level „1“. Additionally, 14 events without safety significance were reported.

The analysis of events and deviations identifies a need of further improvement of the preventive actions efficiency of the divisions with supervisory functions – reallocation of experienced specialists to the supervisory divisions, enhanced supervision over the processes and activities, revision of the documentation in compliance with the requirements of the new NRA regulations, commitment of the management to improve the system for personnel training and qualification.

Weaknesses are identified in the project management and configuration management related to the electrical equipment. Most of the events are caused by failures in newly installed equipment, which in many cases are single, or their detection needs a specialised support by the supplier or by technical support organisation. As a result of the event analysis, adequate measures were taken to identify the causes for the failures.

The analysis of events with recurrent human errors shows that the systematic approach to training is not being applied to a sufficient extent. The inaccuracies in the instructions and main-



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tenance procedures are contributing factors to the occurrence of equipment failures and human errors.

Good practice is the feedback of the international operational experience. NRA is actively using the IAEA IRS database for events, occurred in NPPs worldwide. The NRA maintains close bilateral relations with the regulatory authorities of the countries operating WWER plants. Periodically the Kozloduy NPP receives event analyses from the international experience, corrective measures and lessons learned that could have favorable effect on the improvement of plant safety.

The NRA chairs and hosts the meetings of the Working group on operational experience feedback to the WWER Regulators' Forum.



## RADIATION PROTECTION

NRA permanently controls the state of the radiation protection of the nuclear power units of the Kozloduy NPP, the radiation conditions on the site and the area around the NPP. The control programmes concerning radiation protection of the Kozloduy NPP include:

- the technical condition of the systems and equipment for radiation and dose monitoring control;
- evaluation of the radiological situation;
- occupational exposure of the personnel;
- radioactive releases, environmental monitoring and the radiation exposure of the population.

### RADIATION CONDITIONS IN THE RESTRICTED ACCESS ZONE (RAZ)

Within the RAZ radiation conditions are measured permanently by the plant automatic remote measuring system for monitoring the dose rate, specific volume activity of the air in the operational compartments and the water in the technological circuits.

The data from the radiation monitoring of RAZ in 2004 show that in the serviced and semi-



serviced compartments the equivalent dose rate, the surface beta-contamination and the concentration of beta-active aerosols do not exceed the permissible values set by the Regulation on the Basic Norms for Radiation Protection (BNRP). The protective radiation barriers functioned within the designed specifications and ensured effective protection of the personnel. During maintenance activities timely measures have been taken for localisation of the contaminated areas, decontamination, positioning keep-off barriers and tags, as well as carrying out additional radiation monitoring. For each maintenance activity of a reactor, a radiation protection programme and an expected dose rate are made.

### OCCUPATIONAL EXPOSURE OF THE KOZLODUY NPP PERSONNEL

The collective dose from external and internal exposure of the 5235 controlled persons in Kozloduy NPP in 2004 was 4198.96 man.mSv. The effective collective dose of the personnel of Power Production-1 (PP-1) and Power Production-2 (PP-2) is 39% of the total effective collective dose, for the personnel of other structural units - 5%, for Radioactive Waste and Spent Fuel Department - 2% and for external organisations - 54%. The collective dose from internal exposure is 1.4% from the effective collective dose of the controlled persons in Kozloduy NPP.

In 2004 the average effective dose was 0.80 mSv. For the PP-1 personnel it was 0.92 mSv, for PP-2 personnel - 0.72 mSv, for other structural units of Kozloduy NPP - 0.22 mSv and for external organisations - 1.08 mSv.

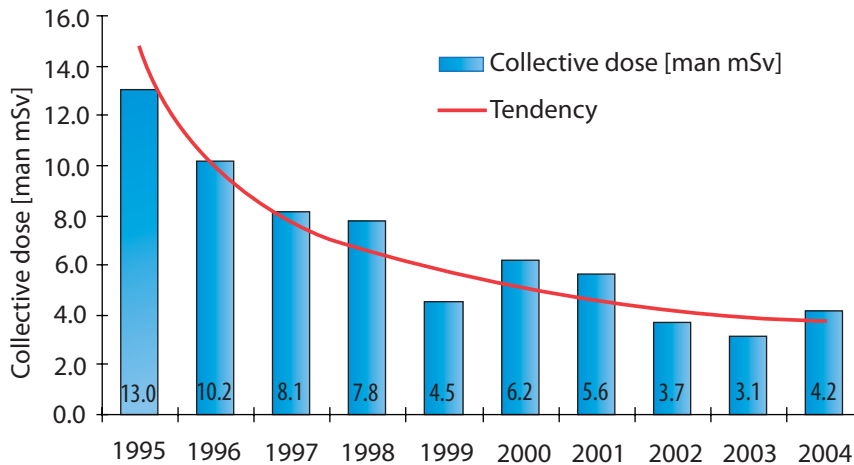
The highest individual dose in 2004, for a person from an external organisation who

worked in RAZ-1 and RAZ-2, is 19.93 mSv, which represents about 40 % of the limit set for occupational exposure in the BNRP Regulation.

The effective collective dose in Kozloduy NPP for 2004 is higher than in the previous year, which is due to extensive planned annual outages and modernisation of Units 5 and 6.

The figure shows the values of the collective dose for the last 10 years. During 1999, 2002 and

**The collective effective dose in NPP Kozloduy**



2003 the planned annual outages were one less than in other years, which explains the lower values.

The collective dose in Kozloduy NPP for 2004, compared to the number of units in operation, was 0.71 man.Sv/reactor i.e. equal to the average value of this indicator for 255 reactor units of PWR type in 2003, namely 0.71 man.Sv/reactor according to data in the Report „WANO’2003 Performance Indicators“.

The NRA statement is that there exists a stable tendency for decreasing the occupational exposure of the personnel at Kozloduy NPP. This statement is confirmed by the facts that:

- During the last eight years no individual effective dose, exceeding the prescribed, in the BNRP limit of 50 mSv has been registered;
- During the last six years not one single case of occupational exposure has been registered, exceeding the prescribed, by BNRP limit of 100 mSv in five consecutive years;
- During the last four years the Kozloduy NPP has not registered an increase over the control level of 20 mSv for individual exposure, according to the requirement of Regulation No. 40 of the Ministry of Health.

## RADIOACTIVE RELEASES, RADIATION EXPOSURE OF THE POPULATION AND ENVIRONMENTAL MONITORING

During 2004 from the ventilation stacks of the Kozloduy NPP in the atmosphere were released 70.9 TBq of noble radioactive gases, 1.31 GBq H-3 and 105 MBq of long-living aerosols. These values are respectively 0.28%, 0.26% and 0.015% of the limits indicated in the technical specifications.

The total activity of technological discharge and waste effluents into the river Danube is 1.23 GBq, for tritium 13.1 TBq – 0.17% and 7.1 % of the limits respectively.

The maximum value of the individual annual effective dose for the population as a conse-



quence of gaseous releases from the Kozloduy NPP during 2004 is estimated at  $6.53 \times 10^{-8}$  Sv/a. This value is negligibly small and represents 0.03% of the dose limit and is below 0.003% of the gamma background exposure of the Bulgarian population.

According to the conducted assessments, the doses received by the population from liquid discharges are also very small – up to  $2.5 \times 10^{-6}$  Sv/a for the critical group of the population.

The area surrounding the Kozloduy NPP is subject to detailed and systematic investigations from the date of commissioning to the present. The monitoring carried out by the operator covers the 100-km zone around the Kozloduy NPP. In

fulfilment of the programme for radiation monitoring annually more than 2000 samples are analysed by more than 4000 gamma spectrometric, liquid scintillation, etc. measurements.

Parallel programs for radiation monitoring of the area of the Kozloduy NPP are carried out by the Ministry of Environment and Water and Ministry of Health.

