

ENVIRONMENTAL IMPACT OF THE NPP KRŠKO

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ABSTRACT

The Ministry of Economic Affairs has for six years now been monitoring the operation of the Krško NPP (NEK) and its impact on the environment. A bulletin titled "NEK - Energy and Environment" is being issued every three months. It contains information on operation of the Krško NPP for the previous three months, a graph of duration of temperature increase of water in the Sava river (delta T) in that period, an assessment of the radiological impact of Krško NPP on the environment through an equivalent dose cumulatively throughout the calendar year, and a short current text related to Krško NPP. The Ministry of Economic Affairs organises a press conference on every issue of the bulletin, as an attempt of introducing this subject to the media and to the public.

This paper contains a review of information given in the NEK bulletin from 1990 to 1995 with a special emphasis on the contribution of the Krško NPP to the artificially caused radiation on the border between the Republic of Croatia and the Republic of Slovenia.

1. INTRODUCTION

The Ministry of Economic Affairs has for six years now been monitoring the operation of the Krško NPP (NEK) and its impact on the environment. A bulletin titled "NEK - Energy and Environment" is being issued every three months. It contains information on operation of the Krško NPP for the previous three months, a graph of duration of temperature increase of water in the Sava river (delta T) in that period, an assessment of the radiological impact of Krško NPP on the environment through an equivalent dose cumulatively throughout the calendar year, and a short current text related to Krško NPP. The Ministry of Economic Affairs organises a press conference on every issue of the bulletin, as an attempt of introducing this subject to the media and to the public.

This paper will contain a review of information given in the NEK bulletin from 1990 to 1995 with a special emphasis on the contribution of the Krško NPP to the artificially caused radiation on the border between the Republic of Croatia and the Republic of Slovenia.

2. CONTENTS OF THE BULLETIN

During the past six years, through which the bulletin has been issued, the contents and the design of the bulletin changed, but the basic data remained the same: a table containing data on the operation of the Krsko NPP, a chart of duration of temperature rise in the Sava river, a short current text related to the Krsko NPP and a radiological impact of the Krsko NPP on the environment. Up to now (July 1996) there have been 24 issues of the "NEK: Energy and Environment" bulletin, and the latest issue (24th) is enclosed to this paper.

2.1. TABLE CONTAINING DATA ON THE OPERATION OF THE KRSKO NPP

The table on the first page of the bulletin shows data per month on the operation of the Krsko nuclear power plant for the period of the past three months. These are:

- netto generated electricity in megawatt/hours (MWh),
- maximum average warming up of the Sava river in kelvins (K),
- emission of radioactive liquids (tritium etc.) in percentages compared to the permitted annual releases,
- contribution to the dose due to emission of radioactive gases in percentages compared to the permitted annual dose,
- number of containers of radioactive waste, with a volume of 208 litres with the newly processed and low-radioactive waste, the total number of those containers and the total number of supercompacted containers with a volume of 864 litres,
- number and duration of outages of the NPP expressed in hours.

Explanations are very important for this table: there is a daily limit for additional warming up of 3 K of the water in the Sava river because of the operation of the Krsko NPP, limits for releases of radioactive liquids and gases from the Krsko NPP, explanation about filling of solid radioactive waste into standard containers with a volume of 208 literes, and some is through a process of supercompacting stored in containers with a volume of 864 litres, and explanation of terms outage as forced (not planned) or planned outage of the NPP. All data are regularly received from the Krsko NPP.

2.2 CHART OF DURATION OF TEMPERATURE RISE OF WATER IN SAVA RIVER

On the bottom of the first page of the bulletin there is a chart of duration of temperature rise of water in Sava. Temperature rise in kelvins from 0 to 3.1 K with an interval of 0.1 K is shown on the horizontal axis. Duration of that rise in days is shown on the vertical axis. The chart shows the distribution of temperature rise of water in Sava river and frequency of occurrence of a certain rise in the period of the past three months. For instance, if a temperature is above 1.4 K for 4 days, it means that an average daily rise of temperature of water in Sava of 1.4 K occurred 4 times in the previous three months.

A short text below the chart contains information on how many days in the observed period of three months the Krsko NPP has been in operation, what were the general hydrological circumstances in that period, what were the minimum, maximum and medium flow of the Sava river at the NPP, and the number of days in that period in which the temperature rise in Sava exceeded 2 K. All data are regularly received from the Krsko NPP.

