



KOZLODUY NPP

# ANNUAL --- REPORT

20  
02





Kozloduy NPP plc

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*The year 2002 shall go on record as an indisputably successful year in the history of Kozloduy NPP. For the twelve months of this report the electricity generated by Kozloduy NPP exceeded the plan. This was achieved by optimization of maintenance periods and minimization of unplanned outages.*

*During the year a record share of electricity generation in the country was achieved – the nuclear power plant provided 47,3% of the generated electricity in Bulgaria. The trend of increasing the utilization of the installed capacities was maintained*

*and for 2002, this indicator was 61,4%, the highest for the last ten years.*

*The year 2002 shall be remembered for the international safety review missions to Kozloduy which have done so much to demonstrate in front of the world professional society and the society at large that Kozloduy is operated to the highest standards. The official conclusions of the safety review of units 3 and 4 by the International Atomic Energy Agency – Vienna, are an exceptional recognition for the efforts made by Kozloduy staff during the last years.*

*The credit for the ongoing safety level of units 3 and 4 assessed by IAEA experts as 'comparable to those of the operating western units of the same vintage' is due to all the personnel of Kozloduy NPP. We managed to demonstrate high professionalism and a new way of corporative thinking, which is evident in every detail of our daily activity.*

*In accordance with the Bulgarian government's commitments to the European Union and as confirmed by a decision of the Council of Ministers, units 1 and 2 were disconnected from the energy system at the end of 2002.*

*The year 2003 meets us with the challenge to provide even more efficient operation of the other units. Our main objective from now on shall be to improve our work in such a way as to preserve Kozloduy's significant share of the total electricity generation of the country.*

Jordan Kostadinov  
Executive Director

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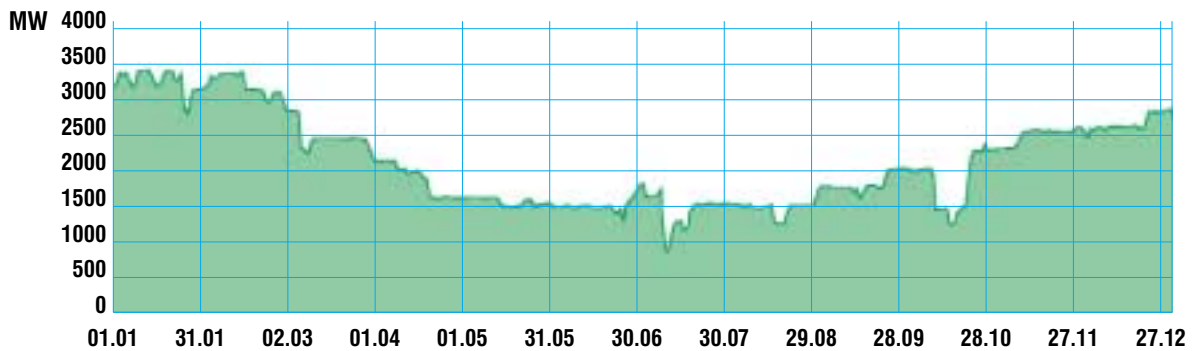
# PERFORMANCE INDICATORS

## LOADING SCHEDULE

In 2002 Kozloduy NPP provided almost half of the electricity necessary for Bulgaria. The high production

results determined the nuclear power plant as the most efficient electricity generating plant in Bulgaria.

Loading schedule of KNPP for 2002



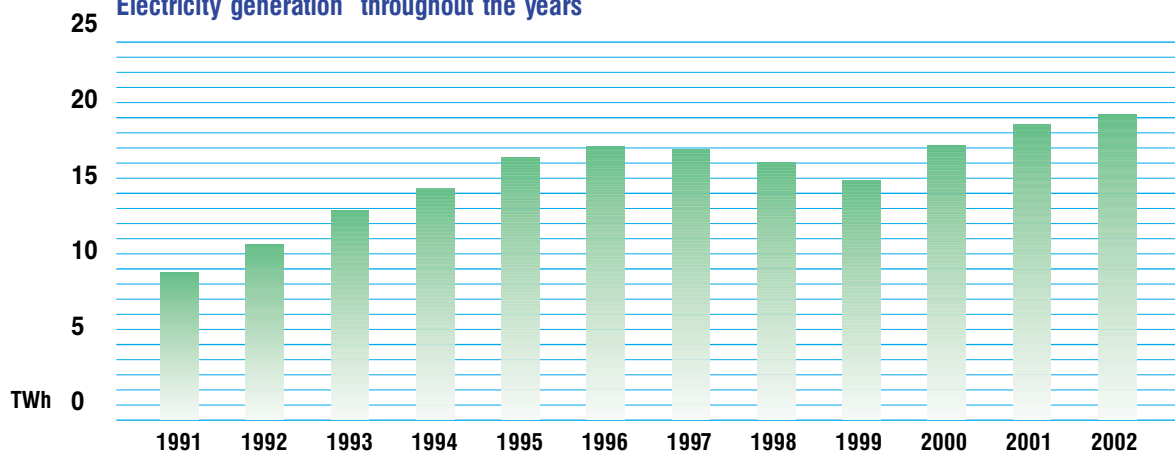
Planned outage	Beginning	End
Unit I	08.03.02	22.05.02
Unit II	20.04.02	08.07.02
Unit III	15.02.02	20.06.02
Unit IV	28.06.02	30.08.02
Unit V	09.10.02	21.12.02
Unit VI	09.07.02	20.10.02

## ELECTRICITY GENERATION

During the year 2002 Kozloduy NPP generated 20 221 719 MWh of electricity, in full compliance with the nuclear safety and radiation protection

requirements. In Kozloduy NPP operational history, this is the highest result achieved.

