# Various contaminants, sources of ground contamination and environmental laws



## Ground water usages in US, 1990

2015 =>20% of total water withdrawal (330Bgal/d) (USGS)

| Category | Ground Water Use (Million gallons/day) | Percent of total use supplied by ground water |
|---|---|---|
| Public Water Supply | 15,100 | 39.2 |
| Domestic, self-supplied | 3,260 | 96.2 |
| Commercial, self-supplied | 908 | 38.0 |
| Irrigation | 57,200 | 37.4 |
| Livestock | 1,220 | 54.2 |
| Industrial, self-supplied (fresh) | 3,950 | 20.5 |
| Industrial, self-supplied (saline) | 9.7 | 2.9 |
| Mining (fresh water) | 2,020 | 61.2 |
| Mining (saline water) | 1,210 | 71.5 |
| Power plant cooling | 525 | 2.7 |

Source: Solley, Pierce, and Perlman, 1993.

C.W.Fetter:" Contamination Hydrology", 1994

NGWA(2010)

| | US | JPN |
|---|---|---|
| Irri | 71 | 23 |
| Domes | 23 | 29 |
| Indust | 6 | 48 |

Japan:14% for drinking water,
Denmark: 95%
=> 98% of total (2010: NGWA)

In the world
2 billion people
20% of global water (600-700km$^3$)
(UNDP2000)
NGWA =>980km$^3$ (2010)



## Facts About Global Groundwater Usage compiled by NGWA (The Groundwater Association)

**The 15 nations with the largest estimated annual groundwater extractions (2010)[7] are:**

| Country | Population 2010 (in thousands) | Groundwater extraction | | | |
|---|---|---|---|---|---|
| | | Estimated groundwater extraction 2010 (km$^3$/yr) | Breakdown by sector | | |
| | | | Groundwater extraction for irrigation (%) | Groundwater extraction for domestic use (%) | Groundwater extraction for industry (%) |
| India | 1224614 | 251.00 | 89 | 9 | 2 |
| China | 1341335 | 111.95 | 54 | 20 | 26 |
| United States | 310384 | 111.70 | 71 | 23 | 6 |
| Pakistan | 173593 | 64.82 | 94 | 6 | 0 |
| Iran | 73974 | 63.40 | 87 | 11 | 2 |
| Bangladesh | 148692 | 30.21 | 86 | 13 | 1 |
| Mexico | 113423 | 29.45 | 72 | 22 | 6 |
| Saudi Arabia | 27448 | 24.24 | 92 | 5 | 3 |
| Indonesia | 239871 | 14.93 | 2 | 93 | 5 |
| Turkey | 72752 | 13.22 | 60 | 32 | 8 |
| Russia | 142985 | 11.62 | 3 | 79 | 18 |
| Syria | 20411 | 11.29 | 90 | 5 | 5 |
| Japan | 126536 | 10.94 | 23 | 29 | 48 |
| Thailand | 69122 | 10.74 | 14 | 60 | 26 |
| Italy | 60551 | 10.40 | 67 | 23 | 10 |

7) Margat, J., and J. van der Gun. 2013. *Groundwater around the World.* CRC Press/Balkema.



## Facts About Global Groundwater Usage compiled by NGWA (The Groundwater Association)

**The 15 nations with groundwater having the largest share in total annual freshwater withdrawals, ranked by all water use sectors[8]**

| Country or territory | Groundwater share in total freshwater withdrawal (excluding reservoir losses) | | | |
|---|---|---|---|---|
| | All water use sectors (%) | Irrigation sector (%) | Domestic water sector (%) | Industry sector (%) |
| Bahrain | 100 | 90 | 100 | 100 |
| Barbados | 100 | Not reported | Not reported | Not reported |
| Malta | 100 | 100 | 100 | 100 |
| Montenegro | 100 | Not reported | 100 | Not reported |
| Palestinian Territory | 100 | 61 | 69 | Not reported |
| Oman | 100 | 97 | 100 | 100 |
| Qatar | 100 | 84 | 100 | 0 |
| United Arab Emirates | 100 | 84 | 0 | 0 |
| Denmark | 98 | Not reported | Not reported | Not reported |
| Libya | 98 | 97 | 100 | 100 |
| Croatia | 97 | Not reported | 100 | 100 |
| Iceland | 97 | Not reported | Not reported | Not reported |
| Djibouti | 95 | 95 | 67 | 100 |
| Saudi Arabia | 95 | 94 | 100 | 100 |
| Mongolia | 91 | 83 | 100 | 100 |

7) Margat, J., and J. van der Gun. 2013. *Groundwater around the World.* CRC Press/Balkema.