2.3 TEXT ABOUT THE KRSKO NPP

On top of the second page of the bulletin there is a current text about the Krsko NPP. It covers issues that cannot be found in standard information, or themes that need to be more extensively discussed. In six years of issuing of the bulletin, numerous issues were discussed, among these the following:

- repairs and changing of fuel,
- supercompacting of waste,
- project of replacement of steam generators,
- international assessments and special analyses of safety,
- radiological surveillance,
- successful periods in operation and special accomplishments.

The author of this text is usually a member of the staff in the Krsko NPP and a guest at the press conference organized by the Ministry of Economic Affairs with every new issue of the bulletin.

2.4 RADIOLOGICAL IMPACT

Radiological impact of the Krsko NPP on the environment is presented in a text and two pie-like charts. The first pie presents the total equivalent dose of radiation in Jesenice na Dolenjskem as a part of a permitted dose that a person may receive in one year according to the limit stated in regulations on permitted irradiation of population.

The second pie shows the contribution of Krsko NPP to the total measured artificially induced/caused radiation in Jesenice pri Dolenjskem cumulatively throughout the year. That contribution amounts to a few percents, so it can be said that the radiological impact of the Krsko NPP is practically negligible.

It is stated in the text that this assessment applies only to the equivalent dose that a person would receive through water in the Sava river. However, contribution to the measured equivalent dose on the site Jesenice pri Dolenjskem would be slightly increased if we added an equivalent dose received by a person through the air.

Data for this part of the bulletin are given by the coordinator of the radiological monitoring of the Krsko NPP for the Republic of Croatia.

3. COMPARISON OF CONTRIBUTION OF THE KRSKO NPP TO THE ARTIFICIALLY CAUSED RADIATION 1990 - 1995

Contribution of the Krsko NPP to the artificially caused radiation in Jesenice pri Dolenjskem from 1990 to 1995 amounts to:

YEAR	CONTRIBUTION (% and uSv)	OUTAGE
1990	4 (0.14)	yes
1991	3.6 (0.09)	no
1992	1.6 (0.12)	yes
1993	2.5 (0.17)	yes
1994	3.03 (0.09)	yes
1995	2.8 (0.06)	yes

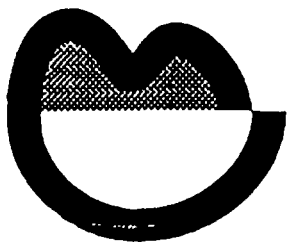
It is clear from the stated facts that there is no rule of rising or falling of the contribution of the Krsko NPP to the artificially caused radiation on the border of the Republic of Croatia and the Republic of Slovenia. An outage in the nuclear power plant is the time when increased amount of controlled emissions of radioactivity is expected/anticipated. The year 1991 is the only one in which there was not an outage in the Krsko NPP in the observed period, and the contribution (in %) of the Krsko NPP to the artificially caused radiation in Jesenice pri Dolenjskem is bigger than in the following observed years. It can be concluded that the cause of the increase or decrease of that contribution is outside the Krsko NPP (such as flow of the river Sava, other sources of radioactivity, excluding natural etc.).

4. CONCLUSION

In the end it can be concluded that the radiological impact of the Krsko NPP on the environment is practically negligible, since the contribution of the Krsko NPP to the total measured artificially caused radiation in Jesenice pri Dolenjskem cumulatively throughout the year amounts only to a few percents (on average, it is 2.9% for the observed period 1990 - 1995).

The significance of issuing the bulletin "NEK: Energy and Environment" is not only in the monitoring of the operation of the Krsko NPP and its impact on the environment, but specially in bringing that subject closer to the media and the public.

ENCLOSURE: "NEK: Energy and Environment", No. 24, July 1996



NEK: energija i okoliš

Bilten o radu NE Krško i njenom utjecaju na okoliš

Broj 24

Drugo tromjesečje 1996. godine

Zagreb, srpanj 1996.