Electricity generation throughout the years

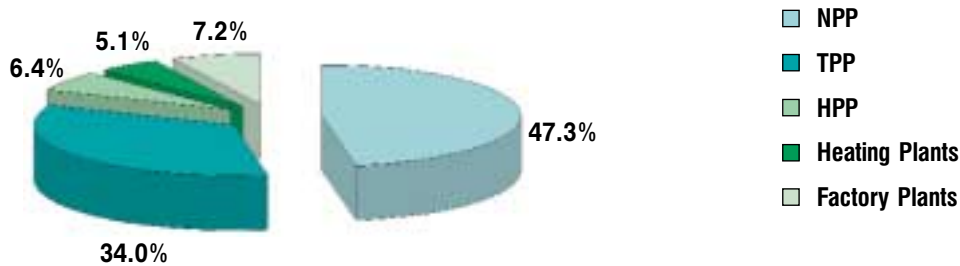


The electricity production program for 2002 is fulfilled at 105,95%. The share of Kozloduy NPP plc in the total electricity generated in Bulgaria in 2002 is 47,3% which is by 2,66% more as compared to 2001 share. Thus, the trend is maintained of the

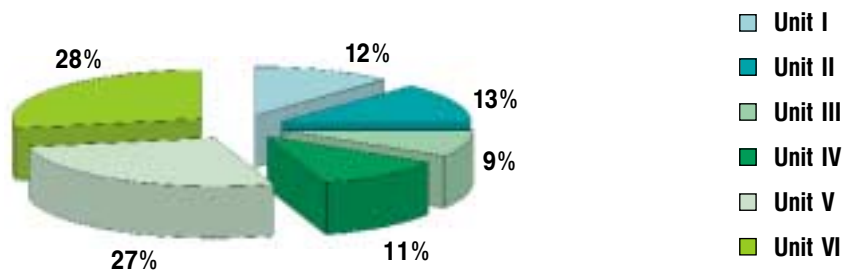
KNPP share increase in the country electricity generation.

In 2002, similar to the last years production, the electricity generation was proportionally distributed between VVER-440 and VVER-1000 units.

### Share of Kozloduy NPP in the 2002 net electricity generation in Bulgaria



### Share of Kozloduy NPP units in the 2002 net electricity generation in Bulgaria



## OPTIMIZATION OF THE PERFORMANCE INDICATORS

The actual availability of Kozloduy NPP in 2002 is 23 206 509 MWh, against the planned 23 152 800 MWh, which is with 0,23% higher than the planned for the year.

Compared to the previous year 2001, the increase is 6,21%.The steady trend of lowering the share of the energy losses (planned and unplanned)

continues, as the values are comparable to the average indicators of the nuclear plants in the world. The energy loss decrease is 8,77%, as compared to the year 2001.

The trend of increasing the load factor of the installed capacities is preserved.

## SAFETY

### SAFETY – MAJOR PRIORITY

The plant site comprises 4 power units with VVER-440 reactors, 2 power units with VVER-1000 reactors and a Spent Fuel Storage Facility (SFSF). All power units are equipped with pressurized water reactors, similar to most existing reactors in coun-



tries having nuclear plants – USA, France, and Finland. These types of units make up 87% of those operated worldwide and are fundamentally different from the reactors of the Chernobyl type. In 2002 the main priority of the management and the Kozloduy NPP plc personnel continued to be the enhancement and maintenance of the nuclear facility safety level in compliance with the contemporary international standards and criteria. The process of safety management at the nuclear power plant was developed to comply with the new higher requirements, formulated in the Safe Use of Nuclear Energy Act (SUNEA), adopted by the Parliament in August 2002.

### COMPLIANCE WITH THE REQUIREMENTS OF THE REGULATORY AUTHORITY

In 2002, significant changes were made in the licensing activity, based on the Safe Use of Nuclear Energy Act adopted during the year. A requirement of the SUNEA is for every power unit and every other nuclear facility to be operated only after the



receipt of the long-term operational licence. As a result of the efforts in November 2002 the necessary documents were deposited in the Nuclear Regulatory Agency. These documents defined the safety research and assessment necessary for long-term licences for Kozloduy NPP units to be requested. The established internal system to satisfy the demands of the licences issued by the Regulatory Authority, is in process of development and extension, this system aims to put in hand the enhanced delegated responsibilities of the plant management.

## QUALITY MANAGEMENT SYSTEM

An updated quality management system, established on the basis of BDS EN ISO 9001:1996 and the International Atomic Energy Agency recommendations, included in the document Safety Series № 50-C/SG-Q, at Kozloduy NPP has been developed.

In 2002 implementing a project, sponsored by the Department of Trade and Industry (DTI), Great Britain, experts from BENIC (a consortium between British Energy and the leading British engineering company NNC), reviewed the quality system of

Kozloduy NPP plc. The major conclusion of the British experts was that Kozloduy NPP plc. has a mature quality management system. In 2002 Kozloduy nuclear power plant received its first certificate of compliance for the quality management system according to BDS EN ISO 9001, issued by TÜV Rheinland to the Diagnostic and control testing centre.

## EVENTS

The NPP operational safety is characterized by the lack of severity of the events which have occurred and were assessed according to the international scale for nuclear events INES (INES-International nuclear event scale).

All operational events at Kozloduy NPP plc are registered, analyzed and reported to the Nuclear Regulatory Agency (NRA), according to the requirements of the Bulgarian legislation and the plant's internal procedures. In 2002 Kozloduy NPP recorded a total of 81 operational events, for which NRA has been notified.

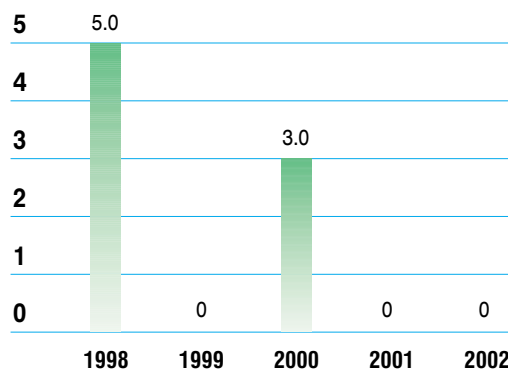
56 of the registered events fall within the reporting criteria of the regulatory body. Following a policy of full openness, Kozloduy NPP has additionally notified about 25 events, which are outside the reporting criteria.

53 of the registered events have been rated INES level '0' due to their safety relevance although they did not result in deterioration of safety. The remaining events are not safety relevant and have been

rated 'below INES scale'.

'Above INES scale' events have not occurred during the year. This fact confirms the steady trend of the last years for decreasing the severity of the operational deviations. The relative share of the events, found through preventive control (testing by schedule, walk downs, sampling and other methods, regulated in the operational documentation) is maintained high.

