CROATIAN-HUNGARIAN COOPERATION ON THE DANUBE RIVER RADIACTIVITY MEASUREMENTS

[(1)]S. Lulić and [(2)]P. Vancsura

[(1)] "Ruđer Bošković" Institute, Bijenička 54, 10000 Zagreb, Croatia

[(2)] Environmental Protection Inspectorate, Lower Danube walley Region Bajcsy-Zsilinszky u. 10, H-6500 Baja, Hungary

SUMMARY

Danube river radioactivity measurements on the border profile Mohač-Batina have been performed since the beginning of 1978 with varying frequency of sampling. Thus, in the period before nuclear power plant Paks started to work joint croatian-hungarian sampling at the border profile was taking place four times a year; the obtained results of measured radioactivity levels were used to assess radioactivity background data. From the start of nuclear power plant Paks running until Chernobyl reactor accident (April 1986) sampling was performed six times a year. After the Chernobyl accident, samples have been taken every month. Since decreased Chernobyl reactor accident influence was estimated until present samples have been taken six times a year.

On the Danube river border profile the concentration activity of gamma radionuclides has been determined in water samples (filtered water and suspended matter), and in fish, sediment and Danube river algae samples.

IMPORTANT DATES DURING THE COOPERATION

1975 Foundation of the Subcommission for the Danube river protection against radioactive and thermal pollution (16 meetings held so far).

1978 First Danube river samples collection

1979 Foundation of the Experts to the Subcommission for the Danube river protection against radioactive and thermal pollution (12 meetings held).

1982 Nuclear power plant Paks started operating (the first block of 440 MW_e)

1987 Nuclear power plant Paks ceased operating, four 1 760 MW_e blocks in total

1991 Yugoslav National Army aggression on Croatia

1993 Meetings of Croatian and Hungarian watermanagement experts held in Budapest (2nd to 4th February, 1993) and in Varaždin (20th to 23rd September, 1993) discussed the issues of watermanagement cooperation between the two countries. The following decision was passed: In accordance with the provisions of the Contract on friendship and cooperation between the Republic of Croatia and the Republic of Hungary, concluded on 16th December 1992, until the conclusion of croatian-hungarian agreement on watermanagement issues has been reached, the parties will apply the existing Agreement between the FNR Yugoslavia and NR Hungary concluded on 8th August 1955.

1993 The first Meeting of Croatian-Hungarian subcommission for water quality (11 meetings held so far)

1993 The first Meeting of the experts to the Croatian-Hungarian subcommission for water quality (10 meetings held so far)

SAMPLING PROGRAM and MEASURING (for one sampling)

TABLE 1. Programs of the measurements radioactivity of the Danube River on border profile

Sample	Type of the measurements	Location of the sampling	Number samples
Water **Filtered** **nofiltered**	Total β γ ^{90}Sr ^{3}H	Left bank The middleRight bank	3 1 1 1
Fish **Plant-eating** **Meat-eating**	total β γ ^{90}Sr	Danube	1 1
Sediment	total β γ ^{90}Sr	Left bank Right bank	2 2
Algae	total β γ	Object on bank	1

RESULTS and DISCUSION

All the measurements performed so far express that the concentrations of long-life fission products activity are significantly reduced compared to the period immediately after the Chernobyl reactor accident. In majority of the results, activity concentration has been reduced to practically the value of "0" level an exception is only the case of ^{137}Cs, where the activity concentration measured in a sediment sample exceeds the value of "0" level (Fig.1. to Fig.3.).