# Type of ground water contaminants

S4-1

**Table 1.2** => contaminants & examples of use
synthetic organic chemicals(有機化合物)
hydrocarbons（炭化水素）
inorganic cations
inorganic anions
pathogens（病原体）
radionuclides（放射性物質）

**Table 1.3**: Contamination in single hazardous waste site:
about 80 compounds were detected at former organic solvent recycling facility. (有機溶剤)

Cost of analysis: **Table 1.4**
The higher, the lower the detection limit.



# Drinking water standards

**Table 1.5**:
In the US the Safe Drinking Water Act directs
the Environmental Protection Agency (EPA)
to establish
maximum contaminant-level goals (MCLGs);
maximum contaminant-level (MCLs)
for drinking water supplied by public water agencies.

carcinogen: zero
chronically toxic compound:not zero

MCLG: nonenforceable goal set with a ***wide margin of safety***
MCL: enforceable standard, taking account water-treatment technology and cost.
Primary MCL: based on health risk
Secondary MCL: based on aesthetics.



# Risk and drinking water

US EPA uses **risk assessment approach** in required cleanup level for ground water and soil contaminated sites that are under federal supervision, primarily Superfund sites.

Cancer risk levels are expressed in terms of the chance that an individual will develop cancer due to a thirty (30)-years exposure within a seventy (70) years lifetime, assuming two liter (2L) of water from the same source. If one individual out of a million would develop cancer from the exposure alone, the risk is $10^{-6}$. If 100 out of a million, $10^{-4}$.

The official EPA position in determining site remediation is
$10^{-6}$ or less: no cleanup;
$10^{-6}$ - $10^{-4}$:the state officials decide;
over $10^{-4}$: cleanup is mandated.

Big uncertainty??
Safety margins



# Risk assessment

*not average*

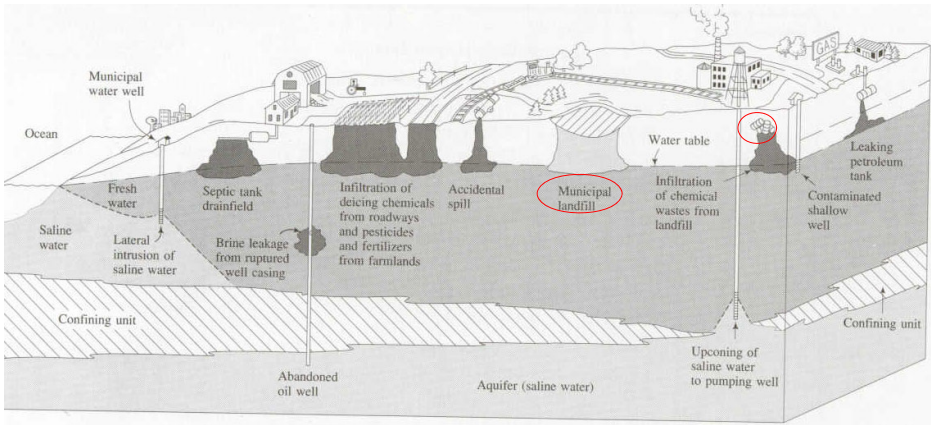
The EPA always uses upper estimates ($95^{th}$ percentile) of the various factors in the risk assessment. ex) use of highest concentration of a chemical found at a site.

The calculated risk is about 100 times grater than it would be if the average values of the risk factors were used.

Very expensive remediation has been driven in low risk site.