The data for the control of the environment in 2004 (including the analysis of the atmospheric air, drinking, surface and ground water, soil, food, etc.) are within the limits of normal values, characteristic for the Republic of Bulgaria. The comparison of the 2004 results with those of previous years as well as those prior to the commissioning of the Kozloduy NPP 1972-1974 show the absence of unfavourable tendencies and changes of the radiological situation.

Regardless of the good results achieved in the field of radiation protection, the NRA considers necessary further enhancement of good practices in application of the ALARA principle and the reviews of self-assessment of the organizational units responsible for radiation protection in the Kozloduy NPP.

## SPENT FUEL STORAGE FACILITY

The spent fuel storage facility (SFSF) is designed for long-term storage of spent nuclear fuel from reactors WWER-440 and WWER-1000.

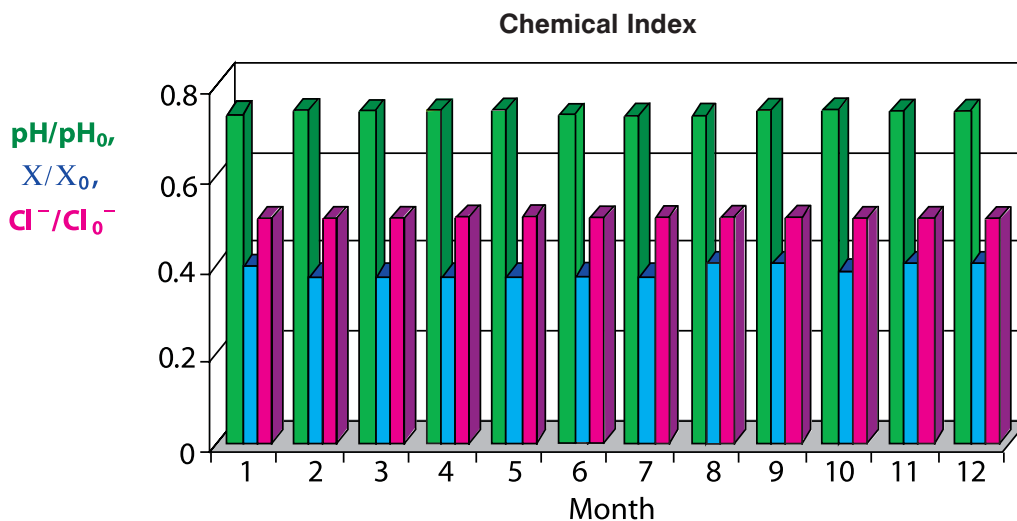
The spent nuclear fuel is stored in storage pools under chemically desalinated water.

### OPERATIONAL CONDITION AND SAFETY

The SNF is stored in SFSF pools, placed in 130 baskets for WWER-440 and 14 – for WWER-1000. A strict water chemistry status is kept in order to maintain leaktightness of assemblies and SNF pools. The quality of the water chemistry status is assessed by so called chemical index, which gives the relation of current values of pH, electric conductivity and admixture content to the values determined by the related limits for normal operation.

Average month values of the chemical index on pH, electric conductivity and chlorine ions content, which are less than the established limit of 1.0, are shown on the attached diagram.

The control over the condition and operability of the structures, systems and components important to safety is performed according to established procedures. There were no registered events, initiated as a result of failures at SNF storage facilities, transport and technological equipment and human errors in 2004. Planned maintenance activities were performed in full scope thus ensuring the necessary operability of the facilities.



### LICENSES AND PERMITS

The NRA Chairman issued a 10-year license for SFSF operation with increased spent nuclear fuel storage capacity in June 2004 following performed review and assessment of the submitted documentation. The main requirements on performance of activities on SFSF operation, staff qualification, radiation and physical protection assurance, accountancy and control of nuclear material, radioactive materials and RAW as well as the conditions and order for provision of periodic information are specified in the license. Specific conditions were included in the issued license with concrete terms for fulfilment, such as:

- development of a programme for a long-term reliable supply with cooling water, chemically desalinated water, chemical agents, electricity and acceptance of RAW following Kozloduy NPP Units 3 and 4 decommissioning;
- development of a long-term programme for SNF transportation;

- development and fulfilment of a programme for implementation of respective changes in the physical protection system taking into account Kozloduy NPP Units 1 to 4 decommissioning;
- development of a plan on structures, systems and components ageing management;
- assessment of the residual resource of structures, systems and components non-subject to rehabilitation.

The operating organisation in fulfilment of the license conditions shall submit to NRA monthly reports, containing specific indicators necessary for assessment of the operational condition and meeting the safety requirements. The assessment, performed by NRA for the year 2004, shows that SFSF operation was performed according to the technical specifications and the operational instructions in force as well as in compliance with the issued licence conditions.



The operation of IRT-2000 was finally terminated by the Council of Ministries Decision No.332 dated 17.05.1999. Based upon detailed cost-benefit analysis of the necessity of a reactor for educational and scientific purposes, the Council of Ministers adopted the Decision No.552 dated 06.07.2001 for reconstruction of IRT-2000 into a low capacity – 200 kW reactor.

### OPERATIONAL CONDITION AND SAFETY

The spent nuclear fuel storage is under chemically desalinated water in a special pool (shaft storage) at the IRT-2000 site. In order to perform the activities on its storage, the main systems of IRT-2000, such as dose-metering system, air ventilation, purification and control system for the working compartments of IRT-2000 as well as the water chemistry status maintaining system are kept in operable condition according to the operational instructions. Maintenance checks and repairs are performed according to approved programmes and schedules.



A system providing circulation and purification of the SNF storage water was installed additionally in order to upgrade safety of SNF storage and to limit the fuel cladding corrosion rate. The water in the storage is controlled by conducting monthly radio-chemical analyses. Results of these analyses show low specific activity of Cs-137, Co-60 and other characteristic radionuclides and low total beta-activity. The system for collection and storage of low-active water is maintained in good operational condition whereas sampling channels are installed and piezometering sensors are mounted for drain water monitoring around the two long-term storage tanks.

Personnel radiation exposure is controlled meeting the requirements of the legislation whereas the average annual exposure of the personnel is significantly below the limit determined in the Regulation on BNRP. This is a result of the good work management and implementation of the radiation protection programme.

### LICENCES AND PERMITS

The INRNE-BAS submitted the project for the research reactor reconstruction in 2004 in fulfilment of the conditions of the permit issued by NRA for design of a low capacity research reactor. Additional information and documents related to the core configuration and the safety analysis report was requested during the process of assessment of the submitted documentation. The NRA used assistance of external experts (The Serco Assurance – UK and the Institute of Energy – Bulgaria) in assessment of the design. An expert opinion, containing specific recommendations, was elaborated as a result of this, which is provided to the INRNE-BAS for consideration during preparation of the required additional documents. The licensing process is on its way and the next step is approval of the design after submission of the necessary documentation.

## RADIATION MONITORING OF THE ENVIRONMENT



The radiation monitoring is performed periodically according to an approved programme the activity of the air, discharged to the atmosphere and of surface and ground water and soil are controlled. Assessment of the impact on the vegetation is performed as well. Values of the total beta-activity of underground and drained water as well as of the soil and vegetation do not differ from the average values for the country. The measured radiation background in the vicinity of the research reactor does not differ from the natural one for the Sofia City and Sofia Region.

# RADIOACTIVE WASTE REPOSITORY NOVI HAN

## OPERATIONAL CONDITION

The radioactive waste repository (RAWR) Novi Han was built in the sixties of the last century for the purpose of long-term storage of radioactive waste (RAW), generated as a result of the use of sources of ionising radiation (SIR) for industrial, scientific and medical purposes. The operation of the repository was stopped in 1994, following the prescription by the Inspectorate on the Safe Use of Atomic Energy (ISUAE), aimed at bringing it in compliance with the up-to-date safety requirements. Activities on repository reconstruction and modernisation were carried out in the period after 1997. The ISUAE permitted RAW acceptance for temporary storage in the newly built storage units in 2000.