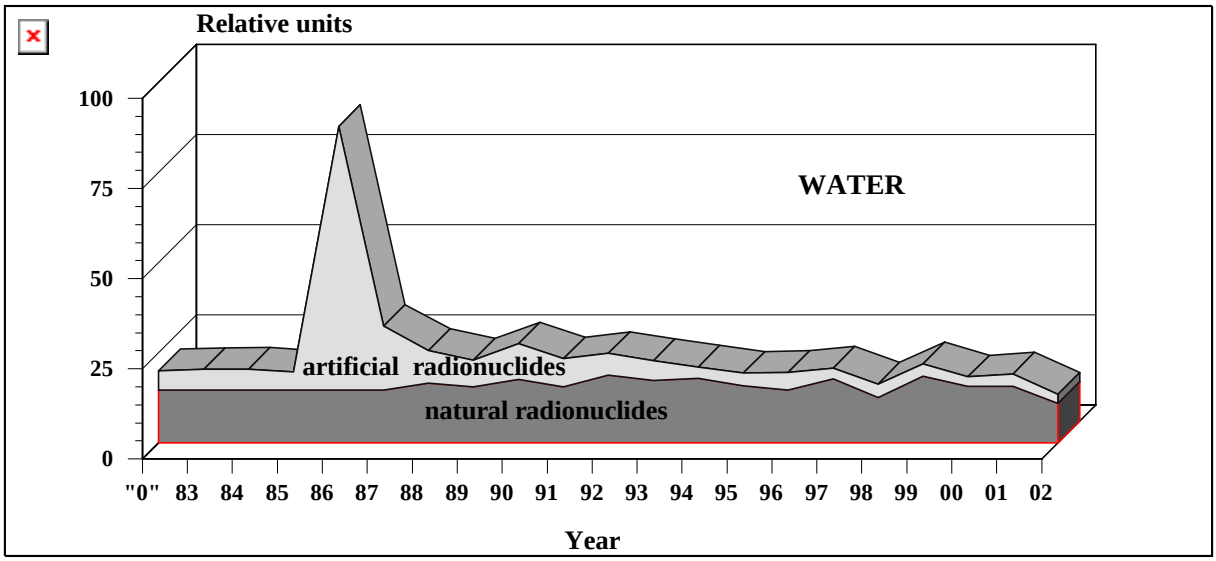

Fig.1. Relationship between artificial and natural radionuclides for water

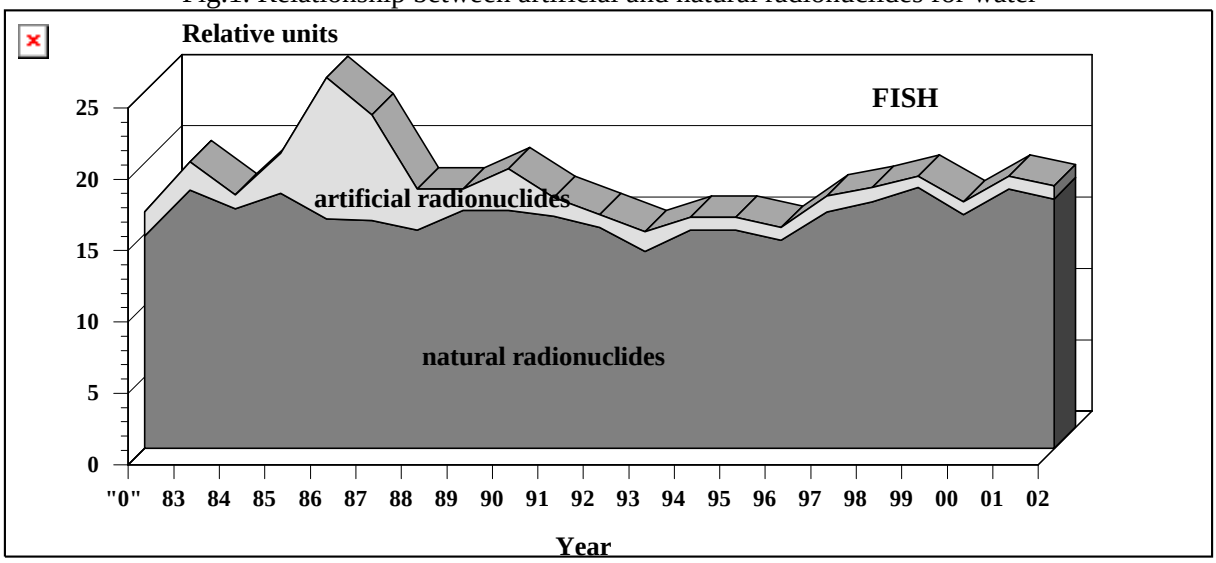

Fig. 2. Relationship between artificial and natural radionuclides for fish

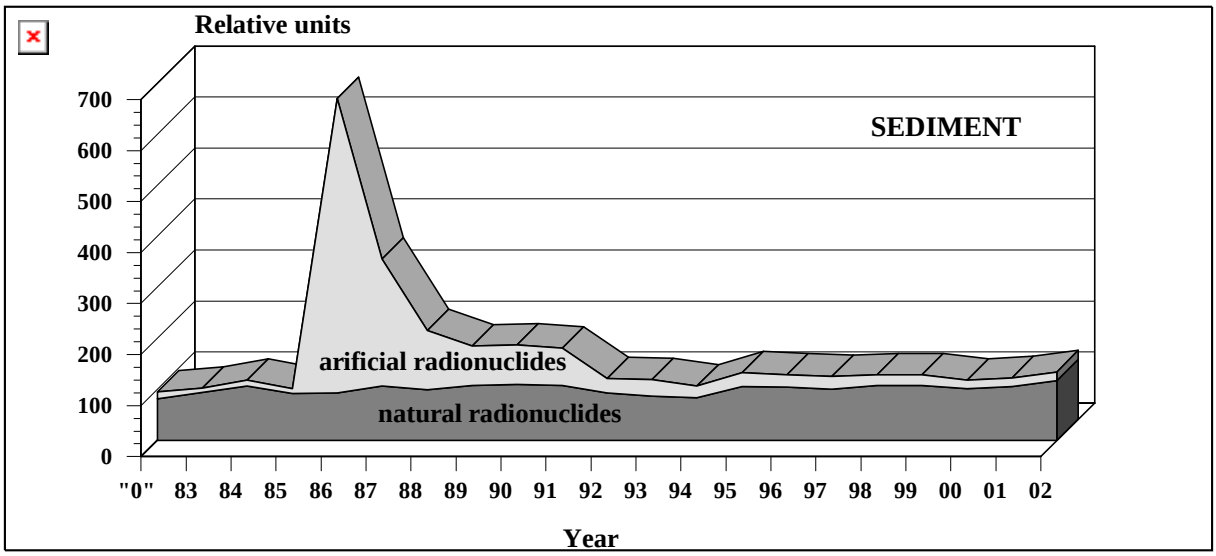

Fig. 3. Relationship between artificial and natural radionuclides for sediment

Irradiation doses for the whole period of measurement of the radioactivity of the river Danube were calculated on the basis of the measurement of the activity of emitted artificial radionuclides and activity of ^{90}Sr and ^{3}H in the samples of the filtered water and measurement of the activity of emitted artificial radionuclides and activity of ^{90}Sr in the fish tissue. During the calculation of the irradiation doses it was assumed that each individual that live in the vicinity the border profile consumed about 880 L of the Danube water and about 39 kg of the Danube fish. Fish consumption had the biggest influence on the irradiation doses, which could be seen from the presented figure. In the time of Chernobyl accident the irradiation doses were the highest (Fig. 4.). After that time, irradiation doses are decreasing