PODACI O RADU NUKLEARNE ELEKTRANE KRŠKO

	travanj 1996	svibanj 1996	lipanj 1996
Proizvedena električna energija (netto) MWh	448 620 MWh	250 752 MWh	-
Maksimalno prosječno zagrijavanje vode Save ¹	1,5 K	1,3 K	-
Ispuštanje radioaktivnih tekućina (% od dopuštenog godišnjeg) ²	tritij 15% ostali 0,04%	tritij 3,5% ostali 0,094%	tritij 3,1% ostali 0,06%
Ispuštanje radioaktivnih plinova - doprinos dozi (% od dopuštene godišnje) ³	8%	2%	0,06%
Radioaktivni otpad: ⁴			
- novoobrađeni srednje i nisko radioaktivni (bačve 208 litara)	21	54	83
- ukupno bačava (208 litara)	1 502	1 556	1 639
- ukupno superkompaktiranih bačava (864 litre)	1 753	1 753	1 753
Broj ispada: ⁵	0		
- trajanje u satima	0	REMONT	REMONT

OBJAŠNJENJA:

¹ Prema Vodnogospodarskom dovoljenju Ministarstva za okolje in prostor br. 355-07-02/93 od 20.02.1996. NE Krško može raditi tako da u 24 sata dodatno zagrije vodu rijeke Save prosječno za 3 K

² Ispuštanje radioaktivnih tekućina iz NE Krško dvojako je ograničeno:

a) ograničenom dopuštenom koncentracijom radioaktivnih tvari u ispuštenim tekućinama u Savi

b) dopuštanjem da se ispuste samo tekućine čija godišnja aktivnost tritija ne premašuje 20 TBq, a aktivnost ostalih radioaktivnih tvari 200 GBq

³ Ispuštanje radioaktivnih plinova dvojako je ograničeno:

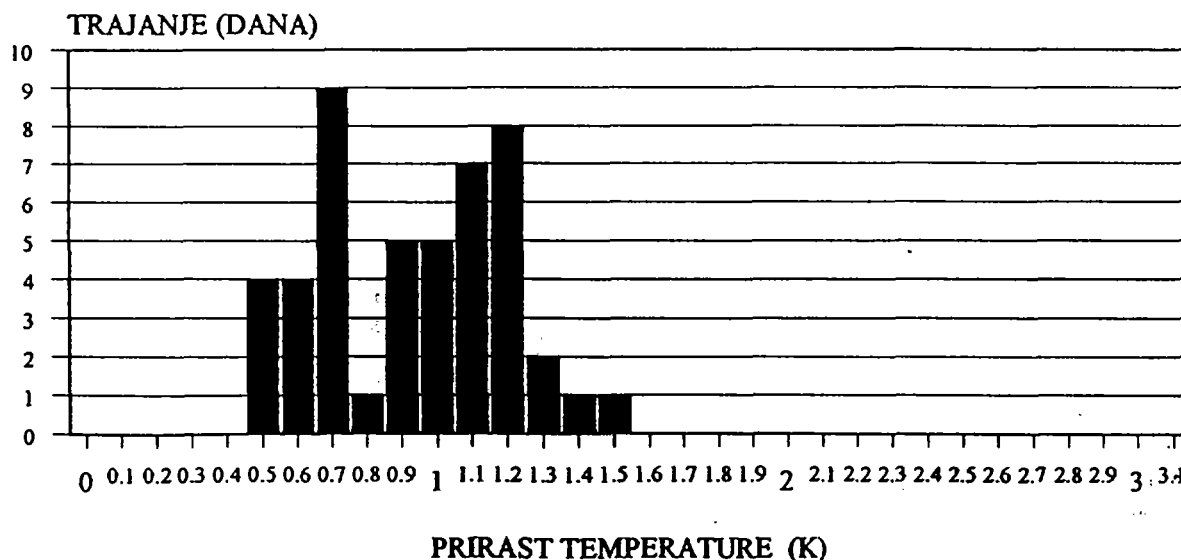
a) ograničenjem koncentracije radioaktivnih tvari u zraku na granici "isključivog područja NE Krško" (500 m od središta zaštitne zgrade)

b) dopuštanjem ukupnom godišnjom efektivnom ekvivalentnom dozom od 50 mikrosiverta što je pojedinac iz okolice NEK smije primiti u godinu dana

⁴ Kruti radioaktivni otpad puni se u standardne bačve volumena 208 litara. Više njih superkompaktiranjem se smješta u bačve volumena 864 litara.