No deviations from normal operation and emergency events were reported at RAWR in 2004.



## MEASURES FOR SAFETY UPGRADING

The safety upgrading of RAWR Novi Han started in 1997 with the development of a programme for repository reconstruction and modernisation. The programme was supported by the IAEA through initiating a Technical Co-operation project „Safety Upgrading of RAWR Novi Han“. Physical and fire protection met the up-to-date requirements as a result of implementation of the safety upgrading programmes. Improvements were made of the long-term storage facilities, infrastructure, site and environment monitoring system.

The construction of a transport conveyance decontamination unit was completed, the radiation monitoring and radiation protection system were upgraded and improvements on site infrastructure were made in 2004.

## REGULATORY CONTROL

The RAWR Novi Han is operated in compliance with the permit for RAW storage in the repository issued by the NRA in 2003. Strict compliance to the permit conditions is guaranteed by effective control from the NRA over acceptance of waste, radiation situation on the site and operational condition of the repository.

The State Enterprise for Radioactive Waste applied for issuing a licence for RAWR operation in June 2004. NRA experts have been assessing the submitted documents.

A complex inspection of the organisation and carrying out activities on reconstruction and preparation licensing of the RAWR Novi Han, was performed in 2004 according to the NRA plan on inspection activities. Based upon it, a protocol of findings was issued, containing recommendations on bringing RAWR in compliance with the new legislative basis and licensing requirements as a nuclear facility.

## RADIATION PROTECTION



A systematic radiation monitoring is carried out on the RAWR Novi Han site and the environment according to a special programme, which fulfilment is subject to control by competent state authorities. Approximately 100 samples from the environment of the site, radiation protection and supervised zones are analysed annually within the framework of the RAWR Novi Han monitoring programme. Samples are examined by gamma-spectrometric and liquid-scintillation analyses. All sig-

nificant technogenic gamma-emitters from the Novi Han inventory are controlled during each measurement.

No technogenic gamma-emitters from the repository inventory were found in soil and plant samples collected from all monitoring points on the site, radiation protection and supervised zones including, as well, farmyards and agricultural land in the vicinity of Novi Han, Krushovitsa and Gabra villages.

The following concentrations of radionuclides were measured in foodstuff samples in 2004.

Type of Samples	Specific Activity(Bq/kg)			
	<sup>137</sup> Cs	<sup>226</sup> Ra	<sup>232</sup> Th/ <sup>228</sup> Th	<sup>40</sup> K
<b>Gabra-butter</b>	0.11±0.12	<0.07	<0.07	32±1
<b>Krushovitsa –goat milk</b>	0.9±0.04	<0.1	<0.08	68±1
<b>Novi Han –cow milk</b>	0.03	<0.08	<0.05	48±1
<b>Elin Pelin – cow milk</b>	<0.06	<0.1	<0.04	53±1
<b>Novi Han – honey</b>	<0.06	<0.1	<0.3	0.21±0.01
<b>Novi Han – wheat</b>	<0.07	<0.1	<0.3	180±4

The measured concentrations are times lower than the permissible norms and are fully comparable to data from the previous years.

Tritium concentration is controlled at different depth in four control boreholes, in a permanent water source on the RAWR site and in water for drinking and agricultural needs. The values specified below of tritium measured in 2004 in water for drinking and agricultural needs do not show deviations as a result of repository operation. Results from measurement of other RAWR characteristic radionuclides show that no contamination with radionuclides from the repository stock of items, of water for drinking and agricultural needs was observed.

Sampling Location	Specific Activity (Bq/l)					
	<sup>3</sup> H	<sup>40</sup> K	<sup>238</sup> U	<sup>226</sup> Ra	<sup>137</sup> Cs	<sup>232</sup> Th
Fontain "Tarnava"	2.33 ±0.37	0.06 ±0.03	0.11 ±0.03	<0.006	<0.003	<0.018
Fontain "Koralets"	1.86 ±0.3	0.22 ±0.03	0.15 ±0.04	<0.01	<0.004	<0.005
Fontain "Blagata voda"	3.63 ±0.66	0.12 ±0.06	<0.091	<0.008	<0.003	<0.025
Fontain "Pobit kamak" (church)	1.77 ±0.29	0.10 ±0.05	<0.08	<0.006	<0.003	<0.011
Fontain "Pobit kamak" (country house zone)	2.42 ±0.38	0.14 ±0.06	<0.08	<0.006	<0.003	<0.018
Drinking water (Lesnovska water)	1.96 ±0.32	0.08 ±0.03	<0.047	<0.009	<0.003	<0.013

Results from the radiation monitoring during the whole RAWR operational period show that the radiation status of the controlled environmental components (water, soil, vegetable and foodstuff, air, natural gamma background) has not changed compared to the period prior to RAWR commissioning. The registered values of the controlled radiation quantity for the environmental components are significantly less than the normatively established limits according to the Bulgarian and European legislation.

## PHYSICAL PROTECTION

The physical protection of RAWR Novi Han meets the up-to-date requirements for such kind of facilities as a result of years of efforts in this field. Measures for improvement of the physical protection were implemented with the USA financial support in 2004, including procurement and installation of a heavy barrier, increased video surveillance over the site and construction of a trestle for examination of specialised transport conveyances.

## SAFETY ASSESSMENT

Results of the assessment of the RAWR operational safety since 1996 were used in determination of modernisation measures. An updated assessment reflecting implemented repository safety upgrading measures is under preparation in connection with the forthcoming facility licensing.

Series of assessments are performed aimed at proving RAWR Novi Han safety after its closure according to the up-to-date requirements to the RAW repository facilities. The assessments show that there exists no immediate risk of facility negative impact over the population and the environment. A decision will be adopted on the future of the disposal facilities at RAWR Novi Han based upon the results of assessment of the potential impact of the facility in a long-term aspect.

## A NEW NUCLEAR POWER PLANT

Licensing a new nuclear power plant is a complicated and a long process due to the exceptional complexity and importance of the social relations that are affected – marked economic and ecological aspects are present. Nuclear power generation development is a matter of a strategic decision for each country as far as the approach shall be filled with responsibilities, with care of the future generations.

Despite of the complexity of the licensing process as a whole, a considerable advantage in the course of construction of the new nuclear power plant at present is the circumstance that, upon NRA proposal, new up-to-date regulations have been adopted following the approximation of the Bulgarian legislation to the Acquis Communautaire, which provides guarantees for conducting the licensing activity at a high level, meeting the international standards.

The Council of Ministers adopted „a decision in principle“ on construction of a NPP on the Belene site at a meeting at the end of April 2004.

The licensing process started at the end of 2004 with the issuing of a permit by the NRA Chairman for site selection of a nuclear facility – a new nuclear power plant. The permit issuing was based upon the written application as of June 2004 and on the completeness and sufficiency of the attached documents, reviewed and assessed by NRA experts. The permit holder is the NEK JSC.

The licensing process shall continue with approval of the selected site for nuclear power plant construction and issuing a design permit.