Number of events above INES level '0'

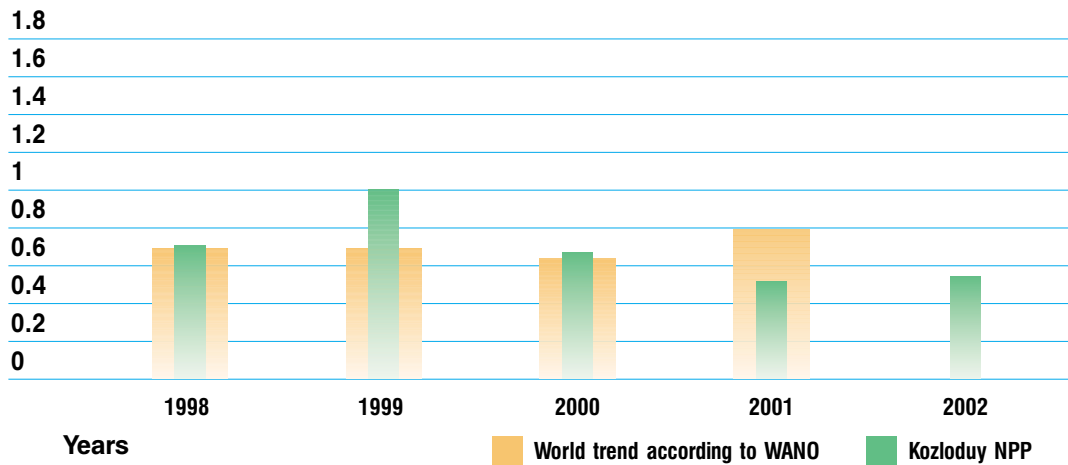




This allowed 60% of the occurred deviations to be retracted. The basic reason for this is the enhanced criteria of the nuclear power plant for registration and analysis of events and conducting a policy of complete openness. This is due to the enhanced personnel safety culture. The average number of unplanned reactor scrams at Kozloduy NPP in the

last ten years show a steady tendency of decreasing, they are now comparable to the average values in the world. The coefficient of unplanned reactor scrams in 2002 maintains the level of 2001. The record for the most continuous operation without scram in the history of Kozloduy NPP – 7 years, is held by unit 5.

#### Coefficient of unplanned reactor scrams



### ACHIEVING CURRENT SAFETY STANDARDS

The international reviews conducted in the last few years, proved that the safety level of Kozloduy NPP units complies with the units of the same type, operated in western countries.

A number of modifications for nuclear safety and radiation protection enhancement have been successfully implemented within the annual outages of the units. A large number of analyses, studies and reviews regarding different aspects of safety have

been implemented. The Safety analysis report of units 3 and 4 was completed in 2002 and the documents were submitted to the Nuclear Regulatory Agency.

This allowed the design basis of these units to be re-qualified at a qualitative new, higher safety level, verified by independent Western engineering organizations.

# RADIATION PROTECTION

## APPLICATION OF ALARA PRINCIPLE

In all aspects of operational and maintenance activities the principle ALARA is successfully applied for minimization of the dose exposure and corrective measures of the performed self assessments.

The latest international practices are implemented. The review conducted by the NRA in 2002 in the area of radiation protection indicated that the achieved good results in the previous years are maintained with trends of improvement.

## RADIATION BACKGROUND ON-SITE AND IN THE RADIOLOGICAL CONTROLLED AREA

The gamma radiation dose rate at the plant site is within the normal range of values and fully compares to previous years values. The analyzed results do not show any negative trends.

The dose rate values (gamma background) at the on-site monitoring locations, controlled with portable instruments and automatic systems shows that the radiological status of the area of preventive protective measures (APPM) has no deviations from the typical natural values within the limits of  $0.06$  p  $0.14$   $\mu\text{Sv/h}$ . The monitoring is carried out according to an approved annual program agreed

with the Ministry of the Environment and Water and the Nuclear Regulatory Agency.

In spite of the continuous maintenance campaigns and the performed modernizations and reconstructions, changes of the radiation status in the radiological controlled area have not been allowed. The trend in the personnel dose exposure indicators proves the efficiency of the radiation protection.

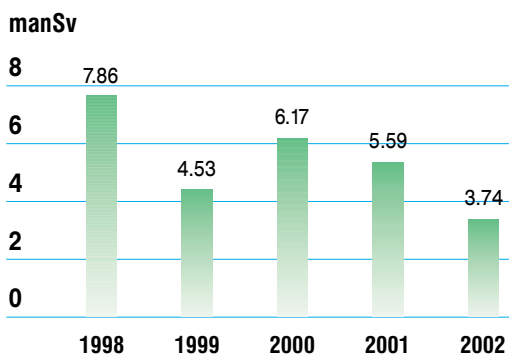
The requirements of the Technical Regulations and the Radiation Protection instructions, which set the requirements for the protective radiation barriers and efficiency control are adhered to.



## PROFESSIONAL EXPOSURE

The optimal radiation protection of site personnel and the wider population is one of the main principles of nuclear power plant safe operation. Kozloduy NPP plc collective effective dose in 2002,

### Kozloduy NPP plc collective effective dose



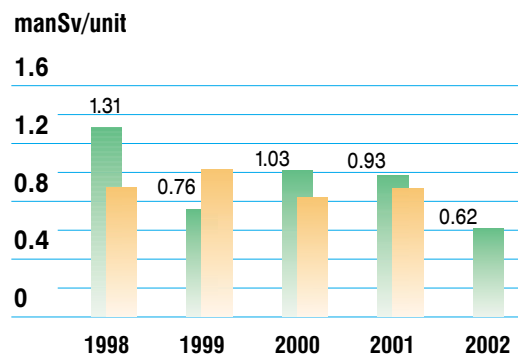
formed by the collective dose of the external and internal exposure is 3.74 manSv for 5766 people classified as 'controlled'. The average individual effective annual dose is 1.3%, and the maximal registered individual annual dose is 39.8% of that specified by the Regulations on the Basic Norms of Radiation Protection 2000. The annual effective dose limit for professional exposure is 50 mSv. The

internal exposure collective dose is 2,7% of the collective effective dose. The collective dose in Kozloduy NPP, normalized as per number of operating units in 2002 is 0,62 manSv/unit total for the power units of Kozloduy NPP plc.

Compared to the previous years it demonstrates a continuous trend of decreasing the professional exposure as a whole in terms of the collective and average annual individual dose, as a result of safety culture enhancement and strict application of ALARA principles.

In the last five years there has not been a registered case of exceeding the annual limit of the professional exposure effective dose – 50 mSv, according to Regulation 40 on individual dosimetry control.

