EAN NORM Workshop, *Hasselt, November 2011*

The fate and behaviour of NORM with respect to environmental protection

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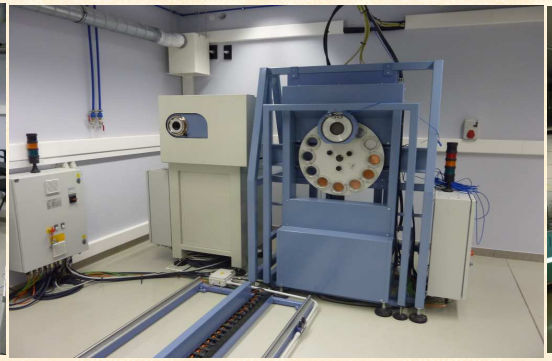
GŁÓWNY INSTYTUT GÓRNICTWA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ICRP vs. protection of environment

„the level of safety required for the protection of all human individuals is thought likely to protect other species, although not necessarily individual members of those species. **The Commission therefore believes that if man is adequately protected then other living things are also likely to be sufficiently protected** „

(ICRP, 1977, § 14).

ICRP vs. protection of environment

„The standard of environmental control needed to protect man to the degree currently thought desirable will ensure that other species

are not put at risk. Occasionally, individual members of non-human species might be harmed, but not to the extent of endangering whole species or creating imbalance between species. **At the present time, the Commission concerns itself with mankind's environment only with regard to the transfer of radionuclides through the environment, since this directly affects the radiological protection of man „**

(ICRP, 1991, § 16).

In 2007 the Commission continues to believe that this is likely to be the case… but

„…also believes that it is necessary to consider a wider range of environmental situations, irrespective of any human connection with them."

(ICRP, 2007)

Trends in legislation

IAEA BSS: Safety Principle 7: **People and the environment, present and future, must be protected against radiation risks**

European Basic Safety Standards:

Chapter I: Subject matter and scope

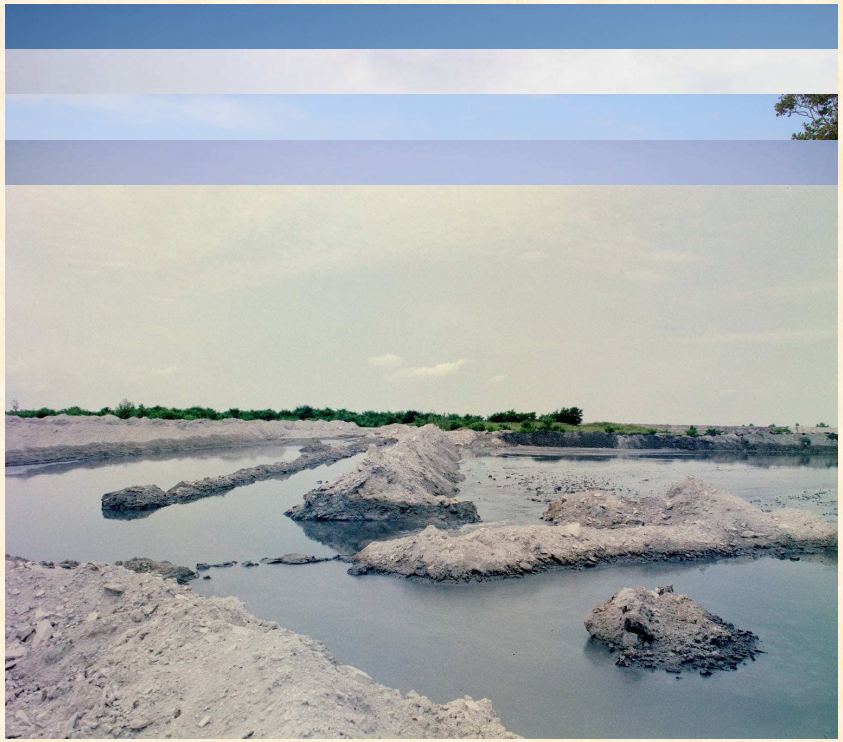
The scope is broadened to include the exposure of space crew to cosmic radiation, domestic exposure to radon gas in indoor air, external exposure to gamma radiation from building materials, and

the protection of the environment beyond environmental pathways leading to human exposure

environmental risk caused by NORM

Features of environmental impact of NORM residues:

physical appearance



source geometry, location and possible dispersion models: typical NORM repositories have the appearance of common waste dumps and tend to have more in common with ordinary industrial waste than with spent nuclear fuel or dispensable radioactive sources;

total amount: NORM residues are usually bulk materials, e.g. phosphogypsum, slag, sediments, sometimes water;