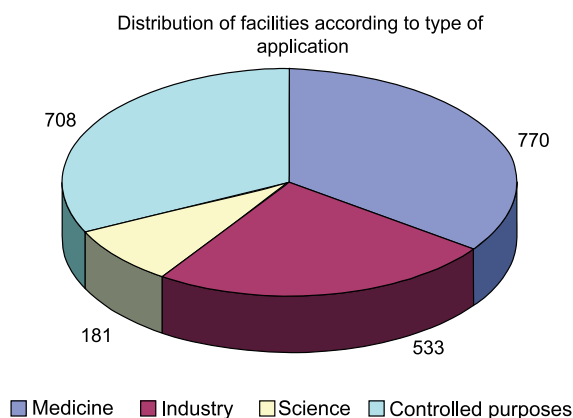
# RADIATION PROTECTION IN FACILITIES WITH SOURCES OF IONISING RADIATION (SIR)

According to ASUNE, the state regulation of the safe use of radioactive sources (sealed and open) and generators of ionising irradiation, as well as the state regulation of safe management of RAW, generated in facilities with SIR is carried out by NRA through the Department Radiation Protection and Emergency Preparedness (RPEP). According to the Rules of Procedure of NRA the Department „RPEP“ carries out primarily three types of activities:

- Issuing of licenses and permits for use, storage, manufacture, import/export and transport of SIR, construction and decommissioning of facilities with SIR;
- Inspection of facilities with SIR and control for observation of legislative requirements for radiation protection, including the control for implementation of the conditions under which the authorisations for activities with SIR have been issued;
- Activities on control and maintaining emergency preparedness and emergency response in case of incidents or accidents with SIR in the country.

The total number of SIR up to 31.12.2004 which are registered and controlled by NRA is 106 836. From them 9465 SIR are employed for industrial, medical, scientific and control purposes at 1534 facilities in the country. The rest are installed in smoke detectors used in 658 facilities.

The total number of registered and controlled facilities with SIR in the country is 2192 (industry – 533, medicine – 770, science – 181, control purposes - 708). The figures show the distribution of facilities according to the type of application.

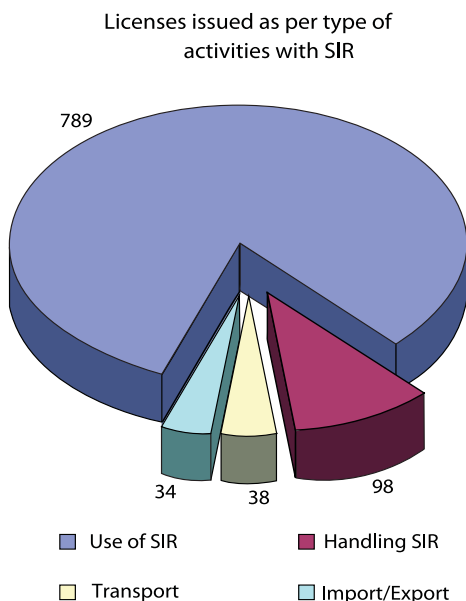


According to ASUNE, the NRA issues the following licenses and permits for activities with SIR:

- license for the use of SIR;
- license for production of SIR;
- license for handling of SIR for services rendered to third parties;
- license for transport of radioactive substances;
- permit for construction of facilities with SIR, installation and preliminary tests;
- permit for temporary storage of radioactive substances, resulting from activities with SIR;
- permit for single transport of radioactive substances;
- permit for import/export of SIR;
- permit for decommissioning of facilities with radioactive substances.

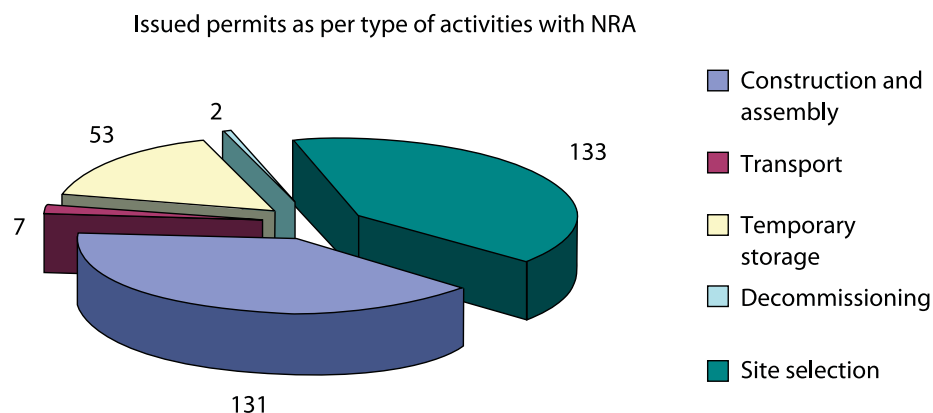
During 2004, the NRA issued 959 licenses and 1440 permits (1114 of them for import/export) to legal entities and persons for activities with SIR.

During 2004 the country imported 2445 SIR – mainly in the field of medicine and for the purposes of non-destructive testing of



metal (gamma radiography). For long-term storage to the State Enterprise „Radioactive Waste“ – Novi Han were transferred 1316 with no further use (disused) SIR and 17712 sources from dismantled smoke detectors.

The inspection activity of NRA is a key element of the regulatory control with the aim to determine on site how the legislative requirements of radiation protection and the conditions of the issued licenses and permits are observed. The priority and the frequency of the inspections (planned and extraordinary) are determined based on the degree of risk and the complexity of the activities carried out at the facility. The inspections are conducted according to the approved, by the chairman of NRA, annual plan for control activities. Recording of the results is



performed according to the internal rules of NRA.

A total of 260 inspections of facilities with SIR were performed. 24 prescriptions for elimination of the detected violations in the field of radiation protection were issued. In one case a penalty statement for violations was delivered.

NRA possesses modern radiometric, dose-metering and gamma-spectrometric equipment used by the inspectors during the control of facilities with SIR and in case of emergencies.

A new integrated computer information system was designed and commissioned by NRA in the period 2003/2004. It contains specialised modules and detailed information for all controlled by NRA facilities with SIR, including data for licensees and holders of permits as well as emergency events, incidents and accidents with SIR. In accordance with the requirements of the IAEA and in order to increase safety, security and control efficiency during use or storage of SIR, the present data base is planned to be improved, thus creating complete national register of SIR.

During 2004 the web page of NRA published in a convenient for the user format a list of typical forms of the required documents and data necessary for issuing licenses or permits for activities with SIR. The web page publishes also information for incidents and events with SIR. In this way NRA carries out one of its main priorities – a policy of complete transparency and openness in the regulatory process for safe use of SIR in the Republic of Bulgaria.

Bulgaria is a country, which does not possess nuclear weapons, and has signed with the International Atomic Energy Agency an agreement for the implementation of the Safeguard System under the Treaty on the Non-Proliferation of Nuclear Weapons (in force from 29.02.1972). According to the Agreement, Bulgaria has assumed the responsibility to observe the obligations under the Safeguards in respect to every output or special fissionable material in its activities.

The control over the non-proliferation of nuclear weapons depends to a great extent on the effectiveness of the system for accounting for the nuclear material in the particular country. The IAEA implements this control in Bulgaria through the Nuclear Regulatory Agency. The nuclear facilities, subject to inspections are the research reactor IRT-2000, the power units in the Kozloduy NPP, and the spent fuel storage facility in the Kozloduy NPP site. In 2004, jointly with IAEA inspectors, 12 inspections have been carried out on the compliance with the Safeguards in the Kozloduy NPP.

### SAFETY ASSESSMENTS AND PERMITS FOR NUCLEAR FUEL TRANSPORTATION

The NRA inspectors perform the state control over the inventory, movement and accounting for the nuclear material on the territory of the country. The NRA Chairman issues the permits for the import and transportation of the fresh nuclear fuel for the Kozloduy NPP, as well as for the transportation of the spent nuclear fuel out of the country. In 2004, 4 permits for import and transportation of fresh fuel for WWER-440 and WWER-1000 and 3 permits for export and transportation of spent fuel were issued.

In all nuclear facilities, the available nuclear material with regard to quantity, enrichment, form and isotope content corresponds to the accounting documentation.