### Collective Dose per Unit (manSv/unit)



■ Collective Dose per Unit (manSv/unit) in KNPP

■ WANO indicator (manSv/unit)

# ENVIRONMENTAL PROTECTION

## RADIOLOGICAL MONITORING OF THE ENVIRONMENT

The impact of Kozloduy NPP operation upon the environment components is subject to detailed and systematic studies since the plant commissioning in 1974. The organization of radio-ecological monitoring is regulated by long-term programs, agreed with the country regulatory authorities – Nuclear Regulatory Agency, the Ministry of Environment and Water, the Ministry of Health. The programs comply with the IAEA recommendations and the good international practices.

The continuous radiation monitoring within the 3 km area around the plant is performed by an automated information system for off-site monitoring, integrated into the National System for Radiation Control.

Within the 100 km surveillance area around Kozloduy NPP, numerous samples are taken of air,

soil, flora, Danube river, drinking water sources and radiation gamma background is measured.

The utility radiation monitoring results are annually verified by independent radio-ecological studies in the frames of the relevant programs of the Ministry of Environment and Water and the National Centre for Radiobiology and Radiation Protection. Joint comparative analyses are conducted as well of the radiation status at the region.

The radiation parameters of the ecological components are within the limits of the values, typical for the region. It is confirmed that the radio-ecological status around Kozloduy NPP complies with the requirements of the radiation protection legislation in force and the environmental status information is available to the population.



## GASEOUS, AEROSOL AND LIQUID RADIOACTIVE RELEASES

The gaseous effluents from Kozloduy NPP are subject to continuous monitoring performed by two independent channels for each vent stack. The control levels established represent 10% of the admissible limits and are used as indicators of the plant efficient and safe operation. In 2002, the total activity of the radioactive noble gases (RNG) released into the atmosphere is 1.05% of the calculated admissible average annual value. The activity of the released long-lived aerosols represents 0.23% of the admissible average annual value. For Iodine 131, the activity of the releases is 0.57% of the admissible average annual value.

The gross and specific activity of the industrial discharge waters released into the Danube river in 2002 are lower than the admissible limit values established by the Nuclear Regulatory Agency in

agreement with the Ministry of Health and the Ministry of Environment and Water. The data confirm the efficiency of the systems and equipment for discharge water treatment and purification.



## GAMMA RADIATION BACKGROUND

The gamma radiation background of the region around the plant and 100 km area varies within the natural background radiation range from 0.07 to 0.15  $\mu\text{Sv/h}$ . The dose rate values at the site boundary are comparable to the ones measured at the monitoring locations and at towns and villages

within the 100 km area. The automated control data do not register any impact of Kozloduy NPP operation on the radiation background within the 3 km area around the plant.

## ENVIRONMENTAL IMPACT

The radioactivity of atmospheric air has been measured in 11 monitoring locations within the 100 km surveillance area around the plant. The results are within the normal range, considerably below the set limits. The technogenic  $^{137}\text{Cs}$  radioactivity in the aerosols is close to the background values of

1-2  $\mu\text{Bq/m}^3$ , which are inherent to the near-ground surface air in this region and global atmosphere pollution. The long-lived beta activity varies within the natural limits, with the average value of 0.47  $\text{mBq/m}^3$ .

The radiological indicators of the Danube water in

2002 show the typical values for the natural water basins. The comparability of the test results obtained from the upper stream and the lower stream of the river in the region around Kozloduy NPP proves the absence of radioactive contamination. The total beta activity, measured in the open water basins does not exceed the value of 0.23 Bq/l, which is 30% of the permitted levels. The content of tritium in the open water basin samples does not exceed the minimum detectable activity of 8-10 Bq/l. The registered technogenic activity of  $^{137}\text{Cs}$  and  $^{90}\text{Sr}$ , typical for the regional natural water basins, is close to the minimum detectable activity.

The radioactivity of drinking water from sources located in the region around the nuclear power plant shows normal values, which are well below the permitted values in the country. The total beta activity varies up to 0.19 Bq/l, the content of tritium being below the minimum detectable activity in all samples.

The soil radioactivity has been measured in all 36 monitoring locations within 100 km area. The results obtained are similar to those of previous



years – detected technogenic activity caused by the nuclear tests in the last century and the Chernobyl accident. A tendency of self decontamination has been identified throughout the long term studies. The analyses of the flora and the basic foods from the region around Kozloduy NPP, such as milk, meat, fish and agricultural products, show the typical values for the analysed vegetal and animal species and products. There is no registered impact upon the basic food and ichthyofauna in the region.

## CONTROL OF THE PUBLIC EXPOSURE

The exposure of the public within the 30 km area, resulting from the operation of Kozloduy NPP is negligibly low. It is lower than 0.02% of the background radiation and is below the 0.05% of the limit of 1 mSv according to Basic Norms for Radiation Protection, 2000. The normalized collective effective dose of population of gaseous aerosol

effluents is completely comparable to the average value for a large number of PWRs world-wide. According to the indicators for radioactive noble gases and Iodine-131, the dose rate is lower than the average for the world. The public dose exposure of the plant liquid effluents is also negligibly low.

## CONVENTIONAL WASTE MANAGEMENT

In implementation of the requirements of the Environmental Protection Act and the Act on Restriction of the Harmful Impact of Waste on the Environment at Kozloduy NPP, a Program for conventional waste management was developed. Since the beginning of 2001 Kozloduy NPP plc

operates an own repository for domestic and industrial waste, which meets the modern for environment protection requirements. The depository is intended to be in operation for 24 years.

## CONTRIBUTION TO THE GREENHOUSE EFFECT LIMITATION

In 2002 Bulgaria ratified the Kyoto protocol, which is a serious step to the emission limitation of 6 greenhouse gases (CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, HFCs, PFCs and SF<sub>6</sub>).



The electricity production technology at Kozloduy NPP in practice does not generate any greenhouse gases and considerably contributes to the environment protection. By the annual electricity production of the nuclear power plant, the harmful impact of more than 29 million tons of carbon dioxide (CO<sub>2</sub>) has been avoided, 1,3 million tons of sulphurous dioxide (SO<sub>2</sub>) and 54 thousand tons of dust, containing natural radioactivity have not been released to the environment.