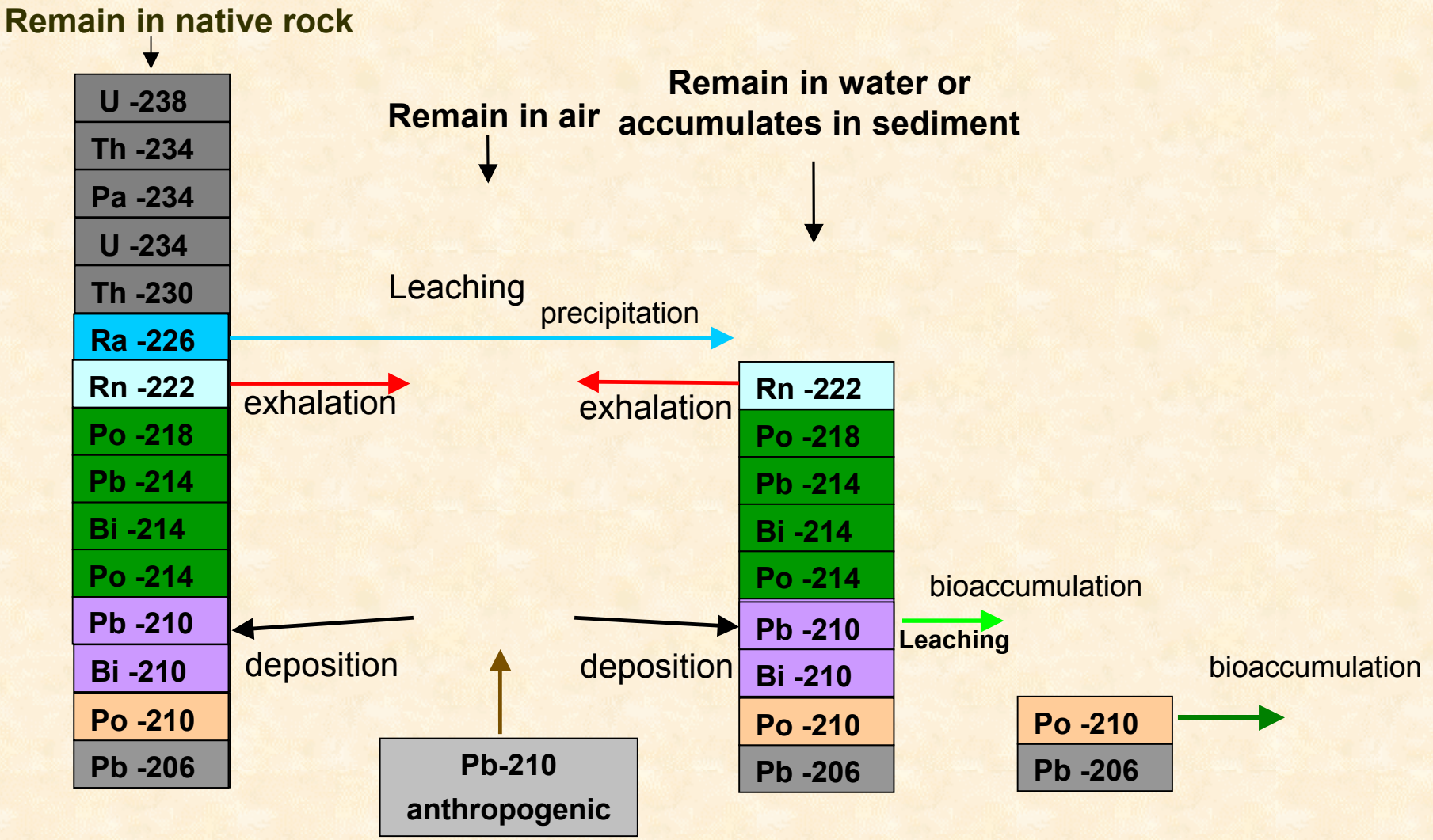
ambient conditions: residues are usually in direct contact with environment, it means that they are exposed to meteorological conditions (water and wind erosion) and unlimited access by biota;

Frequently they are associated with other pollutants as heavy metals, sulphates, hydrocarbons.