### REPORTS ON SAFEGUARDS

In 2004, 20 reports for inventory changes in the nuclear material (ICR) and 155 reports for annual inventory of nuclear fuel (PIL and MBR) in the Kozloduy NPP were prepared and submitted to the IAEA. The official position of the IAEA is that Bulgaria has fulfilled completely its obligations in regard to the accounting for and control of nuclear material for 2004.

### REPORTS ON THE ADDITIONAL PROTOCOL

The Additional Protocol to the agreement between Bulgaria and IAEA for the implementation of the Safeguards, under the Treaty on the Non-Proliferation of Nuclear Weapons, was ratified on 10.10.2000. In implementation of the requirements of the Additional protocol, Bulgaria is obligated to prepare and annually submit to the IAEA information about the activities in the field of the nuclear fuel cycle in the country.

The Bulgarian Report on the Additional Protocol for 2003 was submitted to the IAEA on 14 May 2004. It contains 11 declarations, according to the requirements, set in Art. 2.a. and Art. 2.b. During the year under review, there were also submitted 3 declarations, according to Art. 2.a (ix)(a), as quarterly reports.

### REGULATORY INSPECTIONS

NRA inspectors, in co-operation with IAEA inspectors carried out 3 inspections – on the Kozloduy NPP site, IRT-2000 at the INRNE-BAS and the sorption installation for regeneration of ion resins „Zvezda“ in Elehznitsa.

Measurements of the dose rate were made at the sites, samples were collected and photographs were taken in order to check whether undeclared activities were performed or undeclared nuclear material existed. The analyses, made during the inspections demonstrate a good organisation on the part of the administration in providing the necessary 2-hour access for the IAEA and NRA inspectors. The main conclusion made by the IAEA inspectors was that neither undeclared activities had been performed, nor undeclared nuclear material had been stored.

## EMERGENCY PREPAREDNESS

The Republic of Bulgaria has established and maintains a system for continuous preparedness for actions in case of nuclear emergency on national and local levels, providing maximum protection of the personnel, population, and environment in case of a radiological or nuclear emergency.

The ministries and authorities, empowered and responsible to take actions in case of crises, disasters, accidents, and catastrophes (such as the State Agency Civil Protection, Ministry of Interior, Ministry of Health, Ministry of Environment and Water, National Institute for Metrology and Hydrology etc.) actively participate in the developing and maintaining of the emergency preparedness system. The high level emergency preparedness is maintained through performing periodical inspections, training courses, exercises and participation in international projects and seminars.

According to the NRA Inspection Plan, in 2004 inspections were carried out in nuclear facilities and sites using SIR. The subject of the inspections includes internal emergency plans, conducted training and exercises, as well as the technical means for emergency response.

In 2004, the NRA participated in national and international exercises, as follows:

- International exercise „Convex2c“, organised by the International Atomic Energy Agency. The aim of the exercise was to test the ENAC system for information exchange during the development of a nuclear or radiological accident. 41 countries took part in the exercise, as well as European Commission representatives.

- Emergency exercise in the Kozloduy NPP aiming at the improvement of the preparedness of the personnel for actions according to the Kozloduy NPP Emergency Plan. During the exercise, the communications between NRA, NPP, and the State Agency „Civil Protection“ were tested.

In 2004, the NRA conducted a series of lectures for education and training on emergency preparedness, radiation protection, and application of SIR in industry, medicine, agriculture etc. The aim of the lectures was to acquaint the personnel from different institutions with the different types of SIR, their location, radiation protection methods, as well as the organisation of the interactions in performing the unified control over SIR and the joint actions in case of emergency.

The NRA continued its participation in international projects in the field of emergency planning, preparedness and response, such as:

- IAEA TC Project „Harmonisation of the emergency planning in the Eastern and Central European countries“, as well as the project extension including issues concerning medical actions in case of radiological or nuclear accident;

- EU Project for installation of the RODOS system in the Republic of Bulgaria;

- EU Programme for joining the Project for early notification and information exchange in case of nuclear or radiological accident ECURIE.

The total number of radiation accidents with SIR, registered in 2004, was 23. In most of the cases radioactive material was found in scrap. NRA representatives participated as experts in the incident liquidation jointly with the representatives of other competent authorities.



In accordance with the provisions under Art. 9 of the Act on the Safe Use of Nuclear Energy, to the NRA Chairman are established an Advisory Council on Nuclear Safety and an Advisory Council on Radiation Protection. The lists of the members were appointed by a NRA Chairman's order and include prominent scientists and specialists in the field of nuclear energy and ionising radiation, radioactive waste and spent fuel management, and radiation protection.

In 2004, 6 meetings of the Nuclear Safety Advisory Council were conducted, where reports were presented, positions and decisions were proposed, projects for regulations were developed. Reports and positions on the following topics were presented, namely:

- Concept for the development of secondary legislation in the field of the safe use of nuclear energy;

- Analysis, concept and structure of the Regulation for providing the safety of nuclear power plants;

- On the criteria for risk acceptability and dynamics of the legislative requirements towards risk-metric criteria for nuclear power plants in the countries with developed nuclear energy;

- Status and perspectives of the master education at the Department of Thermal and Nuclear Energy, Faculty of Power Engineering of the Technical University - Sofia;

In 2004 the Radiation Protection Advisory Council conducted 14 meetings. The priority topics for discussions were the new legislative documents, concerning the radiation protection and actions with SIR and RAW, generated outside the NPP. The criteria for exemption of materials with low content and of radionuclides from regulatory control have been discussed in details. Special attention was paid to the so called „medical irradiation“ and a request was made for a statement by the national consultants in the field of radiotherapy, nuclear medicine and X-rays.

Upon a proposal by the NRA Chairman and the Radiation Protection Advisory Council members, several meetings for discussions of emergency planning and preparedness, were frequented by representatives of the Expert Council on nuclear safety and radiation protection to the scientific-coordination council of the Permanent Commission for the Protection of the Population against Disasters, Accidents, and Catastrophes. Representatives of the Energy Commission of the National Assembly took part in the discussions on the Regulation for RAW management.



## JOINT ACTIVITIES WITH OTHER AUTHORITIES

### STATE AGENCY CIVIL PROTECTION

The good co-operation between the State Agency for Civil Protection and the Nuclear Regulatory Agency in the area of radiation protection and emergency preparedness continued in 2004. Experts from the two organisations worked together on a number of topics and problems. Among the most important issues were:

- Development of the project for a Regulation for emergency planning and preparedness for actions in case of a nuclear or radiation accident;
- Preparation of the Third National Report on the fulfilment of the obligations on the Convention on Nuclear Safety in the part for Emergency Planning;
- Conducting of emergency exercises;
- Joint communication with the mass media and public organizations.

### MINISTRY OF ENVIRONMENT AND WATER

According to the national legislation the Ministry of Environment and Water (MEW) is a competent authority, performing specialised control of the environmental radiation conditions.

The data for equivalent dose rates for gamma-radiation at the monitoring stations in the country is received by the National automated system for permanent control over the gamma background. The system provides data for the NRA Emergency Centre and the State Agency Civil Protection. The data is submitted to a common database of the European Commission – EURDEP. The data is also published in the Annual Report for the radioactivity levels in the environment in the European Union countries.

The performed analysis of the data from the environmental radiation monitoring in 2004 shows that:

- The gamma-background is within the limits, specific for the country;
- No changes of the specific activity of natural or man-made radionuclides has been registered.



### MINISTRY OF INTERIOR

In 2004, the joint activities of the MI and NRA were focused on the optimisation of the physical protection, fire and accident safety of nuclear facilities with regard of the new risks and threats. The control on the national border and the interior of the country was increased in relation to illicit trafficking, illegal movement or storage of nuclear materials and radioactive substances.