and at present time they are much lower compared to the time of the “zero-point state” determination. It should be noted that calculated doses of the “critical” individual were significantly lower than the allowed dose (1 mSv/year).

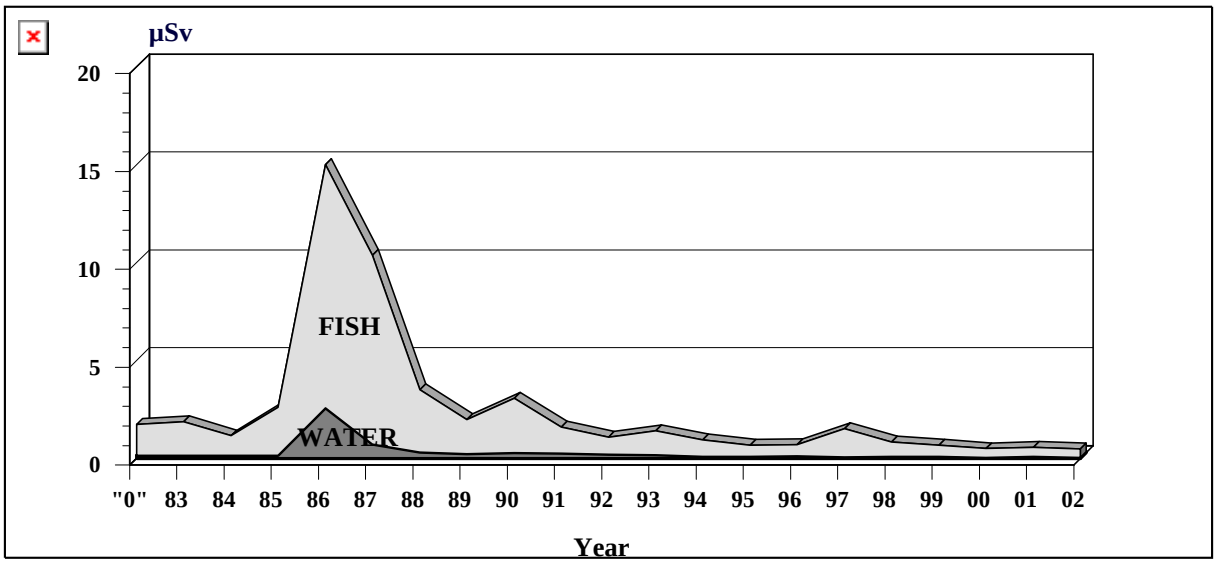

Fig. 4. Annual effective dose, “0” – year 2002 (µSv/year)

CONCLUSION

Based on those results of activity concentrations measurement, particularly concerning the gamma radionuclides, conclusion can be made that no increase in the radioactivity level in the investigated Danube river samples pertaining to the period of Nuclear power plant Paks work has been observed**.**

LITERATURE

1. S. Lulić.: Određivanje radioaktivnosti rijeke Dunav za 1978. do 2002. godine. Zagreb.
2. L. Daroczi and P. Vancsura: Radiológai mérések a Duna határszelvényében. Öszefelolaló az 1993 évi mérési eredményekról. Baja 1994.
3. International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources, Safety Standard No 115**,** IAEA (1997).
4. Pravilnik o granicama izlaganja ionizirajućim zračenjima te o uvjetima izlaganja u posebnim okolnostima I za provedbe intervencija u izvanrednim uvjetima, Narodne Novine RH 108/1999.