Risk of cancer in **chlorinated water**: **Table 1.6**
is compared with those of the other source

# Mechanisms of ground and ground water contamination

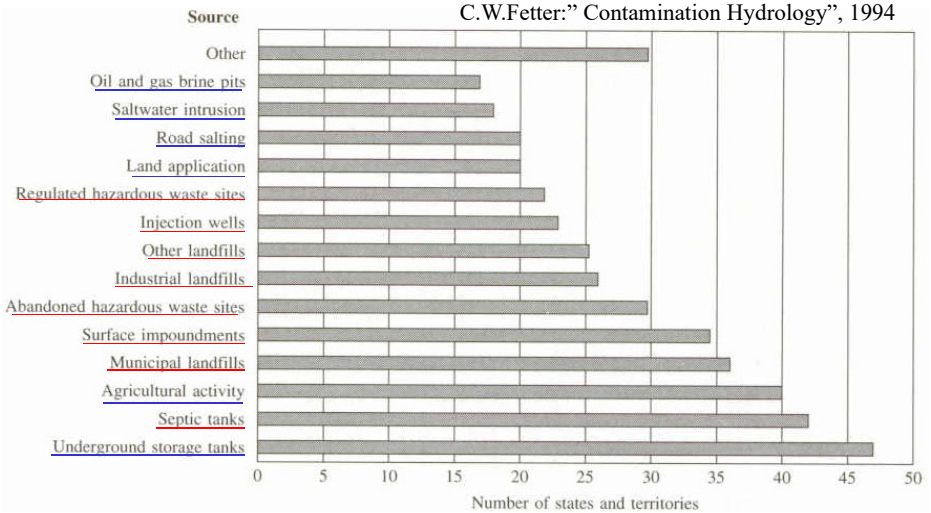



C.W.Fetter:" Contamination Hydrology", 1994



Frequency of various **contamination sources** considered by states and territories in US to be threats to ground water quality

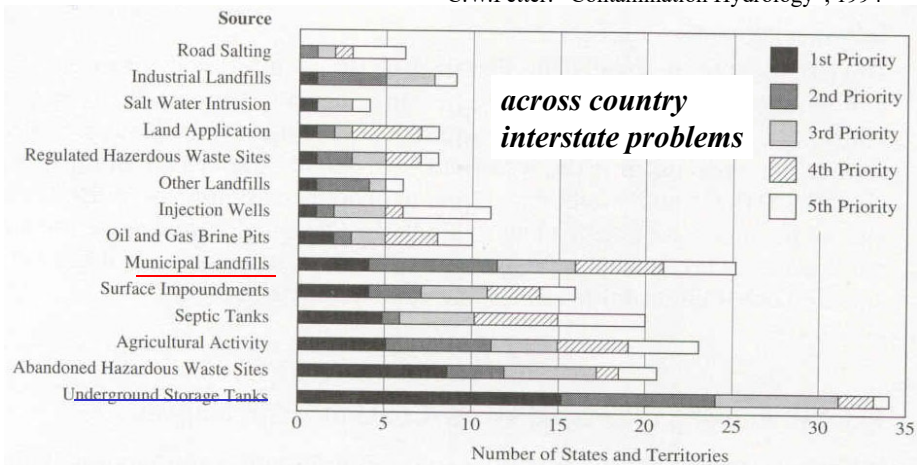
C.W.Fetter:" Contamination Hydrology", 1994






Priority ranking of contamination sources considered by more than 10 states and territories in US to be a major threat to ground water quality

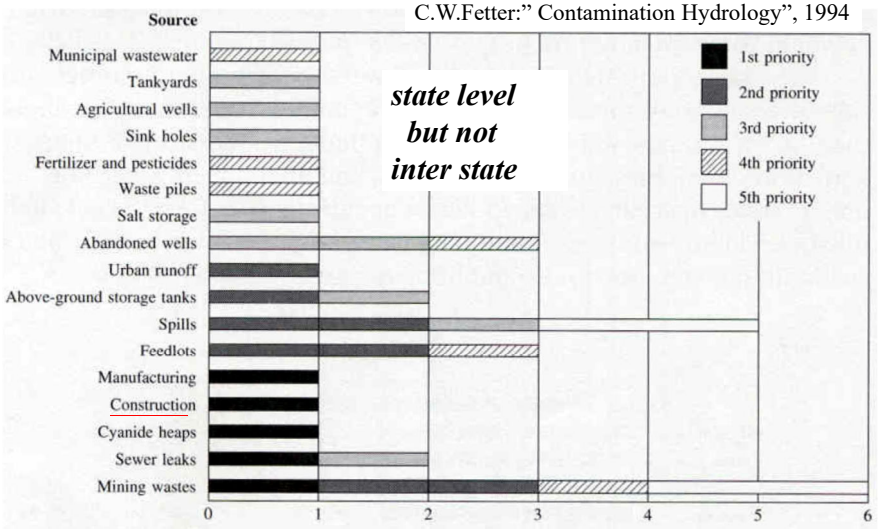
C.W.Fetter:" Contamination Hydrology", 1994