In 2004, the joint activities of the Ministry of Health and NRA were directed towards conducting of inspections and commissioning of sites with SIR, licensing of activities with SIR in medicine, developing the new legislation. In this connection, in 2004, 150 preliminary radiation-sanitary conclusions on projects for new and renewed sites were given. 204 inspections were carried out in the 160 sites, subject to a preliminary radiation-sanitary control. 106 sites were commissioned. In compliance with the Act on the Safe Use of Nuclear Energy, according to the procedure for issuing licenses and permits for medical purposes, the National Centre for Radiobiology and Radiation Protection issued 318 sanitary conclusions. The work on the development of the Regulation for BNRP has been successfully completed. The Regulation was approved by the Council of Ministries in August 2004.



## INTERNATIONAL CO-OPERATION

The Nuclear Regulatory Agency carries out the international co-operation in the field of the safe use of nuclear energy, ionising radiation and radioactive waste and spent fuel management, in accordance with the Act on the Safe Use of Nuclear Energy.

In 2004, the NRA continued successfully its activities in the area of international co-operation and European integration. The main part of the NRA activities consists of the co-operation with the International Atomic Energy Agency (IAEA) – Vienna and the Joint Institute for Nuclear Research (JINR) – Dubna. On bilateral ground, the co-operation was realised with a number of countries with a leading role in the application of nuclear technologies, such as USA, Germany, Great Britain, Ukraine, Norway etc.

### INTERNATIONAL ATOMIC ENERGY AGENCY - IAEA

In 2004, Bulgaria actively participated in the joint IAEA activities. A Bulgarian delegation under the leadership of the Minister of Energy took part in the 48th regular session of the IAEA General Conference. This presented the opportunity for our country to participate in the development of the new directions as well as the decision-making concerning current and future activities of the largest international organisation in the UNO.

NRA and Kozloduy NPP representatives took part in two regional meetings of the IAEA Member States from Europe. At the meetings, the implementation of the Programme for technical co-operation for 2003-2004 was reviewed and the Programme for regional projects in Europe for 2005-2006 was agreed. Proposals were made for future projects for safe operation of the Kozloduy NPP and proposals from other countries, of interest for Bulgaria, were supported.

In the framework of the programme for technical co-operation between Bulgaria and IAEA in 2004, the activities were completed on the following national projects:

- Re-Training Personnel Involved in Decommissioning of Kozloduy NPP (BUL/4/007);
- Planning and Management of Decommissioning Kozloduy NPP Units 1 and 2 (BUL/4/008);
- Evaluation of Radioactive Waste Incineration Facility (BUL/4/012).

In November, the IAEA Board of Governors extended by one more 2-year cycle the active project for technical co-operation Strengthening Capabilities of the Nuclear Regulatory Agency (BUL/9/018) and approved 3 new national projects for Bulgaria, as follows:

- Enhancement of Radioactive Waste Management (BUL/3/003);
- Strengthening the National Nuclear Power Infrastructure (BUL/4/013);
- Refurbishment of Research Reactor (BUL/4/014).

The disbursements for 2004 are given in the table below (in USD) for each of the projects



Project	Human resources				Equipment	Total
	Experts	Fellowships	Scientific visits	Total		
<b>BUL/0/008</b>	0	7,109	0	7,109	0	7,109
<b>BUL/4/007</b>	17,942	0	0	17,942	56,970	74,912
<b>BUL/4/008</b>	5,318	0	7,249	12,568	326,711	339,278
<b>BUL/4/009</b>	2,056	0	0	2,056	0	2,056
<b>BUL/4/012</b>	7,852	0	14,558	22,409	0	22,409
<b>BUL/8/014</b>	0	1,500	0	1,500	46,249	47,749
<b>BUL/9/018</b>	57,282	31,229	1,790	90,301	0	90,301
<b>Total</b>	90,448	39,838	23,597	153,885	429,930	583,815

Bulgaria, jointly with the IAEA Member States from the European region participated in 23 regional projects under the IAEA Technical Co-operation Programme for 2003-2004. The projects are related to priority activities and are closely connected with the further application of nuclear science and technology. Some of the important projects with Bulgarian participation are:

- Support for Decommissioning of Nuclear Power Plants (RER/3/003);
- Strengthening Capabilities for Nuclear Power Plant Performance and Service Life Including Engineering Aspects (RER/4/027);
- Improvement of Design Basis and Configuration Management Documentation (RER/9/082);
- Strengthening Safety Assessment Capabilities and Risk-informed Decision Making (RER/9/083);
- Effectiveness of Regulatory Authorities and Advanced Training in Nuclear Safety (RER/9/084);
- Thematic Programme on Nuclear Medicine (RER/6/011);
- Quality Assurance/Quality Control in Radiation Oncology (RER/6/012).

The International Atomic Energy Agency conducts and finances a great number of different in respect to subject and content training courses and seminars. The NRA, as a main partner in the co-operation between Bulgaria and IAEA, organised the participation of many Bulgarian scientists and specialists in the IAEA activities in Slovenia, Slovak Republic, Czech Republic, Ukraine Spain, Belarus, Hungary, Germany and Russia. In addition, many scientists and specialists were awarded IAEA fellowships and scientific visits.

In 2004, Bulgarian scientists and specialists from NRA, INRNE, TU-Sofia, Kozloduy NPP, Risk



Engineering, NCCRP, BAS, National Centre for Agricultural Sciences etc. presented reports at international conferences, symposia and seminars, organised by the IAEA on different aspects of the peaceful use of atomic energy. A significant number of Bulgarian specialists participated in technical meetings, expert, advisory and working groups.

Scientists from different laboratories and institutes in Bulgaria continued the participation of the country in the IAEA Research Programme. Some of the active

research contracts were extended and new contracts in different areas of the peaceful use of atomic energy were approved.

According to the Rules for foreign language examinations of candidates for fellowships and scientific visits, organised by the IAEA and other international organisations, approved by a NRA Chairman's order, in the year under review, the Departmental Examination Commission for English language carried out 20 examination sessions for certification of 45 Bulgarian specialists. 35 of them passed the examination and obtained certificates for English language.

## ACCESSION TO THE EUROPEAN UNION

During the year, NRA experts participated in the activities for the completion of the negotiations for the accession to the European Union in the framework of Chapter 14 „Energy“ and Chapter 22 „Environment“, sector „Nuclear Safety and Radiation Protection“. They prepared and presented to the heads of the working groups on accession the necessary documents concerning nuclear safety and radiation protection. They also participated in a number of meetings, as well as in the development and harmonisation of legislative documents.

The working group 30 „Nuclear Safety“, operating under the NRA guidance, developed the necessary documents on the accession of Bulgaria to the European Union in the sector „Nuclear Safety and Radiation Protection“ of Chapter 22 „Environment“. The work contributed to the beginning of the process of the preparation and harmonisation of the accession documents.

## PHARE PROJECTS

The co-operation with the EU under the PHARE Programme was focused again on nuclear safety. The technical support for the NRA was realised through projects aimed at specific activities in the field of nuclear regulation. Joint actions were performed in the following important aspects:

- Technical support to the NRA and its structures in the safety review of the Kozloduy NPP units 3, 4, 5, and 6, as well as in the assessment of the measures for providing the integrity of the reactor pressure vessels for these units;
- Know-how transfer to the NRA and its structures for a long-term technical support aiming the strengthening of their competence and capabilities;
- Assistance to the NRA in the licensing process for the decommissioning of units 1 and 2, in accordance with the Western approach in this field;
- Assistance to the NRA for the improvement of the safety the sealed radiation sources management, including disused ones;
- Approximation to the EU practice in the field of emergency preparedness and developing of an acceptable and efficient framework for better communication and understanding between the facilities and emergency centres (installation of the RODOS system);
- Developing of a modern documentation system for quality management and its implementation in the NRA.