Features of environmental impact of NORM residues:

radionuclides fractionation

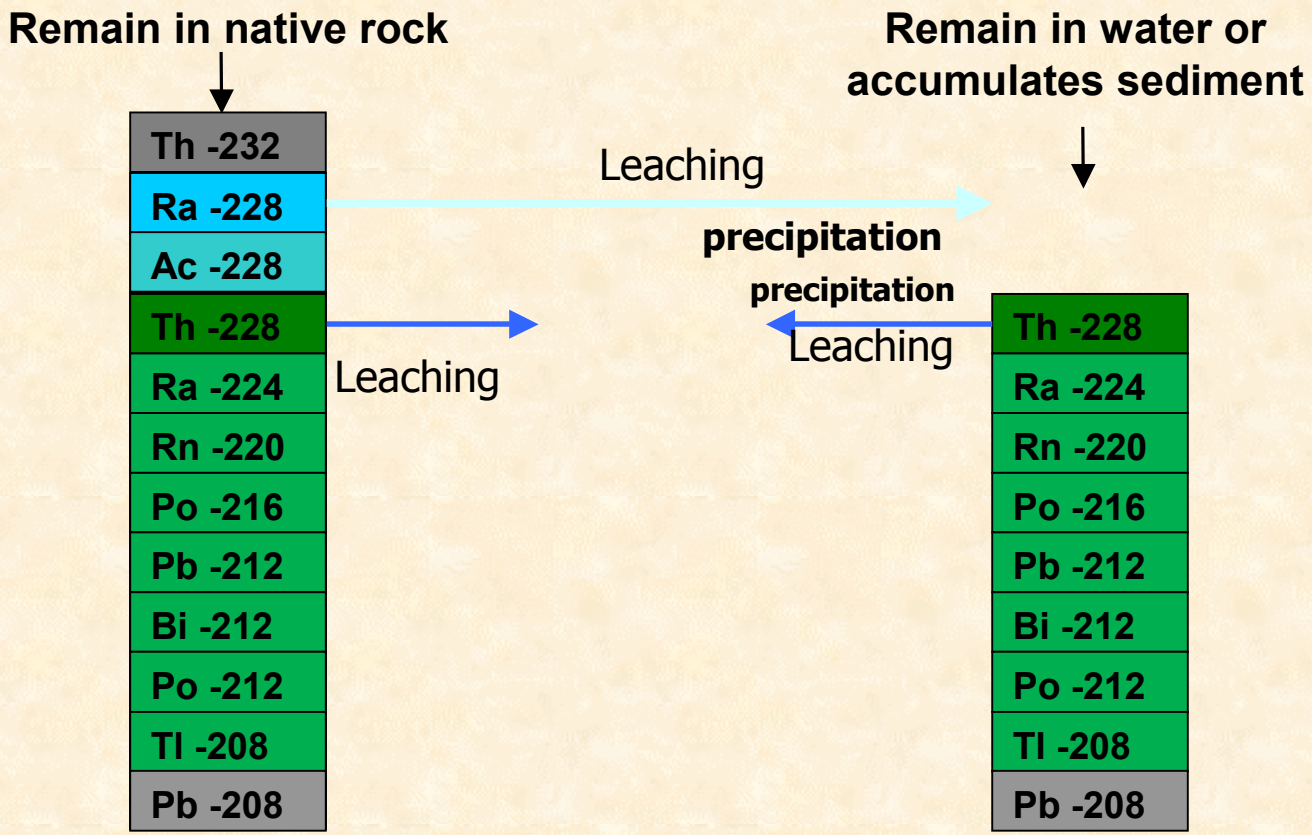
^{238}U decay chain



Features of environmental impact of NORM residues:

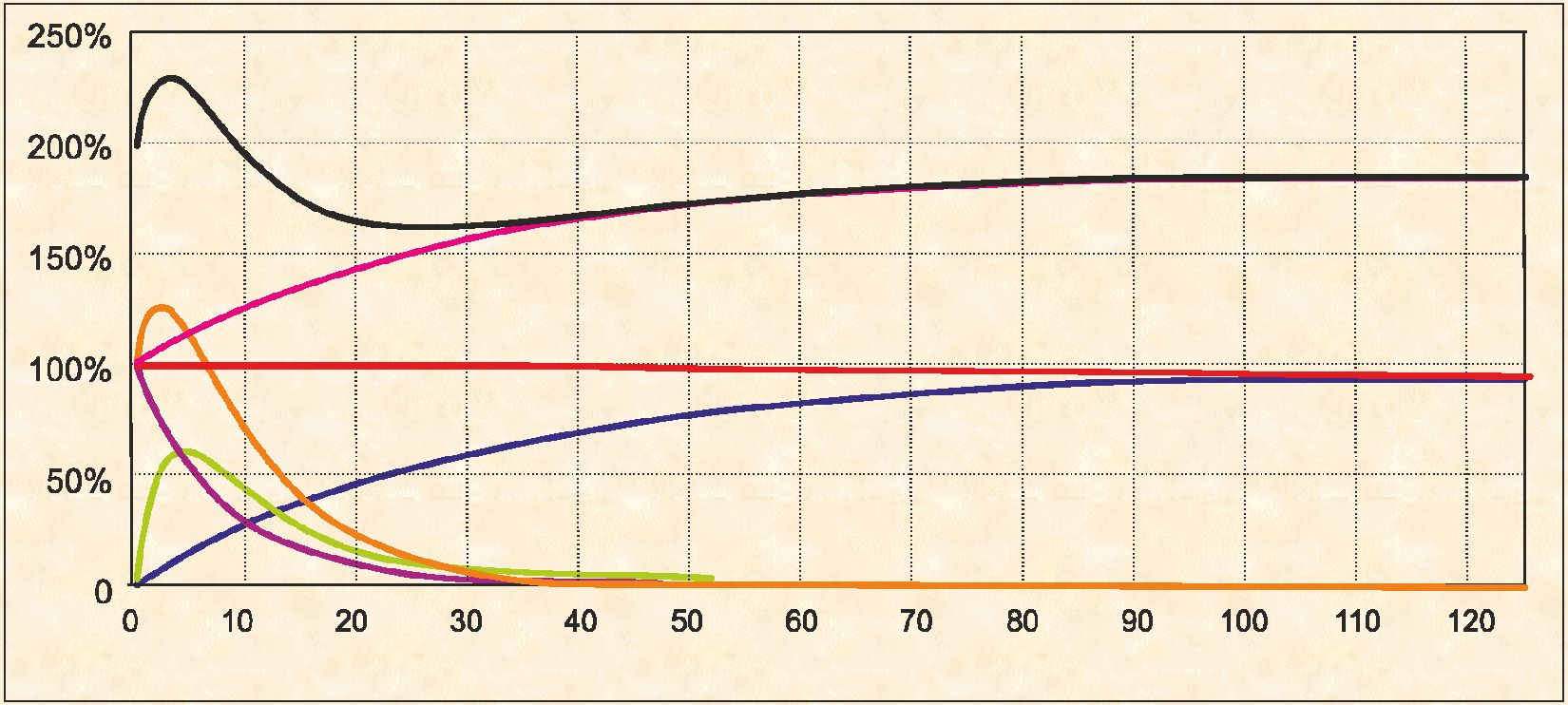
radionuclides fractionation

^{232}Th decay chain



Features of environmental impact of NORM residues:

activity concentration evolution



^{226}Ra + ^{222}Rn *and short lived progeny*

^{228}Ra ^{228}Th *and short lived progeny*

^{210}Pb + ^{210}Bi + ^{210}Po

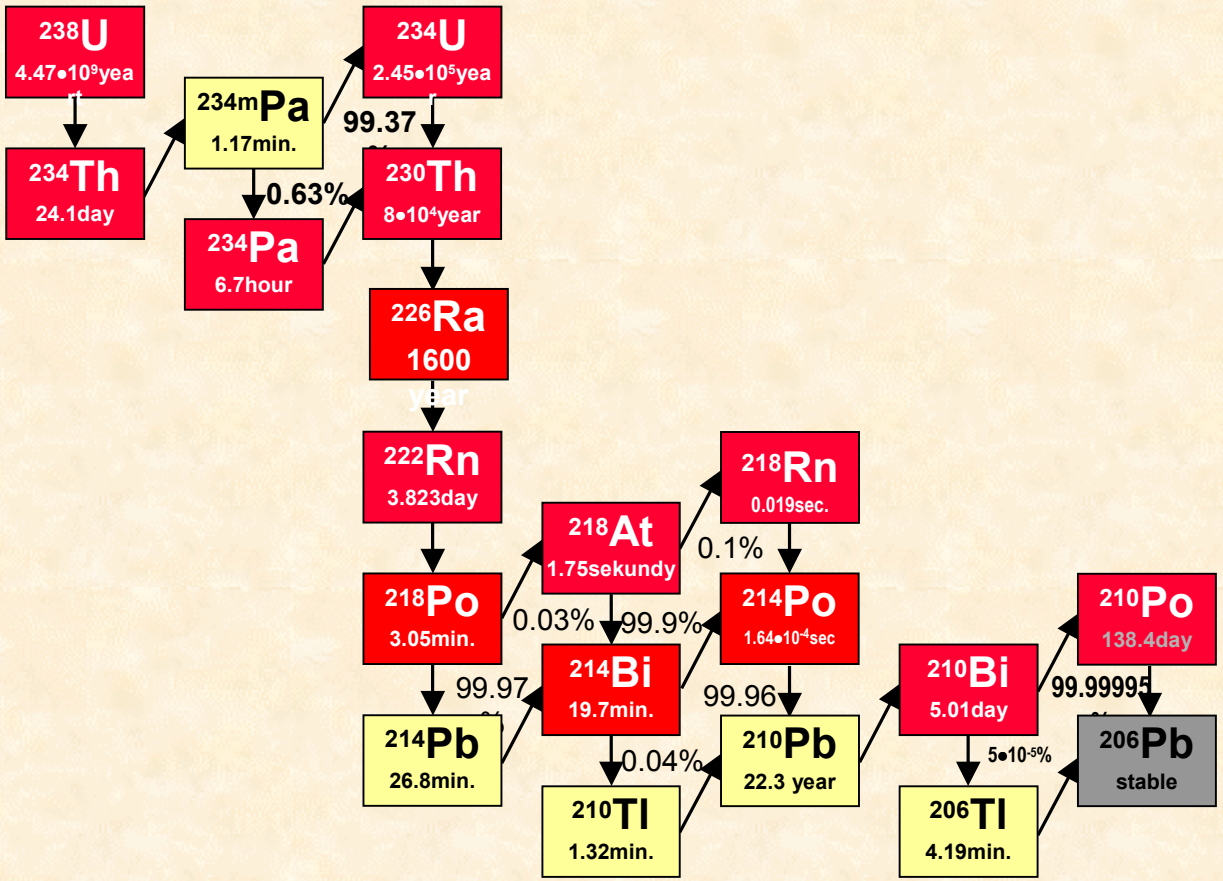
Total ^{228}Ra decay chain

Total ^{226}Ra decay chain

Total natural radionuclides suite

Features of environmental impact of NORM residues:

alpha particles within uranium decay series



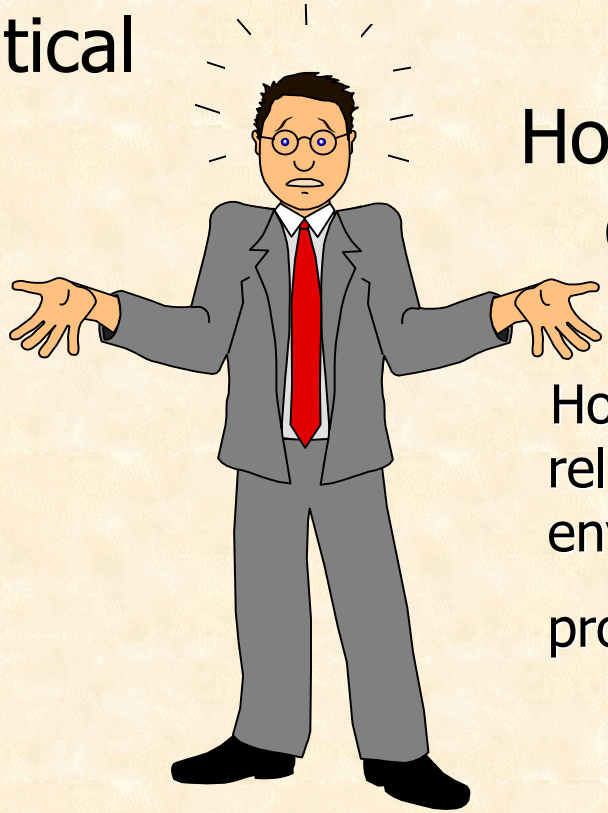
European Basic Safety Standards

- **Article 76**
- **Environmental criteria**

Member States shall include, in their legal framework for radiation protection and in particular within the overall system of human health protection, ***provision for the radiation protection of non-human species in the environment***.