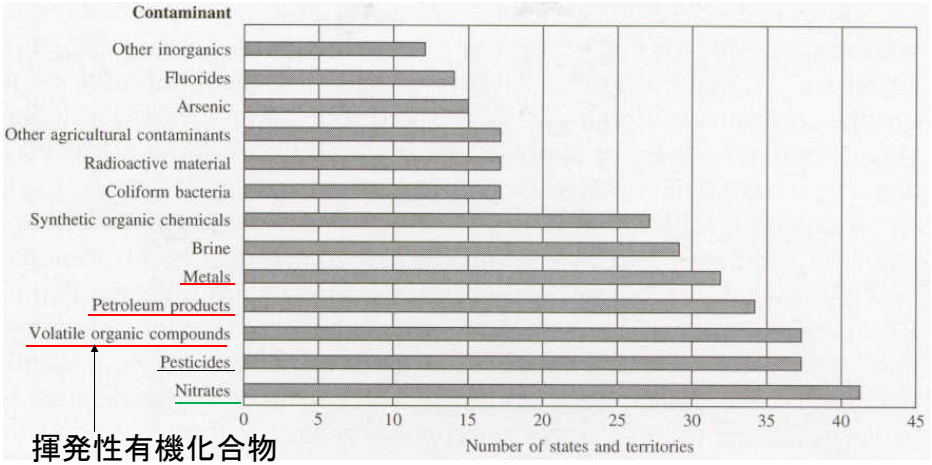

Priority ranking of contamination sources considered by fewer than 10 states and territories in US to be a major threat to ground water quality

C.W.Fetter:" Contamination Hydrology", 1994



Frequency of various **contaminants** considered by states and territories in US to be a major threat to ground water quality

C.W.Fetter:" Contamination Hydrology", 1994




揮発性有機化合物



# Well quality investigation in Japan by Ministry of Environment

Nation wide investigation on quality of water in wells is conducted annually in order to survey the ground water contamination in Japan.

Number of investigated well: **8,327** in 2017.

Three types of survey

***General survey, Near contaminated well, Monitoring survey***
概況調査　　汚染井戸周辺地区調査　　定期モニタリング調査

Investigation chemicals: those listed in

-Environmental Standard for human health　28 chemicals

- Monitored Substances and Guideline Values



# Types well water investigation for Groundwater Surveys

| Name of survey | Purpose of survey | Details of survey (number of wells investigated in 2017) |
|---|---|---|
| Survey of overall conditions | Collection of data about **overall conditions of groundwater quality** | Implementation of measurements at one spot in each block (3,196) =>*177 (5.5%) over ES* |
| Survey of areas adjacent to the contaminated well | Confirmation of **the range of contamination** in the block where new contamination is detected according the results of the survey on overall conditions | Measurement of water quality collected from wells adjacent to the block where new contamination is detected (818)=>*119 (14.5%)* |
| Regular monitoring survey | Collection of data about annual changes in quality of water from **the contaminated well** | Continuous measurement of water quality from the contaminated well (4,313)=>*1,909 (44.3%)* |