In June 2002 Kozloduy NPP was awarded by the Ministry of Environment and Water of the Republic of Bulgaria for the significant contribution to the protection of environment reproduction and natural resources.

# ECONOMIC AND FINANCES

The past year 2002 was especially successful for Kozloduy NPP plc in terms of fulfillment of the electricity generation program, which is a prerequisite for the achievement of good financial results. The electricity sales amounted to 18.8 TWh, 23.2 TWh of active power being provided. This is

respectively by 7.20% and 3.33% more than the amounts initially contracted with the National Electricity Company.

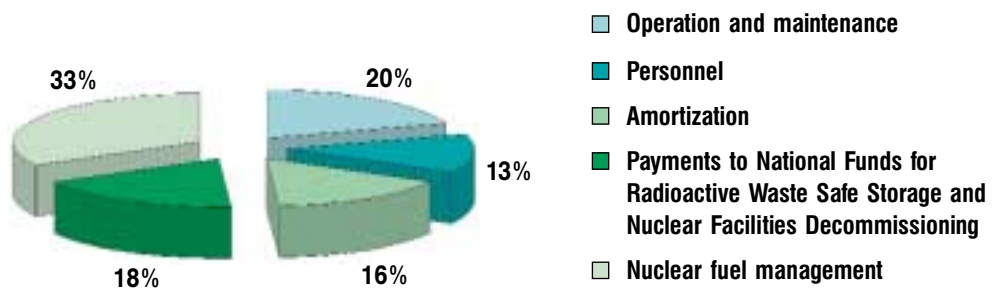
## The financial status of Kozloduy NPP plc by 31.12.2002

<b>ASSETS</b>	<b>2002</b> (in thousands of BGN)	<b>2001</b> (in thousands of BGN)
<b>Long-term assets – total, incl.:</b>	<b>787 589</b>	<b>733 653</b>
Long-term material assets	700 508	728 585
Long-term immaterial assets	81 979	3 834
Long-term financial assets	4 408	151
Expenditures on future periods	694	1 083
<b>Short-term assets – total, incl.:</b>	<b>485 570</b>	<b>486 014</b>
Material reserves	204 409	215 758
Short-term accounts receivable	181 148	230 509
Financial resources	99 260	39 523
Expenditures for future periods	753	224
<b>Assets holdings – total:</b>	<b>1 273 159</b>	<b>1 219 667</b>
<b>Provisional assets</b>	<b>4 739</b>	<b>12 153</b>
<b>Liabilities</b>	<b>2002</b> (in thousands of BGN)	<b>2001</b> (in thousands of BGN)
<b>Own capital – total, incl.:</b>	<b>755 086</b>	<b>748 586</b>
Fixed capital stock	35 631	35 631
Reserves	694 114	691 701
Financial result	25 341	21 254
<b>Long-term assets – total, incl.:</b>	<b>345 897</b>	<b>193 943</b>
Long-term obligations	283 218	127 270
Incomes for future periods and financing	62 679	66 673
<b>Short-term liabilities</b>	<b>172 176</b>	<b>277 138</b>
Short-term obligations	171 613	276 573
Incomes for future periods and financing	563	565
<b>Liabilities holding – total:</b>	<b>1 273 159</b>	<b>1 219 667</b>
<b>Provisional liabilities</b>	<b>4 739</b>	<b>12 153</b>



<b>INCOMES, EXPENDITURES, FINANCIAL RESULT</b>	<b>2002</b> (in thousands of BGN)	<b>2001</b> (in thousands of BGN)
<b>Incomes from the activity</b>	<b>751 147</b>	<b>643 063</b>
<b>Expenditures for the activity</b>	<b>731 507</b>	<b>623 386</b>
<b>Account profit</b>	<b>19 640</b>	<b>19 677</b>
<b>Tax expenditures</b>	<b>6 161</b>	<b>9 985</b>
<b>Net profit</b>	<b>13 479</b>	<b>9 692</b>

#### Structure of 2002 expenditures



The structure of expenditures is similar to that of other nuclear plants, the major expenses being

related to nuclear fuel supply and management.



# UPGRADING, MODERNIZATION AND INVESTMENT

In order to ensure compliance with the enhancing safety standards, Kozloduy NPP units designed according to the requirements of the respective period of their stage-by-stage commissioning were subjected to extensive modernization programs. In the frames of the 2002 outages, a number of

modifications aiming at nuclear safety and radiation protection enhancement have been implemented. All the activities were implemented according to the optimized schedule.

## UPGRADINGS OF UNITS 1&2



In fulfillment of the decision of the Government of the Republic of Bulgaria, Kozloduy NPP Units 1 and 2 were shut down on December 31, 2002. In order to maintain the high level of their operational safety, during 2002 all scheduled activities were accomplished and a major part of the Complex Modernization Program PRG-97A was completed.

## UPGRADINGS AND MODERNIZATIONS OF UNITS 3&4

After the upgrade, the safety systems of the units are brought in full compliance with the current safety regulations and standards. The utilization of

equipment designed and manufactured by leading companies ensures the reliability enhancement of different elements and systems up to the level of





recent vintage nuclear plants.

As a result of the localization system modernization by the installation of a jet vortex condenser, at Units 3 and 4 a reliable functioning was provided of the fourth, last barrier against the spread of radioactive fission products, including the cases of a maximal diameter pipeline break at the Primary Circuit.

New microprocessor systems for improving the safety systems equipment control were implemented. The seismic stability of the buildings, premises and equipment was assured by seismic qualification and by additional anchoring.

The installation of new controllers and new system for steam generators level control provided enhancement of operational reliability and efficiency. New filters and ball-cleaning installations were installed at turbine generators (TG) 5, 6, and 7, which led to the significant increase of the technological cycle effectiveness.

The development of a modern Safety Analysis Report (SAR) is a basis for units licensing by the Nuclear Regulatory Agency.

New Symptom Based Emergency Procedures (SBEP) have been introduced. The SBEP account-

ing in the updated Probabilistic Safety Analysis showed that their implementation reduces the reactor core damage frequency approximately by one grade.

A set of studies and analyses was performed as well in order to test the main equipment and implement measures to ensure its residual lifetime for a minimum of 35-40 years of Units 3 and 4 operation. The analyses results proved the high effectiveness of the implemented modernizations and confirmed that the damage probability of the reactor core and the Primary Circuit main equipment is comparable to the results of the same vintage pressurized water reactors.