During the year, the NRA implemented two PHARE projects under the common title „Strengthening of the NRA capabilities in the safety assessments“. The projects include assessments of the measures for modernisation of units 3, 4, 5, and 6, as well as assessment of the Safety Analysis Report (SAR) for units 3 and 4. The project on the SAR was successfully completed in November 2004. The completion of the other project is planned for 2005. Proposals were

made for establishing of new projects for safe management of sealed sources, decommissioning of units 1 and 2 (extension of a project, completed in 2003), developing of manuals for severe accidents management, assessment of the SAR for units 5 and 6, installation of RODOS system.

## JOINT INSTITUTE FOR NUCLEAR RESEARCH - DUBNA

In 2004, a Bulgarian delegation participated at the meeting of the Plenipotentiary Committee of the JINR Member States as well as at the Financial Committee meetings. Bulgarian scientists participated also in advisory committees for developing of a programme for scientific research and international co-operation in the Institute for 2005.

According to a bilateral agreement between the Republic of Bulgaria and JINR, 25 projects were approved for priority financing, proposed by scientists from BAS institutes to a total amount of 40 500 USD.

In 2004, 6 Bulgarian specialists were sent for a long-term contract in the JINR Dubna, which increased their number to a total of 24. The co-operation with the JINR augmented further in the form of 3-month- and short-term visits of Bulgarian specialists, with the purpose of participation in experiments, work on contracts and common problems, participation in scientific activities of the Institute. In 2004, 21 three-month visits were organised.

## BILATERAL CO-OPERATION

### USA

In 2004, with the assistance and financial support by the US regulatory authority (US NRC) and within the scope of the IAEA activities, a 6-month training in USA of two Bulgarian inspectors from NRA was organised. The training addressed mainly the probabilistic safety analyses and their application in the inspection work. Visits to two NPPs and one of the regional subdivisions of the US NRC were organised.



### GREAT BRITAIN

In 2004, the first projects aimed at strengthening the NRA activities, in the framework of the nuclear safety programme of the British government were completed. The programme was administered by the Department of Trade and Industry and its purpose was to ensure the priority activities in the field of energy production, and especially in the field of nuclear safety in Central and Eastern Europe. The projects completed in year 2004 covered the following topics:

- Assistance to the NRA in the development of inspection manuals for the programmes on ageing management and their application;
- Assistance to the NRA in licensing of the research reactor reconstruction;

- Training of the NRA personnel aimed at the improvement of their English language knowledge.

The implementation of 3 new projects started in the framework of the programme of the British Government, aiming to assist the NRA in the application of the regulatory approach for the assessment of non-destructive testing and non-destructive testing qualification, as well as training of the personnel for development and improvement of management abilities.

In addition, two projects were proposed for the assessment of risk-informed non-destructive testing and developing of manuals for regulatory inspection and assessment of computer-based information and management systems. The projects will be realised after January 2005.

## FEDERAL REPUBLIC OF GERMANY

The Federal Ministry of environment, nature protection and reactor safety of Germany carries out the programme for the scientific-technical co-operation between the Federal Republic of Germany and the countries from the Commonwealth of Independent States, Central and Eastern Europe, by organising seminars and meetings on different topics, concerning the safe operation and physical protection of NPPs, regulatory aspects of licensing, nuclear legislation etc. Six Bulgarian specialists participated in courses, financed by Germany.

## JAPAN

In 2004, two Bulgarian specialists took part in training courses, organised and financed by Japan – training course on safeguards and training course on nuclear safety organised by the JAERI and JEPIC-ICC, respectively.

## NORWAY

In 2004, Bulgaria continued the participation in the Halden Reactor Project.

The main activities under the project were directed in the following aspects:

- Thorough examination of the fuel for power reactors, aimed mainly at increasing the burn up credit, investigation of new fuel types and fuel behaviour during operation;
- Upgrading of the systems for power reactor operation, including monitoring the condition of the materials in the reactor core;

- Training of the personnel in the field of reactor physics and reactor engineering

The NRA Chairman is a member of the Board of Governors of the Project. In accordance with the adopted policy, each Member State has a representative in the scientific council. In 2004, Bulgaria was offered to submit candidatures.



During the year, the National Centre of the International Nuclear Information System (INIS) continued its work on the fulfilment of Bulgarian obligations, ensuing from the Membership in INIS. In accordance with the obligations, the Bulgarian INIS Centre maintained the system through providing access to bibliographic information (if necessary by additional arrangement with publishers) for all published on the territory of the country documents in the field of nuclear science and technology and submitting the input to the IAEA database. In addition to the information about published documents, the INIS Centre is obliged to submit information about so called „non-conventional” literature (NCL), including conference reports, accounts, patents etc. The full texts of the documents are processed and submitted to a separate full-text database in the IAEA.

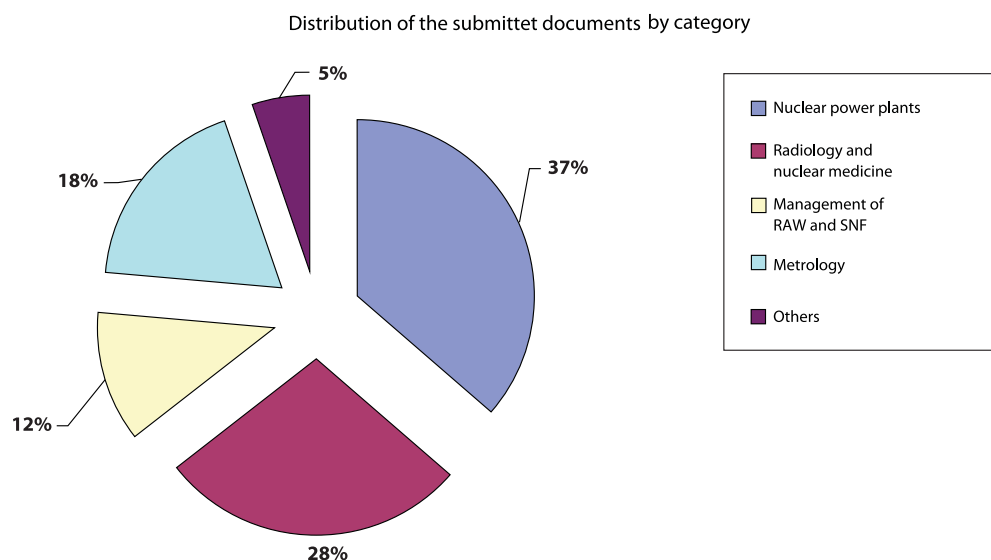
In 2004, more than 600 documents were categorised, 330 of which were submitted as Bulgarian input. The conventional literature (70 documents) includes articles from the journals „Energetika”, „Roentgenology and Radiology”, „Clinical Oncology”. 180 NCL documents (reports from 6 international conferences conducted in Bulgaria) were processed and abstracts were submitted. The full texts of all documents were submitted to the database.

During the year, the following information services were performed:

- Provision of bibliographic information from the INIS Database and other databases to Bulgarian users;
- Provision of full texts from the Full-text database as well as from the available in the Centre non-conventional information on CD-ROM to Bulgarian users;
- Provision of full texts of Bulgarian documents to other National INIS Centres.

The Bulgarian INIS Centre maintains continuous communications with the INIS Secretariat at the IAEA, as well as other National Centres on current issues about system operation.