⁵ Prisilni (neplanirani) i planirani prekid rada elektrane i ukupno trajanje u satima

TRAJANJE PRIRASTA TEMPERATURE VODE SAVE



U drugom tromjesečju 1996. godine je Nuklearna elektrana Krško radila 47 dana. Hidrološke prilike bile su u tom razdoblju povoljne. Minimalan protok rijeke Save kod NEK bio je 150 m³/s, maksimalan 522 m³/s, a srednji 309 m³/s. Prirast temperature vode rijeke Save u tom razdoblju nije ni jedan dan bio veći od 2 K. Podaci su dobiveni iz NE Krško.

Sektor za inspeksijski nadzor u Upravi Republike Slovenije za nuklearnu sigurnost (URSJV) u skladu sa svojim ovlaštenjima i postojećim zakonima, pravilnicima, standardima i tehničkim uputama nadzire korisnike nuklearnih objekata od kojih je najveći Nuklearna elektrana Krško. U Sektoru za inspeksijski nadzor URSJV zaposleno je pet djelatnika.

U 1995. godini u NE Krško je provedeno 97 inspeksijskih pregleda nuklearne sigurnosti od čega 81 redovni inspeksijski pregled, 5 izvanrednih inspeksijskih pregleda i 11 inspeksijskih pregleda s ovlaštenim organizacijama u svezi sa zbirnom stručnom ocjenom na kraju remonta u 1995. godini. Redovni inspeksijski pregledi u NE Krško uključivali su aktivnosti od uticaja na nuklearnu sigurnost, radiološki nadzor, održavanje i nadzorna ispitivanja, pripremljenost za djelovanje u slučaju izvanrednog događaja, inženjering i osiguranje kvalitete.

Pri izvođenju inspeksijskih pregleda u NE Krško, Sektor za inspeksijski nadzor URSJV surađuje s Republičkim energetske inspektoratom, Upravom Republike Slovenije za zaštitu i spašavanje, inspektoratom Republike Slovenije za požarnu sigurnost i Zdravstvenim inspektoratom Republike Slovenije. Isto tako postoji i međunarodna suradnja u okviru koje su inspektori iz američke Nuclear Regulatory Commission, iz Belgije i Španjolske, sudjelovali u inspeksijskim pregledima NE Krško. Nalazi inspeksijskih pregleda publiciraju se u godišnjem izvješću o nuklearnoj i radiološkoj sigurnosti Ministarstva za okoliš i prostor Republike Slovenije.

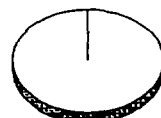
RADIOLOŠKI UTJECAJ

Radiološki utjecaj NE Krško na okoliš i dalje je praktički zanemariv - prema podacima dobivenim od koordinatora radiološkog monitoringa NE Krško za Republiku Hrvatsku dr. Stipe Lulića iz Centra za istraživanje mora-Zavod Zagreb, Instituta "Ruđer Bošković" iz Zagreba. U prvom polugodištu 1996. godine tzv. "najizloženiji pojedinac" (praktički nepostojeći, koji bi tijekom godine trebao popiti 730 litara vode iz Save i pojesti 16 kilograma ribe ulovljene u toj rijeci) primio je 0,82 mikrosiverta zračenja - a to je tek 0,08% od dopuštene doze što je "najizloženiji pojedinac" smije primiti u godinu dana, prema ograničenju (1000 mikrosiverta) iz propisa o dopuštenom ozračivanju pučanstva. Od ukupno izmjerene umjetno prouzročene zračenja u Jesenicama na Dolenjskem, tek je 2,29% posljedica ispuštanja iz NE Krško.

Prema podacima dobivenim od Odjela za zaštitu od zračenja Instituta za medicinska istraživanja i medicinu rada (lokacija Pušća), doprinos izmjerenoj ekvivalentnoj dozi na lokaciji Jesenice na Dolenjskem (kritični put putem vode rijeke Save) bio bi nezamjetno povećan ako bi dodali ekvivalentnu dozu koju bi pojedinac primio putem zraka.

Ekvivalentna doza zračenja u Jesenicama na Dolenjskem

Ukupno
0,82 μ Sv \approx 0,08%



1 000

Doprinos NEK
0,02 μ Sv \approx 2,29%



0,82

Ekvivalentna doza (μ Sv) zračenja za prvo polugodište 1996. godine

U ovom broju biltena "NEK: energija i okoliš" surađivala je gospođa Stanka Bračić iz Ministarstva gospodarstva Republike Hrvatske i gospođa Ljiljana Čepulić iz Instituta "Ruđer Bošković".



NEK: energija i okoliš
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