This legal framework shall introduce ***environmental criteria aiming to protect populations of vulnerable or representative non-human species*** in the light of their significance as part of the ecosystem. Where appropriate, types of practices shall be identified for which regulatory control is warranted in order to implement the requirements of this legal framework

How to define the critical effect on the environment ?



How it should be quantified ?

How provide a reliable evidence that environment in well protected?

Occurrence of radionuclides ≠ effect on environment

Knowing natural radionuclides activity concentration in particular compartment of environment is by far too less to assess any environmental effect .....

Environmental effects ????

an reductionistic approach:

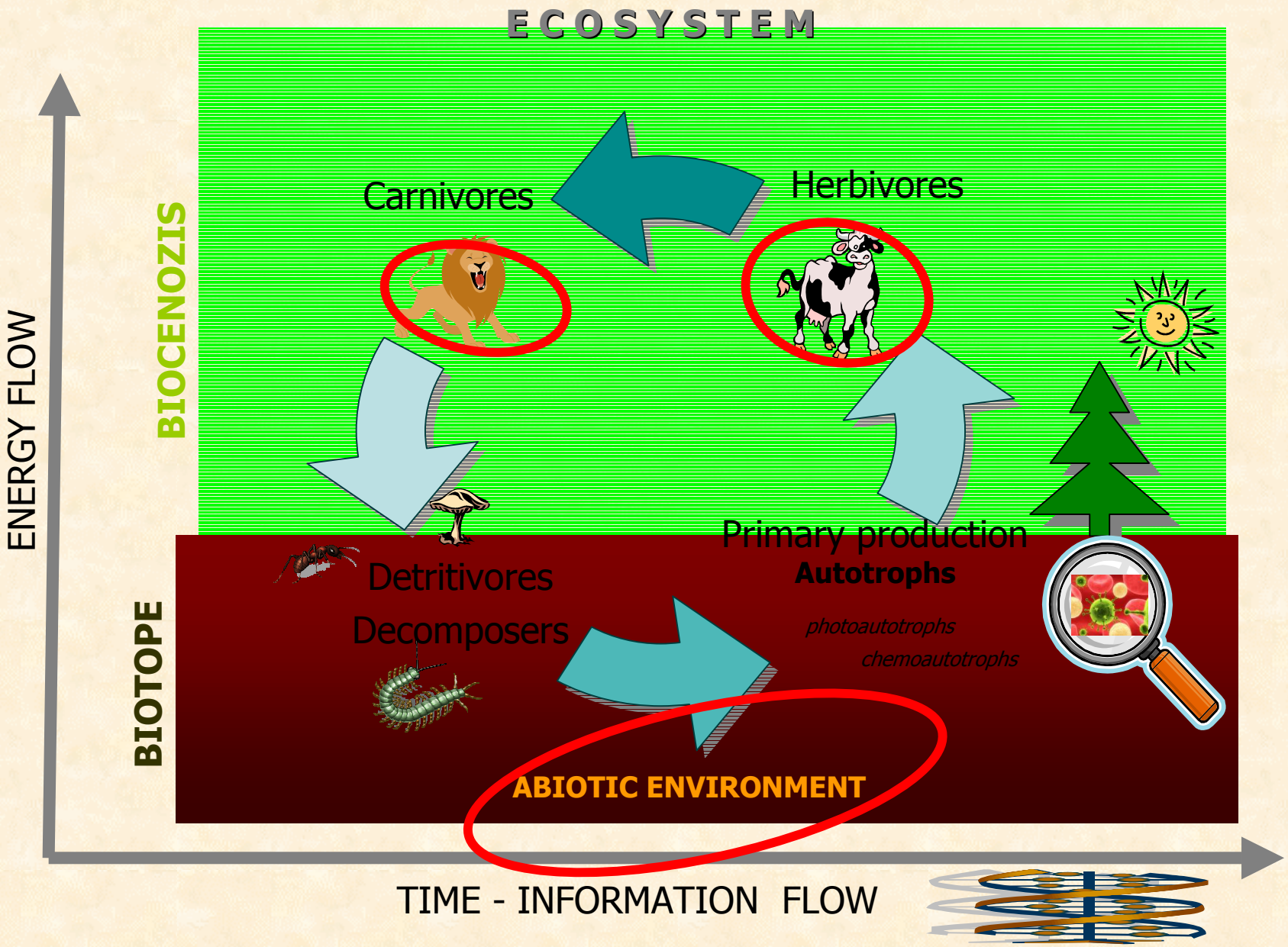
Reflected in the concept of

„reference organism"