The operation of the INIS Centres is co-ordinated by the INIS Secretariat in Vienna and it is reported and planned at INIS Liaison Officers Meetings. As a result of the co-operation between INIS and ETDE (Energy Technology Data Exchange, DOE - USA), Bulgaria was provided with free access to the ETDE Database ETDEWeb. In June 2004, in Sofia and in November 2004 at the International Centre for Theoretical Physics in Trieste, 2 seminars were conducted, connected with the IAEA initiative for nuclear knowledge preservation. The main topics of the seminars were the structuring, organisation, preservation and transfer of nuclear information and nuclear knowledge.



## INTERNATIONAL EVENTS

In 2004, Bulgaria organised and hosted several international meetings and seminars jointly with the IAEA and EU.

### IAEA

- From 19 to 23 April 2004 NRA hosted a technical meeting on the developing of a database for the frequency of initiating events for WWER-440 reactors;
- From 26 to 29 April 2004 NRA hosted a seminar on risk oriented regulation;
- From 5 to 9 July 2004 a technical meeting „Application of PSA for support of operational practices, including optimisation of outages for WWER 440 type reactors“;
- From 27 September to 1 October 2004 a regional workshop „Safety Assessments in licensing of near surface radioactive waste facilities“ was conducted in the NRA;
- From 4 to 8 October a seminar „Operation stability of the facilities for processing and storage of RAW“ was conducted in the INRNE“;
- From 22 to 24 November 2004, the NRA hosted a regional workshop „Safety decommissioning of research reactors“



### European Commission

- From 11 to 12 May 2004, on a joint initiative of NRA and EC a seminar was conducted in the NRA Training Centre on issues, concerning the installation of the RODOS system in Bulgaria;
- From 22 to 23 June 2004, with the co-operation of the Emergency Planning and Preparedness Division, a bilateral seminar on emergency planning was conducted in the NRA. NRA experts as well as the deputy director of the Institute for Radiation Protection and Nuclear Safety (France) took part in the seminar;
- From 10 to 12 May 2004, the 25th CONCERT Group meeting was conducted. Heads of regulatory bodies from the European Union countries, Central and Eastern Europe countries as well as responsible experts from the European Commission took part in the meeting.

The tasks of the meeting were:

- Exchange of experience and information about the programmes for mutual aid and co-operation, with regard to the regulatory bodies responsibilities;
- Proposals of measures for future activities;
- Determination of technical areas for regional projects;
- Development of a common strategy and long-term co-operation and aid for the Member States in the application of the strategy in the corresponding national plans.

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- Stimulation of the development of a common approach to nuclear safety in Europe, through topical discussions of different regulatory aspects.

The meeting included reports, discussions and round tables, as well as a visit to the Kozloduy NPP



The public relations in the field of nuclear regulation are conditioned by two specific factors. On one hand, in case of emergency, the social importance of the sector requires the provision of detailed and understandable information for the media. One of the main factors for the development of confidence and overcoming the usual for such cases suspicions of the type „when radiation is involved not everything is said“ is keeping the media informed. On the other hand, the continuous technological development of the sector as well as its priority place in the economy of the country makes it interesting for the media.

In this connection, the Nuclear Regulatory Agency, together with the activities for increasing of its authority, has assumed the complicated task to develop confidence in nuclear technologies and to provide timely information for the media about all events in the field. It is also necessary to improve the communications and bring closer the special expert language and the plain language of the ordinary people on such an important subject.

Information is among the priorities for the NRA not only in case of real emergencies, subject of media interest, but also for the disproof of rumours, not grounded on real facts.

During the year, the NRA organised a training seminar for journalists with the participation of representatives from the national media, as well as the press centers of the Kozloduy NPP, State Enterprise "RAW", State Commission on Energy Regulation and the NRA Management. At the seminar, lectures about the responsibilities of the regulatory body were presented, and basic information about sources of ionising radiation and emergency planning was given. It was also useful for the opportunity to discuss and improve the communications between the media and NRA.

The presentation of Bulgarian regulatory activities in international organisations, experts and the world community is also a priority for the NRA. A meeting was organised by the European Nuclear Community in February 2004 in Barcelona, Spain, in which a NRA representative took part. The goal of the meeting was the exchange of experience between public information units of organisations in the field of nuclear energy.



In March 2004, in Karlsruhe, Germany, an IAEA regional working meeting for representatives of public relation sections from regulatory bodies and NPPs from Eastern Europe was conducted. The goal was to present the procedures for public information in different countries and organisations and to report the good practices. The NRA representative presented a report „The Peer Review or why politicians do not trust experts?“

## LIST OF ABBREVIATIONS:

<b>AB</b>	Auxiliary building	<b>MCR</b>	Main control room
<b>ACNS</b>	Advisory Council on Nuclear Safety	<b>NEK</b>	National Electricity Company
<b>ACRP</b>	Advisory Council on Radiation Protection	<b>NM</b>	Nuclear material
<b>ALARA</b>	As Low As Reasonably Achievable	<b>NPP</b>	Nuclear Power Plant
<b>ASUNE</b>	Act on Safe Use of Nuclear Energy	<b>NRA</b>	Nuclear Regulatory Agency
<b>BAS</b>	Bulgarian Academy of Science	<b>PIL</b>	Physical Inventory Listing
<b>BNRP</b>	Basic norms on radiation protection	<b>PIME</b>	Public Information Materials Exchange
<b>CI</b>	Chemical index	<b>PM</b>	Planned maintenance
<b>CM</b>	Council of Ministers	<b>PSA</b>	Probabilistic Safety Analysis
<b>CONCERT</b>	CONCertation on European Regulatory Tasks	<b>PU</b>	Power Unit
<b>CPS CD</b>	Control and protection system control devices	<b>QA</b>	Quality assurance
<b>CS</b>	Confinement system	<b>QMS</b>	Quality management system
<b>DG</b>	Diesel generator	<b>RAW</b>	Radioactive waste
<b>EC</b>	European Commission	<b>RAW TE</b>	RAW Treatment Enterprise
<b>ENAC</b>	Emergency Notification and Assistance Convention	<b>RAWR</b>	Radioactive waste repository
<b>ETDE</b>	Energy Technology Data Exchange	<b>RAWSF</b>	Radioactive waste storage facility
<b>FRI</b>	Fuel Reliability Indicator	<b>RAWTF</b>	Radioactive waste treatment facility
<b>IAEA</b>	International Atomic Energy Agency	<b>RAZ</b>	Restricted access zone
<b>ICA</b>	Instrumentation, Control and Automation	<b>RM</b>	Refuelling machine
<b>ICR</b>	Inventory Change Report	<b>RMG</b>	Reversible motor-generator
<b>INES</b>	International Nuclear Event Scale	<b>RODOS</b>	Real time On-line Decision Support system
<b>INIS</b>	International Nuclear Information System	<b>SACP</b>	State Agency for Civil Protection
<b>INRNE-BAS</b>	Institute for Nuclear Research and Nuclear Energy	<b>SE „RAW“</b>	State Enterprise „Radioactive Waste“
<b>IRS</b>	Incident Reporting System	<b>SFP</b>	Spent fuel pool
<b>IRT</b>	Research reactor IRT	<b>SFSF</b>	Spent fuel storage facility
<b>JAERI</b>	Japan Atomic Energy Research Institute	<b>SG</b>	Steam generator
<b>JEPIC</b>	Japan Electric Power Information Center	<b>SIR</b>	Sources of ionising radiation
<b>JINR</b>	Joint Institute for Nuclear Research	<b>SIS</b>	Systems important to safety
<b>MBR</b>	Material Balance Report	<b>SNF</b>	Spent nuclear fuel
		<b>SS</b>	Safety systems
		<b>SSR</b>	Safety Substantiation Report
		<b>STC</b>	Study and training centre
		<b>TG</b>	Turbine generator
		<b>WANO</b>	World Association of Nuclear Operators
		<b>WCS</b>	Water Chemistry Status
		<b>WWER</b>	Water-water power reactor

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