http://www.env.go.jp/water/report/h30-03/h30-03_full.pdf



Environmental Standards on Groundwater in Japan

| Chemical | Standard | Remarks |
|---|---|---|
| cadmium カドミウム | 0.01mg/L | |
| cyanide 全シアン | Not detected | |
| lead 鉛 | 0.01mg/L | |
| hexa chromium 六価クロム | 0.05mg/L | |
| arsenic 砒素 | 0.01mg/L | |
| total mercury 総水銀 | 0.0005mg/L | |
| alkyl mercury アルキル水銀 | Not detected | |
| PCB(Polychlorinated Biphenyl) ポリ塩化ビフェニール | Not detected | |
| dichloromethane ジクロロメタン | 0.02mg/L | |
| carbon tetrachloride四塩化炭素 | 0.002mg/L | |
| vinyl chloride 塩化ビニルモノマー | 0.002mg/L | added 2009.11 |
| 1,2-dichloroethane 1,2-ジクロロエタン | 0.004mg/L | |
| 1,1-dichloroethene 1,1-ジクロロエチレン | 0.1mg/L <= 0.02mg/L | revised 2009.11 |
| 1,2-dichloroethene 1,2-ジクロロエチレン | 0.04mg/L | revised 2009.11 |
| 1,1,1-trichloroethane 1,1,1-トリクロロエタン(TCA) | 1mg/L | |
| 1,1,2-trichloroethane 1,1,2-トリクロロエタン | 0.006mg/L | |
| trichloroethene トリクロロエチレン(TCE) | 0.01mg/L | revised 2014 |
| tetrachloroethene テトラクロロエチレン(PCE) | 0.01mg/L | |
| 1,3-dichloropropane 1,3-ジクロロプロペン | 0.002mg/L | |
| thiram チウラム | 0.006mg/L | |
| simazine シマジン | 0.003mg/L | |
| thiobencarb チオベンカルブ | 0.02mg/L | |
| benzene ベンゼン | 0.01mg/L | others |
| selenium セレン | 0.01mg/L | |
| nitric and nitrous nitrogen 硝酸性窒素及び亜硝酸性窒素 | 10mg/L | added 1999 |
| fluorine ふっ素 | 0.8mg/L | added 1999 |
| boron ほう素 | 1mg/L | added 1999 |
| 1,4-dioxane 1,4- ジオキサン | 0.05mg/L | added 2009.11 |

## Results of quality investigation of wells: **general survey invest.** in Japan by Ministry of Environment, 2017

| Chemical | 2017 sample (well) | 2017 detected (well) | 2017 detected ratio(%) | 2017 exceeing (well) | 2017 exceeding ratio(%) | 2016 sample (well) | 2016 exceeing (well) | 2016 exceeding ratio(%) |
|---|---|---|---|---|---|---|---|---|
| cadmium | 2,627 | 26 | 1.0 | 2 | 0.1 | 2,668 | 0 | 0.0 |
| cyanide | 2,450 | 0 | 0 | 0 | 0 | 2,494 | 0 | 0 |
| lead | 2,689 | 114 | 4.2 | 4 | 0.1 | 2,758 | 9 | 0.3 |
| hexa chromium | 2,673 | 2 | 0.1 | 0 | 0 | 2,708 | 0 | 0 |
| arsenic | 2,725 | 328 | 12.0 | 60 | 2.2 | 2,809 | 64 | 2.3 |
| total mercury | 2,619 | 1 | 0.0 | 1 | 0.0 | 2,668 | 0 | 0 |
| alkyl mercury | 774 | 0 | 0 | 0 | 0 | 678 | 0 | 0 |
| PCB | 1,952 | 1 | 0.1 | 0 | 0 | 1,981 | 0 | 0 |
| dichloromethane | 2,723 | 2 | 0.1 | 0 | 0 | 2,751 | 0 | 0 |
| carbon tetrachloride | 2,661 | 9 | 0.3 | 0 | 0 | 2,703 | 0 | 0 |
| vinyl chloride | 2,433 | 14 | 0.6 | 4 | 0.2 | 2,448 | 1 | 0 |
| 1,2-dichloroethane | 2,631 | 3 | 0.1 | 0 | 0 | 2,672 | 0 | 0 |
| 1,1-dichloroethene | 2,625 | 12 | 0.5 | 0 | 0 | 2,663 | 0 | 0 |
| 1,2-dichloroethene | 2,734 | 35 | 1.3 | 1 | 0.0 | 2,769 | 2 | 0.1 |
| 1,1,1-trichloroethane | 2,768 | 18 | 0.7 | 0 | 0 | 2,799 | 0 | 0 |
| 1,1,2-trichloroethane | 2,525 | 4 | 0.2 | 1 | 0 | 2,572 | 1 | 0 |
| trichloroethene | 2,816 | 53 | 1.9 | 5 | 0.2 | 2,849 | 3 | 0.1 |
| tetrachloroethene | 2,812 | 89 | 3.2 | 4 | 0.1 | 2,839 | 2 | 0.1 |
| 1,3-dichloropropane | 2,335 | 1 | 0.0 | 0 | 0 | 2,371 | 0 | 0 |
| thiram | 2,216 | 2 | 0.1 | 0 | 0 | 2,267 | 0 | 0 |
| simazine | 2,213 | 1 | 0.0 | 0 | 0 | 2,264 | 0 | 0 |
| thiobencarb | 2,213 | 1 | 0.0 | 0 | 0 | 2,263 | 0 | 0 |
| benzene | 2,676 | 0 | 0 | 0 | 0 | 2,722 | 0 | 0 |
| selenium | 2,441 | 43 | 1.8 | 0 | 0 | 2,494 | 0 | 0 |
| nitric and nitrous nitrogen | 2,925 | 2,503 | 85.6 | 81 | 2.8 | 2,976 | 107 | 3.6 |
| fluorine | 2,751 | 1,134 | 41.2 | 17 | 0.6 | 2,807 | 16 | 0.6 |
| boron | 2,603 | 910 | 35.0 | 7 | 0.3 | 2,631 | 3 | 0.1 |
| 1,4-dioxane | 2,429 | 5 | 0.2 | 0 | 0 | 2,463 | 0 | 0 |
| Total sample | 3,196 | 2,923 | 90.0 | 177 | 5.5 | 3,278 | 200 | 6.1 |