## UNITS 5&6 MODERNIZATION

The main objective of Units 5 and 6 Modernization Program is to implement the improvements necessary to meet all international requirements to NPP in terms of safety and reliability, which will lead to units lifetime extension by 15 years.

The implementation of the main scope of measures is contracted to leading European companies united in the European Consortium Kozloduy (ECK), and to the US company Westinghouse.

At the Modernization Program development, it was accounted for the recommendations of the Main Designer and international missions held at the plant and the positive operational experience of other plants with VVER-1000/V-320 reactors. The Program is based on IAEA recommendations described in Safety issues and their ranking for VVER-1000 model 320 NPPs (IAEA-EBP-VVER-05). In this document, the safety issues of VVER-1000

reactors are divided in two main groups – design and operational issues.

Units 5&6 Modernization Program solves these issues and comprises 212 measures, each including one or more issues. The identified measures adequacy towards the list of unresolved safety issues was reviewed by IAEA in 2000. The IAEA expert mission concluded that for all safety issues, the process of their resolving was started and relevant measures are completely or partially implemented, in accordance with Safety issues and their ranking for VVER-1000 model 320 NPPs (IAEA-EBP-VVER-05).

In 2002, the second implementation phase was continued of Units 5&6 Modernization Program. This phase comprises design development, equipment manufacturing and delivery, installation and commissioning of equipment, additional studies





and personnel training.

During 2002, 14 measures of the Program were completed. With their implementation, seven issues were resolved related to the defense-in-depth degradation.

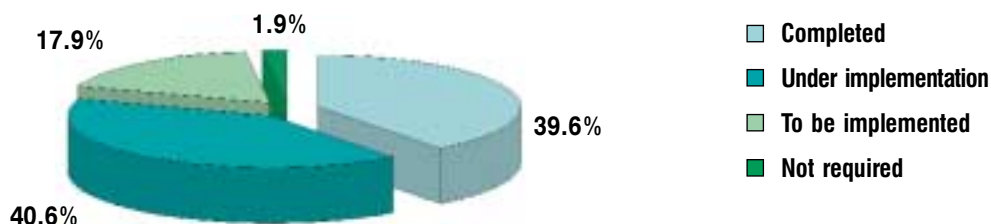
Some of the most important measures of Units 5 and 6 Modernization Program implemented by the Main Contractors are related to the improvement of the containment test procedure; installation of advanced equipment for radiation monitoring; development of methods and techniques for replacement of small diameter pipeline sections; lifetime extension of the Secondary Circuit pipelines operating in two-phase medium. The personnel responsible for operation and maintenance of the newly installed equipment received the necessary training.

A major task is to update the Probabilistic Safety Analysis, Level 1 for Units 5 and 6 which will provide adequate input data for the implementation of the Modernization Program measures.

In 2002, the funds invested in units modernization amount to 62.9 M€, including 37.55 M€ by international credit institutions and 25.35 M€ by Kozloduy NPP own resources.

**The implementation status of Units 5 and 6 Modernization Program by the end of 2002**

Total number	Completed	Under implementation	To be implemented	Not required
212	84	86	38	4
	39.6%	40.6%	17.9%	1.9%



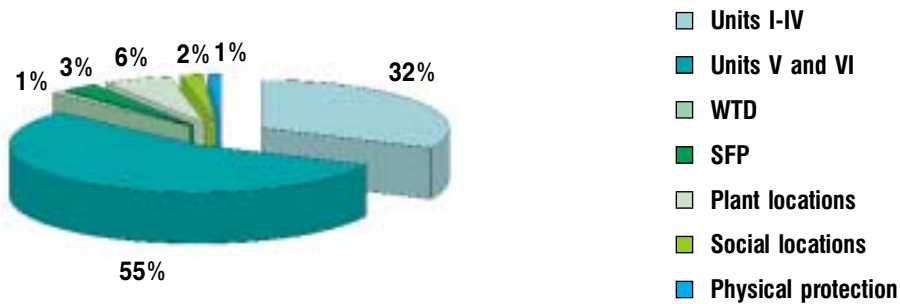
## INVESTMENT PROGRAM IMPLEMENTATION

The implementation of the modernization programs measures was performed in the frames of the "Investment program for 2002", approved by the Council of Directors. The investment expenses, including also plant finances and aid amount to 99 821 000 leva (97% of the planned expenses). 94 645 000 leva own money (106%) and financial

support – 5176 000 leva (40%). The following expenses were realized:

- construction works – 25 984 000 leva
- machinery and installations – 36 451 000 leva
- design and research activities – 37 062 000 leva
- other expenses – 324 000 leva.

### Long term assets



## PREPARATION FOR SAFE DECOMMISSIONING



According to the signed Agreement of November 29, 1999 between the Government of the Republic of Bulgaria and the European Commission on behalf of the European Union, Units 1 and 2 were

shut down on December 31, 2002.

The accumulation of the National Decommissioning Fund continues. A disbursement plan is developed for the purposes of the decommissioning preparation activities during 2003.

At present, two projects are under implementation which are financed by Kozloduy International Decommissioning Support Fund with the EU as a main donor:

- Consultant selection for the Project Management Unit. The consortium formed by BNFL – UK and EDF – France will support Kozloduy NPP in the implementation of seven decommissioning related investment projects.
- Dry Spent Fuel Storage Facility. Under the supervision of the European Bank for Reconstruction and Development, a tender for the construction of a Dry Spent Fuel Storage Facility is held. This facility will enable the safe storage of spent fuel from Units 1 and 2 after the decommissioning.



# TRAINING AND QUALIFICATION

## MODERN TRAINING CONDITIONS

The well trained and qualified personnel assure safe, reliable and effective operation of Kozloduy NPP. The overall training process and the control of personnel qualification are conducted in accordance with the Systematic Approach to Training, which is widely implemented in all nuclear power plants. At the Training Centre all contemporary training forms and methods are applied, such as self-training, classroom training, dynamic video training, computer-based training, on-the-job training, mock-ups and

models training, simulator training, shadow drills, laboratory training and real-life equipment training.



## SIMULATOR TRAINING

A modern simulator training facility is equipped at the plant Training Centre, ensuring adequate training for licensed operational and senior operational personnel as well as the performance of a number of

engineering tasks and analyses. The modern American practice for preparation of licensed operational staff is applied aiming at implementation of Symptom Based Emergency Procedures at





Kozloduy NPP nuclear units. Both simulators are used for verification and validation of these procedures.

