

## **Effects of WATER Pollution**

### **1. Effects on the health of humans and other organisms**

When any substance that is involved in water rises above a certain level, it has negative effects on humans and all other organisms. These pollutants or situations caused by various human activities rarely have an acute effect. Since the levels are usually sub-lethal concentrations, these effects can sometimes take up to 10-20 years to observe. However, often when these effects reach a measurable size, it is very difficult to rehabilitate the environment or recycle the damages it causes.

Many toxic substances, biological agents (bacteria, viruses, etc.), radioactive compounds and drug/cosmetic residues are like this..

**Acute:** It develops in a short time (from a few hours to 1-2 days).

**Sub-acute:** It's less severe than the acute stage. Effects are observed in a 3-4 day period.

**Chronic:** After a long period of time without any sudden symptoms, the effects begin to be observed.

**Per-acute:** Very strong toxic substances and sudden and severe changes in environmental conditions are observed without symptoms (such as electrical leakage in water).

## **Some of the water-borne diseases**

**Cholera** is a bacterial disease that causes *Vibrio cholera* and can result in death if left untreated. WHO reports that between 20-140 thousand people in the world die of this disease every year.

**Leptospirosis** is a bacterial disease caused by *Leptospira interrogans*. It can be transmitted not only through contaminated water but also through contamination with the urine of the carrier animal.

**Typhoid fever** is a bacterial disease caused by *Salmonella typhi*. also known as enteric fever (enteric pathogens). It is common in areas where drinking water is contaminated by sewage.

## **2. Effects on Natural Sources**

Pollutants that enter water or are discharged directly into the water have negative effects on aquatic organisms first and then on other organisms that feed on these organisms, and on organisms that use aquatic environments for breeding or sheltering at regular intervals.

Aquatic pollution, whether acute or chronic, leads to reduced biodiversity.

As some species become dominant, some become less and often even eliminated from the environment. Such a situation is extremely dangerous for endemic species.

# Major Pollutant Groups



## 1. Heavy Metals

A common definition of heavy metal that are accepted by all scientific community has not yet been made. Some of the definitions made are based on density, atomic number, or atomic weight. However, even in these definitions, a part of heavy metals does not conform to this generalization.

## Heavy Metals

Metal having atomic weight greater than sodium (23) and specific gravity (density)  $> 5\text{gm/cm}^3$  *(Hollemen and Wiverd,1985)*

### On health effects basis

**Essential**  
Cu, Zn, Co,  
Cr, Mn, Fe

**Non essential**  
Ba, Li, Zr

**Less toxic**  
Sn, Al

**Highly toxic**  
Pb, Hg, Cd

*(Mukesh K. Raikwar et al.,2008)*



According to the most commonly used definition for heavy metal: In the periodic ruler, elements with an atomic number greater than 20 and a specific weight greater than 5 g/cm<sup>3</sup> are called heavy metals.

*«heavy metals comprise a block of all the metals in **Groups 3 to 16** that are in **periods 4 and greater**»*