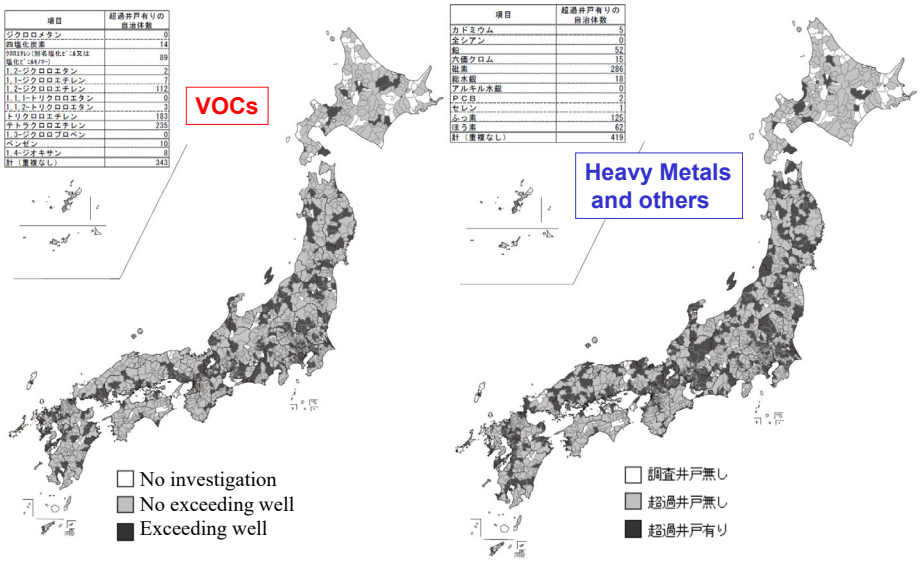


## Results of quality investigation of wells: **monitoring wells** in Japan by Ministry of Environment, 2017

| Chemical | 2017 sample (well) | 2017 detected (well) | 2017 detected ratio(%) | 2017 exceeing (well) | 2017 exceeding ratio(%) | 2016 sample (well) | 2016 exceeing (well) | 2016 exceeding ratio(%) |
|---|---|---|---|---|---|---|---|---|
| cadmium | 42 | 5 | 11.9 | 2 | 4.8 | 42 | 2 | 4.8 |
| cyanide | 52 | 0 | 0 | 0 | 0 | 59 | 0 | 0 |
| lead | 162 | 44 | 27.2 | 12 | 7.4 | 173 | 17 | 9.8 |
| hexa chromium | 128 | 42 | 32.8 | 22 | 17.2 | 136 | 26 | 19.1 |
| arsenic | 632 | 490 | 77.5 | 380 | 60.1 | 613 | 358 | 58.4 |
| total mercury | 91 | 23 | 25.3 | 19 | 20.9 | 103 | 19 | 18.4 |
| alkyl mercury | 29 | 0 | 0 | 0 | 0 | 19 | 0 | 0 |
| PCB | 20 | 2 | 10.0 | 2 | 10.0 | 17 | 2 | 11.8 |
| dichloromethane | 357 | 1 | 0.3 | 0 | 0 | 350 | 0 | 0 |
| carbon tetrachloride | 497 | 27 | 5.4 | 16 | 3.2 | 471 | 14 | 3 |
| vinyl chloride | 1,355 | 161 | 11.9 | 92 | 6.8 | 1,344 | 87 | 6.5 |
| 1,2-dichloroethane | 514 | 12 | 2.3 | 0 | 0 | 510 | 0 | 0 |
| 1,1-dichloroethene | 1,549 | 80 | 5.2 | 4 | 0.3 | 1,583 | 5 | 0.3 |