At present two simulators, VVER-1000 full-scope simulator (FSS-1000) and VVER-440 multi-functional simulator (MFS-440), are used for training. Current modernization programs are implemented at the simulators aiming to maintain their the conformity with the referent units. During 2002, part of the systems of MFS-440 were upgraded in order to be brought into compliance with the configuration of the referent unit. At present, a project of MFS-440 upgrade to a full-scope simulator is under development.

Simulator training sessions are annually updated based on analysis of events that have occurred in nuclear power plants, training experience feedback, modifications of referent units, the policy and the safety related requirements of the plant management and the regulatory body.

## THEORETICAL AND PRACTICAL TRAINING

Two main forms of training are applied for improving the qualification of plant personnel – theoretical training and practical training. Theoretical training is held in halls and classrooms, equipped with standard and specialized means of training. Practical training is provided in real-life equipment workshops, laboratories and specialized centers. The



existing 18 basic, 40 specialized training courses and 10 handbooks for self-training are continuously upgraded. Kozloduy NPP Training Centre conducts training courses on safety, operation, maintenance and computers.

More than 96 model and 48 individual training programs as well as more than 50 scenarios for simulator sessions have been developed.

During the 2002, the periodical off-the-job training held includes 11 387 training hours with 12 176 trainees, and on-the-job training hours amount to 1 583, with 12 444 trainees.

The work authorization training was provided to 7 548 trainees from external organizations.

# PHYSICAL PROTECTION

The physical protection system of Kozloduy NPP is based on the IAEA requirements and internationally recognized good practices.

The physical protection system aims at measures implementation for protection of nuclear facilities and materials of Kozloduy NPP plc. The main system components are the security guards, who belong to a specialized police unit, the technical security systems and organizational measures for access control, implemented by the physical protection personnel. Organization of the physical protection is set up and applied in compliance with the requirements of all the national and international regulations, as well as the internal plant regulations. Despite the complicated international situation in the year 2002 (the terrorist attacks in the USA and the war in Kosovo), Kozloduy NPP physical protection system continued to function efficiently and no violations of the rules were detected.

The operation and the technical support of security systems are performed according to the approved schedules.

From February 18, 2002 to March 01, 2002 by the invitation of the Bulgarian Nuclear Regulatory Agency, an IAEA IPPAS-Follow-up Mission (International Physical Protection Advisory Service) was held in Bulgaria. The first mission worked at Kozloduy NPP site on February 18-25, 2002 when the mission team comprising experts from Canada, USA, Great Britain, France and IAEA performed a full-scope evaluation of the plant physical protection. The mission objective was to examine the implementation of the recommendations and proposals related to the plant physical protection, which were formulated by the previous mission in 1996.

The Mission Report stated that the experts were



impressed by the efforts to fulfill the recommendations and proposals of the main mission in 1996. It was underlined that a high security culture was observed in the cooperation between Kozloduy NPP and the units of the Ministry of Interior – National Services Police, Border Police and Security.

The experts found that all recommendations of the 1996 mission were met and the implemented measures were assessed as completely satisfactory. Four good practices were identified and recommended for implementation at other nuclear power plants.

In 2002, emergency drills have been performed at Kozloduy NPP in accordance with the Emergency Plan and have shown a high level of preparedness and good interaction between Kozloduy NPP, the regional and national emergency response authorities.

## RADIOACTIVE WASTE TREATMENT AND STORAGE

The radioactive waste management activities are carried out in compliance with the requirements of Vienna Convention on Safety of Spent Nuclear Fuel Management and on Safety of Radioactive Waste Management, the IAEA radioactive waste management principles being applied.

At Kozloduy NPP site, a facility was constructed for



treatment, conditioning and storage of low-level and intermediate-level liquid and solid radioactive waste. This facility is unique in Eastern Europe in terms of purpose and technology.

In 2002, the facility operation was licensed by the State Construction Control Directorate. A program of step-by-step commissioning is under implementation, in compliance with the licensing procedure regulated by the Safe Use of Nuclear Energy Act. The commissioning of this facility gives a long-term

solution of the radwaste reliable storage issue and significantly contributes to the environment protection. The achieved reduction factor of the solid radioactive waste volume is about 7. After commissioning of the solid wastes line of the processing plant, by the end of 2002 were reprocessed 2 793 super compacted drums and some of them were stored in steel reinforced concrete containers.

In 2002 all the newly generated solid radioactive wastes were treated, as well as a certain amount of the radwaste generated in the previous years and stored in Kozloduy NPP storages.

Contaminated liquids are reprocessed by evaporation until obtaining minimal RAW quantities, so that their further storage is most economically and ecologically profitable.

Liquid radioactive wastes are stored in tanks located in the Auxiliary Buildings. All tanks of the liquid radioactive waste systems are constructed using the 'tank in tank' principle. The outside tank is the compartment in which the main trunk is situated and for this purpose it has a liner of stainless steel. Thus the possibility of liquid radioactive waste leakages in the soil is prevented.

As a result of the applied program for radioactive waste minimization, preconditions were created for treatment and conditioning acceleration of the radioactive waste, subject to long-term storage.

# INTERNATIONAL COOPERATION

## PEER REVIEW PROCESS

The involvement of Kozloduy NPP in the international peer review process ongoing in the nuclear industry worldwide started more than a decade ago. The experience exchange, peer expert assessments and technical support provided by this process, significantly contributed to the success of the plant continuous efforts for safety and reliability enhancement.



During 2002 Kozloduy NPP was subject to two reviews.

By the invitation of the Nuclear Regulatory Agency of Bulgaria, from February 18 to March 03, 2002 an IAEA IPPAS Mission (International Physical Protection Advisory Service) was held on the issues related to the plant physical protection. From June 23 to 29, 2002 an IAEA Safety Review Mission on Kozloduy NPP Units 3 and 4 was held by the invitation of the Government of the Republic of Bulgaria. The mission evaluated the overall approach to the plant safety enhancement and the status of Units 3 and 4 safety including design, seismic and operational safety. According to the conclusions the main safety functions were

improved to the level and in some cases above the level of IAEA recommendations that were formulated in TECDOC-640. It was underlined that keeping the safety and quality as a highest priority is the main factor of plant's safety at present and in the future. Another positive evaluation of Kozloduy NPP approach to safety was received at the presentation of the Second National Report of Republic of Bulgaria under the Convention on Nuclear Safety on April 25-26, 2002.