Grup

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

1 <b>H</b> Hydrogen 1.00794	Atomic # Symbol Name Atomic Mass																2 <b>He</b> Helium 4.002602						
3 <b>Li</b> Lithium 6.941	4 <b>Be</b> Beryllium 9.012182	<b>Metals</b> Alkali metals Alkaline earth metals Lanthanoids Actinoids Transition metals Poor metals										<b>Nonmetals</b> Other nonmetals Noble gases			5 <b>B</b> Boron 10.811	6 <b>C</b> Carbon 12.0107	7 <b>N</b> Nitrogen 14.0067	8 <b>O</b> Oxygen 15.9994	9 <b>F</b> Fluorine 18.9984032	10 <b>Ne</b> Neon 20.1797			
11 <b>Na</b> Sodium 22.98976928	12 <b>Mg</b> Magnesium 24.3050																	13 <b>Al</b> Aluminium 26.9815386	14 <b>Si</b> Silicon 28.0855	15 <b>P</b> Phosphorus 30.973762	16 <b>S</b> Sulfur 32.065	17 <b>Cl</b> Chlorine 35.453	18 <b>Ar</b> Argon 39.948
19 <b>K</b> Potassium 39.0983	20 <b>Ca</b> Calcium 40.078	21 <b>Sc</b> Scandium 44.955912	22 <b>Ti</b> Titanium 47.867	23 <b>V</b> Vanadium 50.9415	24 <b>Cr</b> Chromium 51.9961	25 <b>Mn</b> Manganese 54.938045	26 <b>Fe</b> Iron 55.845	27 <b>Co</b> Cobalt 58.933195	28 <b>Ni</b> Nickel 58.6934	29 <b>Cu</b> Copper 63.546	30 <b>Zn</b> Zinc 65.38	31 <b>Ga</b> Gallium 69.723	32 <b>Ge</b> Germanium 72.64	33 <b>As</b> Arsenic 74.92160	34 <b>Se</b> Selenium 78.96	35 <b>Br</b> Bromine 79.904	36 <b>Kr</b> Krypton 83.796						
37 <b>Rb</b> Rubidium 85.4678	38 <b>Sr</b> Strontium 87.62	39 <b>Y</b> Yttrium 88.90585	40 <b>Zr</b> Zirconium 91.224	41 <b>Nb</b> Niobium 92.90638	42 <b>Mo</b> Molybdenum 95.96	43 <b>Tc</b> Technetium (97.9072)	44 <b>Ru</b> Ruthenium 101.07	45 <b>Rh</b> Rhodium 102.90550	46 <b>Pd</b> Palladium 106.42	47 <b>Ag</b> Silver 107.8682	48 <b>Cd</b> Cadmium 112.411	49 <b>In</b> Indium 114.818	50 <b>Sn</b> Tin 118.710	51 <b>Sb</b> Antimony 121.760	52 <b>Te</b> Tellurium 127.60	53 <b>I</b> Iodine 126.90447	54 <b>Xe</b> Xenon 131.293						
55 <b>Cs</b> Caesium 132.9054519	56 <b>Ba</b> Barium 137.327	57-71		72 <b>Hf</b> Hafnium 178.49	73 <b>Ta</b> Tantalum 180.94788	74 <b>W</b> Tungsten 183.84	75 <b>Re</b> Rhenium 186.207	76 <b>Os</b> Osmium 190.23	77 <b>Ir</b> Iridium 192.217	78 <b>Pt</b> Platinum 195.084	79 <b>Au</b> Gold 196.966569	80 <b>Hg</b> Mercury 200.59	81 <b>Tl</b> Thallium 204.3833	82 <b>Pb</b> Lead 207.2	83 <b>Bi</b> Bismuth 208.98040	84 <b>Po</b> Polonium (209.9824)	85 <b>At</b> Astatine (209.9871)	86 <b>Rn</b> Radon (222.0176)					
87 <b>Fr</b> Francium (223)	88 <b>Ra</b> Radium (226)	89-103		104 <b>Rf</b> Rutherfordium (261)	105 <b>Db</b> Dubnium (262)	106 <b>Sg</b> Seaborgium (266)	107 <b>Bh</b> Bohrium (264)	108 <b>Hs</b> Hassium (277)	109 <b>Mt</b> Meitnerium (268)	110 <b>Ds</b> Darmstadtium (271)	111 <b>Rg</b> Roentgenium (272)	112 <b>Uub</b> Ununbium (285)	113 <b>Uut</b> Ununtrium (284)	114 <b>Uuq</b> Ununquadium (289)	115 <b>Uup</b> Ununpentium (288)	116 <b>Uuh</b> Ununhexium (292)	117 <b>Uus</b> Ununseptium	118 <b>Uuo</b> Ununoctium (294)					

Periyot

For elements with no stable isotopes, the mass number of the isotope with the longest half-life is in parentheses.

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57 <b>La</b> Lanthanum 138.90547	58 <b>Ce</b> Cerium 140.118	59 <b>Pr</b> Praseodymium 140.90765	60 <b>Nd</b> Neodymium 144.242	61 <b>Pm</b> Promethium (145)	62 <b>Sm</b> Samarium 150.36	63 <b>Eu</b> Europium 151.964	64 <b>Gd</b> Gadolinium 157.25	65 <b>Tb</b> Terbium 158.92535	66 <b>Dy</b> Dysprosium 162.500	67 <b>Ho</b> Holmium 164.93032	68 <b>Er</b> Erbium 167.259	69 <b>Tm</b> Thulium 168.93421	70 <b>Yb</b> Ytterbium 173.054	71 <b>Lu</b> Lutetium 174.9668
89 <b>Ac</b> Actinium (227)	90 <b>Th</b> Thorium 232.03806	91 <b>Pa</b> Protactinium 231.03688	92 <b>U</b> Uranium 238.02891	93 <b>Np</b> Neptunium (237)	94 <b>Pu</b> Plutonium (244)	95 <b>Am</b> Americium (243)	96 <b>Cm</b> Curium (247)	97 <b>Bk</b> Berkelium (247)	98 <b>Cf</b> Californium (251)	99 <b>Es</b> Einsteinium (252)	100 <b>Fm</b> Fermium (257)	101 <b>Md</b> Mendelevium (258)	102 <b>No</b> Nobelium (259)	103 <b>Lr</b> Lawrencium (262)

Heavy metals are divided into two classes according to their function and amount of presence in organisms:

1- Essential heavy metals: These are elements that have certain functions within the living body, activate an enzyme or catalyze a direct biochemical reaction. These elements include Fe, Cu, Zn, Co, Mn.

2- Non-essential heavy metals: They are elements that have no function defined within the organism and act as toxic even at very low concentrations. These elements include Cd, Pb and Hg.