

3. European congress of the International Radiation Protection Association. Criteria for radiation protection. Amsterdam, 13-16 May 1975

CEA-CONF--3123

FR7600109

CONSEQUENCES OF THE RELEASE OF CHEMICAL POLLUTANTS  
ON THE TRANSFERS OF RADIOACTIVE PRODUCTS IN AQUATIC SYSTEMS

R. BITTEL

Département de Protection

Association EURATOM-CEA

" Niveaux de Pollution du Milieu Ambiant "

Commissariat à l'Energie Atomique

BP N° 6, 92 260 Fontenay-aux-Roses, France

ABSTRACT

With the increasing rate of industrial activities, aquatic systems undergo, more and more frequently, the accumulation of chemical and radioactive wastes released separately or associated in the same discharge. In this paper an attempt is made to evaluate the consequence of the " association " of pollutants on the transfers of neutron activation radionuclides. In our studies, emphasis is given to heavy metal pollution and complexing agents.

I - INTRODUCTION -

At a time when human activities are rapidly expanding, it is clear that an aquatic ecosystem is likely to receive wastes with different characteristics. As a result, interactions are occurring between pollutants. The effects are complex and difficult to be forecast a priori. In this paper we present a few examples which allow us to assess the consequence of the release of chemicals on the transfers of man made radionuclides in the aquatic food chains and the environment. These studies contribute to forecast the consequences of such waste releases on biological equilibrium conservation and to evaluate human health hazards, as long as man is the final consumer of the trophodynamic chains.

II - EXAMPLES -

2.1. Consequences of contamination of a freshwater fish by an heavy metal ( cadmium ) on the accumulation of a neutron activation product ( zinc 65 )

Biochemical relationships which exist between elements with very closed chemical properties are wellknown in the case of cadmium and zinc. Therefore it's interesting to quantify the consequence of a cadmium water pollution on  $^{65}\text{Zn}$  uptake as long as this neutron activation product is a critical one for hydrobiological chains.

Experiments carried out at the Biology Division of Euratom at Ispra (1) show that pumpkinseed sunfish (Lepomis gibbosus) precontaminated by Cd (treatment one week, Cd concentration in water 0,04 ppm) accumulates <sup>65</sup>Zn in lesser extent compared to the control (tableau I).

## 2.2. Effects of the occurrence of complexing compounds in water -

It is important to stress the incidence of discharges of complexing agents in water as they are part of the commercial formulations of a great number of detergents, for instance, polymetaphosphates, NTA, EDTA. EDTA is particularly used in the nuclear industry as a surface decontaminant. Experiments show that complexing compounds increase the mobility of cationic activation products and decrease, in general, the uptake of radionuclides by aquatic organisms (2 - 3). The fraction absorbed is presumed to be an indicator of the amount of the radionuclide which is uncomplexed in water (tableau II). Results from the CERBOM on Nice suggest the same conclusions into marine chains (4).

## III - DISCUSSION AND CONCLUSION -

The above examples confirm that the behaviour of radionuclides in the aquatic environment is depending upon parameters which are themselves a function of the environmental pollution at large.

At the present time we have an idea of the role of associated pollutants in the accumulation processes; however research has to be carried out to give a deeper view of the long term toxicological effects when different pollutants are associated. Additivity, synergy, antagonism are phenomena which imply further research on metabolic and genetic processes. In any case consequences on ecological species, as much as human health, should be considered.

## REFERENCES -

- [1] MERLINI M. et alii  
Euratom Report EUR 4800 (1972) 1327-1344
- [2] BITTEL R. et alii  
Report CEA R 4157 (Euratom EUR 4628 f) (1971)
- [3] BITTEL R.  
Radioprotection 9 2 (1974) 411-430
- [4] AUBERT M., BITTEL R. et alii  
Rev. Intern. Océanogr. Méd. 33 (1974) 7-29

TABLEAU I - Specific activities of <u>Lepomis gibbosus</u> ( $^{65}\text{Zn}$ ), consequences of a pretreatment with cadmium ( pCi/g )		
	Untreated fish (control)	Pretreated fish with cadmium
Muscle	44 ± 5	5,0 ± 0,5
Skeleton	76 ± 10	7,0 ± 1,0
Blood	46 ± 3	6,0 ± 0,1
Gastrointestinal tract	≈ 250	≈ 50
Scales, skin	≈ 200	≈ 30

TABLEAU II - Consequences of the presence of complexing agents on the transfers of $^{65}\text{Zn}$ and $^{60}\text{Co}$ on <u>Eudiplatcus padanus</u>		
	$^{65}\text{Zn}$	$^{60}\text{Co}$
NTA : 0 ppm	803	3,852
0,5 ppm	159	721
1 ppm	427	278
EDTA : 0 ppm	803	3,852
0,5 ppm	66	558
1 ppm	30	25