In 2002, Kozloduy NPP continued its active cooperation with the WANO – Moscow Centre, where the plant sent a permanent representative. Kozloduy NPP specialists participated in the WANO international teams conducting peer reviews in Armenian NPP, Khmelniysky NPP (Ukraine), Torness NPP (Great Britain). Papers were presented at a number of WANO seminars and in February 2002 Kozloduy NPP hosted the WANO – Moscow Centre seminar on Strategy and experience in NPP system and equipment maintenance.

Kozloduy NPP participated as well in the IAEA expert mission programs. In 2002 the plant experts took part in the IAEA mission in Armenian NPP, Safety Review Mission in Angra NPP (Brazil) and review of Buser NPP (Iran). In April 2002 the plant hosted an IAEA regional workshop on the Techniques of increasing the efficiency of the walk downs.

## TECHNICAL COOPERATION

The plant participated in a number of regional projects and technical assistance programmes of the IAEA, European Union, US Department of Energy, WANO etc.

During 2002 in the frames of PHARE Nuclear Safety Program of the European Union, Kozloduy NPP started the development of Guidelines for severe accident management.

The international nuclear safety related programs of US Department of Energy and UK Department of Trade and Industry in 2002 enabled Kozloduy NPP cooperation with leading companies in the fields of training, development and implementation of Symptom Based Emergency Procedures, quality assurance system optimization, qualification of eddy current control and modernization of Units 3 and 4 reactor trip systems.

The cooperation with Electricite de France (EDF), which has a 10-year history, was resumed in 2002. The exchange of experience of operation in conditions of transition to liberalized electricity market is carried out in the frames of the current cooperation with the British Energy & NNC International Consulting.

The management of the large scale Units 5 and 6 Modernization Program is supported by an international consultancy team led by the American company PARSONS.

The involvement of Kozloduy NPP specialists in the work of the most significant nuclear industry organizations such as World Nuclear Association, European Nuclear Society and European Nuclear Forum FORATOM, is a good opportunity to follow the industrial and scientific innovations, as well as to present the achievements of the Bulgarian nuclear industry before the international community and European Union institutions.

The results of Units 3 and 4 safety enhancement program as well as their assessment by the IAEA Safety Review Mission'02 were broadly presented by the plant specialists during the plant's visits of Bulgarian and European industrial, diplomatic and political representatives, and at the numerous scientific conferences and seminars held in 2002.



# PUBLIC RELATIONS

The necessity of openness was clearly confirmed in Kozloduy NPP communication policy as a response to the increased public interest to the activities and perspectives of the nuclear plant during 2002.

## INTERNAL COMMUNICATION

The successful internal communication is very important for achieving agreement on all important issues and assuring support of the management initiatives.

A comprehensive PR campaign was developed and implemented in preparation of the plant's personnel for the IAEA Safety Review Mission at Units 3 and 4. The project was nominated by the Bulgarian Public Relations Association and was awarded with a second prize for organization of internal corporate PR campaign.

The main principle of the communications with the company personnel is providing dialogue opportunities.

The improved efficiency of communications with the media and the public, both in the country and abroad, is among the priorities of the plant management.



## COMMUNICATIONS WITH THE MEDIA



An important objective was the efficient communication with the media as one of the key factors of the open public dialogue. The plant continued the practice of comprehensive daily reviews of national and local press and systematic monitoring of the electronic media. During 2002 representatives of all national, regional and local media relied on the cooperation with the Information Centre team in presenting the plant's operation. Regular visitors of Kozloduy NPP were journalists from the Bulgarian

National Television, bTV, NT, TOP-TV, Den, Evrocom; from the Bulgarian National Radio, Darik radio, radio Express; from the newspapers Trud, 24 Hours, Standart, Novinar, Dnevnik, Monitor, Sega, 168 Hours etc.

On May 15, 2002 journalists from leading international agencies such as Reuters, ITAR-TASS, the Russian Information Agency Novosty, Sinhua – China, Associated Press, France Press, the Anadol

Agency, and representatives of the biggest newspapers of Japan, Italy, Russia, Finland visited Kozloduy NPP.

At a working meeting on July 5, 2002, Kozloduy NPP management introduced the representatives of the Balkan Information Pool to the status and perspectives of nuclear energy in Bulgaria.

## INTERNATIONAL INFORMATION EXCHANGE

Kozloduy NPP plc receives daily information from the central office of NucNet – the international agency for news in the nuclear field regarding events and activities. A periodical digest of those events is published on the web page of the plant's Information Centre and in the First Atomic Periodical. The plant sends regularly press releases to the Agency about important events occurring at the plant.

The regular information exchange between NucNet and Kozloduy NPP is of great importance and is an example of good relations.

Reporters from a number of international information agencies in Japan, France, Romania, Germany and other countries showed interest in Kozloduy NPP during the year.



## VISITS TO KOZLODUY NPP

During the year the nuclear power plant was open for visits of Bulgarian and foreign reporters as well as for specialists, citizens and politicians.

Over 1000 visitors had the opportunity to visit Kozloduy NPP. June 15, 2002 was the Day of Open Doors, when more than 330 visitors from all over the country, came to Kozloduy to see the production process and to receive answers to all questions they have.

Students from Sofia, Plovdiv, Varna, Gabrovo, Bulgarian and Libyan students from the Technical University – Sofia, students from many Bulgarian cities as well as from the college in Amberue en Bugee – France were interested in the operation of Bulgarian nuclear power plant.

During the year Kozloduy NPP was visited by the representatives of the Ukrainian Regulatory Body, Regional Inspectorate of Environment – Veliko Tarnovo, Ministry of Environment and Water.

Special plant guests were a group of retired people, who have worked in the energy field.

Simeon Saxe Coburg Gotta, the Prime Minister of the Republic of Bulgaria and the President Georgi Parvanov made official visits to Kozloduy NPP.



“My visit to Kozloduy NPP convinced me that very responsible and qualified specialists and professionals work at the plant! Bulgarian nuclear energy has a future!” wrote the President in the visitor’s book during his visit on April 9, 2002.

“I am extremely impressed by what I saw. The unique plant and the spirit of the people who work here are an honour to every country” said the Prime Minister after his plant tour on January 28, 2002.





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KOZLODUY NPP