

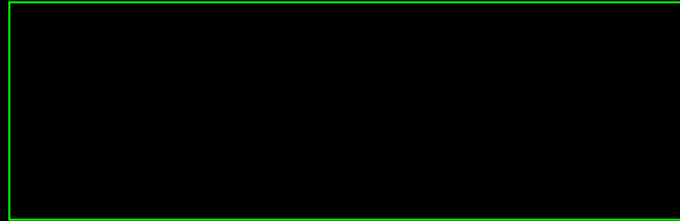
Estimation of risk factor bounded up with water ecosystem pollution

Dr. Fedorova Irina Viktorovna
Hydrology Department

Risk

- Risk –possibility of hazard realization , or expected value of damage due to, for example, pollution of water.
- Risk can NOT be measurement by technical methods
- in a qualitative sense risk is characterized by adverse consequences nature
- in a quantitatively sense risk is characterized by probability of their beginnings

Risk - quantitatively



- in a quantitatively sense risk can be shown:
 - P, P_i – probability of adverse consequences Z, Z_i , that can be put into money (sum damage) or public permissible risk without money dimension.
 - As a public permissible risk can be used MPL (maximum permissible load) of different toxic substances

Risk factor

- Risk factor – has dimension and can be show by:

- $Risk = Exposure * Toxic$

- Exposure – volume of contaminant for one biological target
- Risk management - decision about contaminant using or putting a veto upon it, limitation its production, preparation of special corresponding documentation

Risk factor



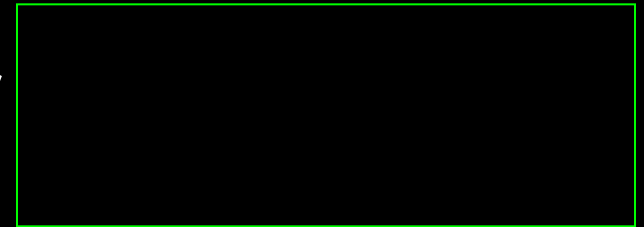
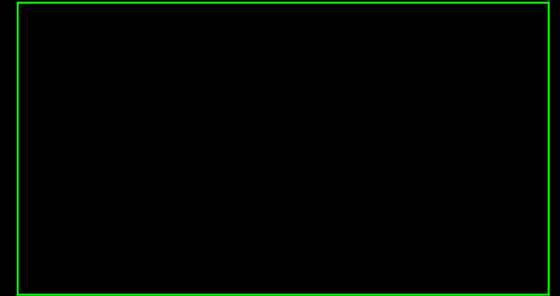
- P_w – characteristic of hydrolyze volume (speed) ($P_w=1$ – for quick type an $P_w=2$ – for slow)
- BA – bioaccumulation factor, corresponds to contaminant bioconcentration B_{cf} in a hydrobiont
- C_f – contaminant concentration in hydrobiont
- C_w – contaminant concentration in water
- R – risk factor
- E – exposition factor, from 04 to $25C_w$
- EF_w – factor of effectiveness impact of contaminant
- E_w – factor of water exposition
- U – method of chemical using ($U=5$ for “close” - indoors and $U=1$ for “open”)
 - $BA=2$ for $B_{cf}<100$;
 - $BA=4$ for $100<B_{cf}<1000$;
 - $BA=8$ for $1000<B_{cf}<10000$;
 - $BA=16$ for $B_{cf}>10000$.

Toxic

- Toxic – potential risk of contaminant, its possibility to damage.
 - for toxic estimation there are some standard tests, for lethal (fatal) dose of 50% fish destruction.
 - In Europe there are 9 tests and three of them - for water:
 - LC50 – during 96 hours – for fish;
 - LC50 – during 48 hours – for water flea;
 - EC50 - inhibition of algea growth
 - LC50 depend on water conductivity and species diversity
 - Sum of tests results – EFw.
 - $R \rightarrow Sy$, $\max R=1$, $\min R=0$ (Isidorov, 1997).
- LC50 for:
 - Cu – 0,02-1,0;
 - Zn – 0,5-5,0;
 - Pb – 0,5-10,0;
 - Cd – 0,5-105,0;
 - Cr – 3,5-118,0;
 - Ni – 5.0-100,0;
 - Fe – 1,4-133,0 mg/l
 - Conclusion about risk by risk factor volume:
 - $Sy \geq 0,55$ – high risk
 - $0,3 \leq Sy < 0,55$ - potential
 - $Sy < 0,3$ –without risk

Your work

- Calculate risk correspond to contaminant “X” in water availability
- Calculate risk correspond to contaminant “Y” in water availability
- Normalized a risk factor (R) by the equation if risk increases account of “X” increasing
- Calculate risk factor for natural water object (LC50 for fish – as was above noticed)



Data. What are the “X” and “Y” contaminant?

| | "X" contaminant | "Y" contaminant |
|--------------------------|----------------------|-----------------------|
| Cw concentration | 30 mkg/l | 50 mkg/l |
| Cw min concentration | 0,1 mkg/l | 10 mkg/l |
| Cw max concentration | 100 mkg/l | 100 mkg/l |
| U method | open | open |
| Pw hydrolize speed | slow | very slow |
| Cf | $Cf = Cw * 20$ times | $Cf = Cw * 100$ times |
| $Bcf = Cf / Cw$ | 20 in 20 times | 100 in 100 times |
| LC50 for fish | 4 mg/l | 2 mg/l |
| LC50 for flea | 50 mkg/l | 40 mkg/l |
| EC50 of algae inhibition | 20 mkg/l | 20 mkg/l |