| 1,2-dichloroethene | 1,632 | 452 | 27.7 | 115 | 7 | 1,673 | 120 | 7.2 |
| 1,1,1-trichloroethane | 1,051 | 79 | 7.7 | 0 | 0 | 1,051 | 0 | 0 |
| 1,1,2-trichloroethane | 500 | 7 | 1.4 | 0 | 0 | 484 | 1 | 0.2 |
| trichloroethene | 1,800 | 617 | 34.4 | 224 | 12.4 | 1,833 | 240 | 13.1 |
| tetrachloroethene | 1,737 | 878 | 50.5 | 346 | 19.9 | 1,774 | 360 | 20.3 |
| 1,3-dichloropropane | 191 | 0 | 0 | 0 | 0 | 197 | 0 | 0 |
| thiram | 29 | 0 | 0 | 0 | 0 | 34 | 0 | 0 |
| simazine | 29 | 0 | 0 | 0 | 0 | 34 | 0 | 0 |
| thiobencarb | 29 | 0 | 0 | 0 | 0 | 34 | 0 | 0 |
| benzene | 280 | 9 | 3.2 | 5 | 1.8 | 290 | 5 | 1.7 |
| selenium | 44 | 4 | 9.1 | 1 | 2.3 | 49 | 0 | 0 |
| nitric and nitrous nitrogen | 1,649 | 1,607 | 97.5 | 683 | 41.4 | 1,613 | 654 | 40.5 |
| fluorine | 420 | 321 | 76.4 | 179 | 42.6 | 413 | 176 | 42.6 |
| boron | 172 | 129 | 75.0 | 44 | 25.6 | 177 | 40 | 22.6 |
| 1,4-dioxane | 108 | 10 | 9.3 | 4 | 3.7 | 109 | 5 | 4.6 |
| Total sample | 4,372 | 3,675 | 85.2 | 1,909 | 44.3 | 4,372 | 1,888 | 43.2 |



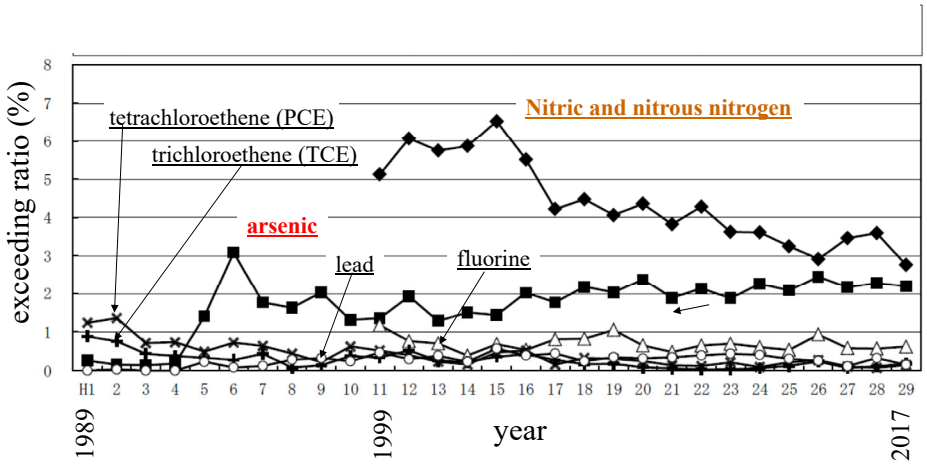
## Results of quality investigation of wells in Japan done, '13-17