- early mortality
- morbidity
- reduced reproductive success

ICRP 2008: Environmental Protection – the Concept and Use of Reference Animals and Plants. ICRP Publication 108

ECOLOGY & EVOLUTION



Effects on biota

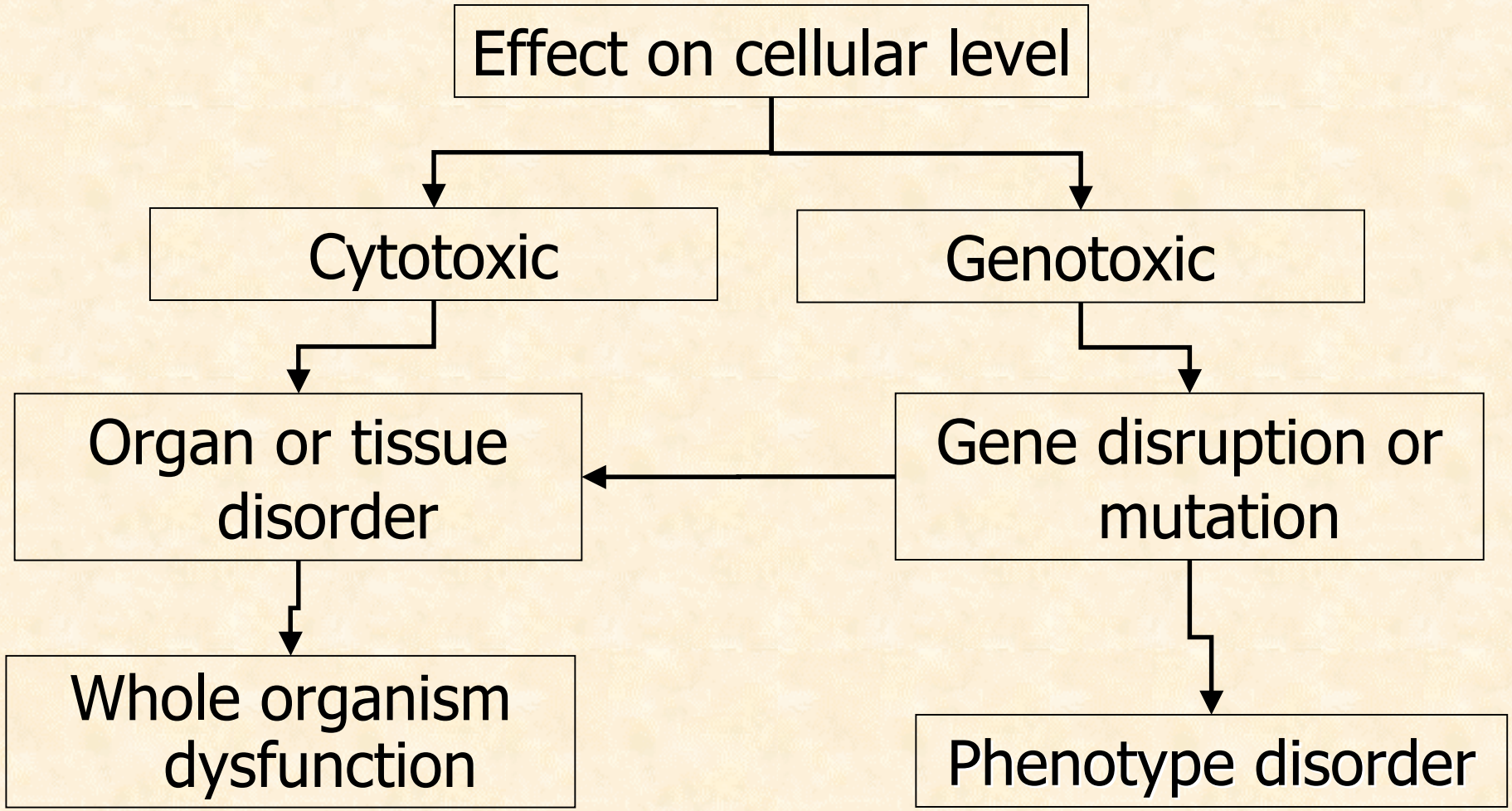
Interaction of contaminants with living matter takes place at the cellular level

Cellular response is:

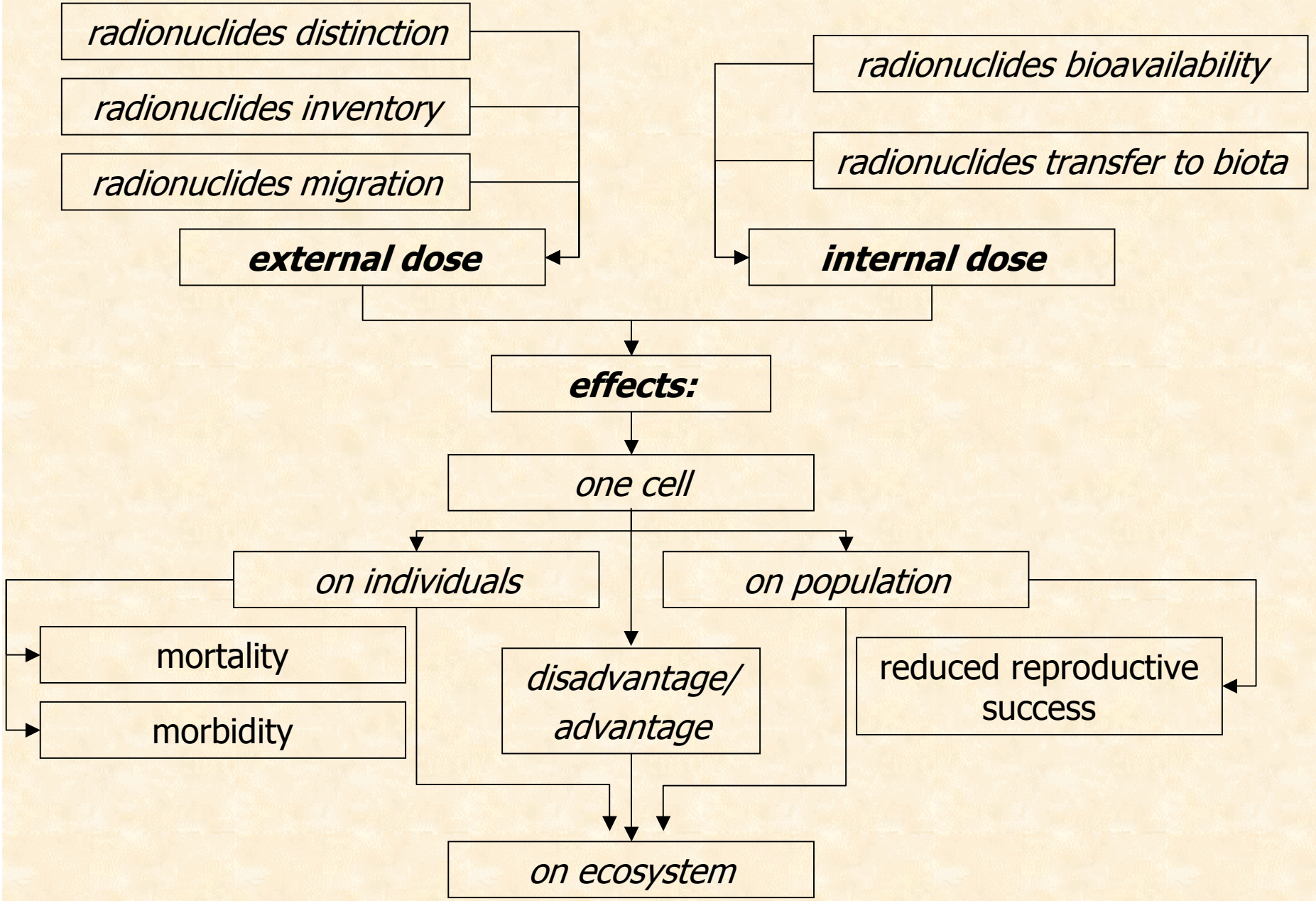
the first manifestation of harmful effects

Genetic test-systems can be applied for an early and reliable displaying of the alterations in ecosystems

What is the expected effect on environment ?



Environment risk assessment procedure



Conclusion

Advantages:

- **The assumption:**

No observed effect at cellular level = no effect on biota at all

Is easy to defended and no one is able to challenge this,

- **Tests of genotoxicity and cytotoxicity when applied widely are justified enough from economic point of view**

Disadvantages:

The presence of other pollutants can blur the results of applied tests

Thank you for your attention

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