http://www.env.go.jp/water/report/h30-03/h30-03_full.pdf

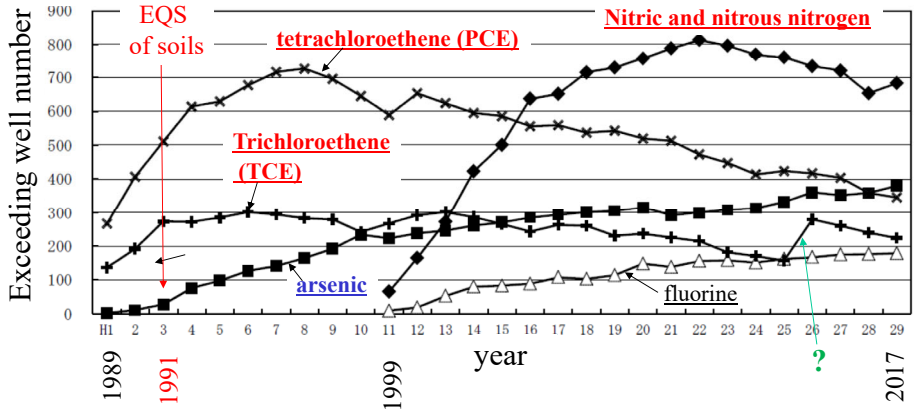


## Chronological variation of exceeding ratio : General survey investigation




http://www.env.go.jp/water/report/h30-03/h30-03_full.pdf

# Chronological variation of exceeding well number found in monitoring well quality investigation




http://www.env.go.jp/water/report/h30-03/h30-03_full.pdf



Soils

# Estimation of soil contaminated sites in Japan

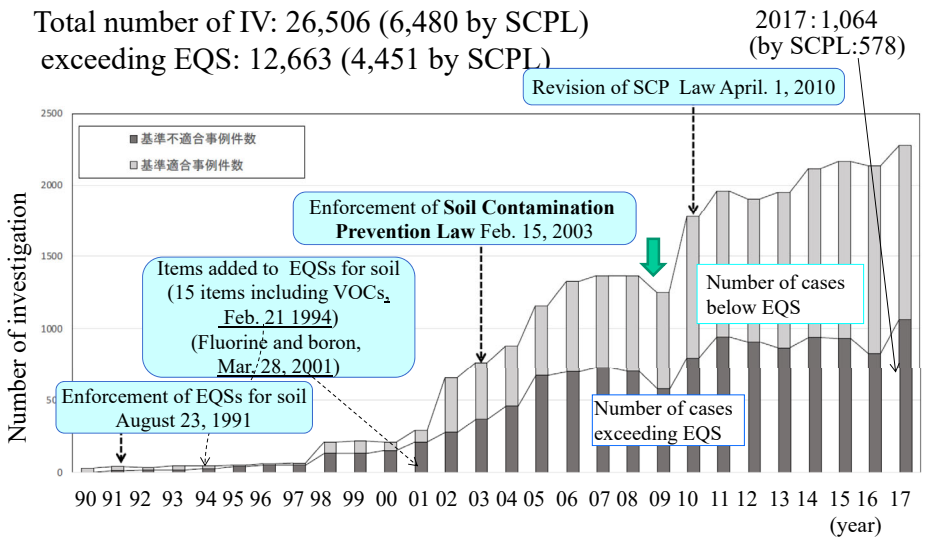
Geo-environmental Protection Center
土壌環境センター （April, 2000）

- Possible sites：manufacturer:646,000、non-manufacturer:282,000; 928,000sites in total
- Total cost of investigation: 2.3T yen
- Possible contaminants:
  226,000sites: Volatile Organic Compounds (VOCs)
  83,000sites: Heavy Metals (HMs)
- Total cost of remediation:11T yen
- Current market on cleanup business:
  70.0～80.0 B yen



## Number of soil contamination cases identified in Japan

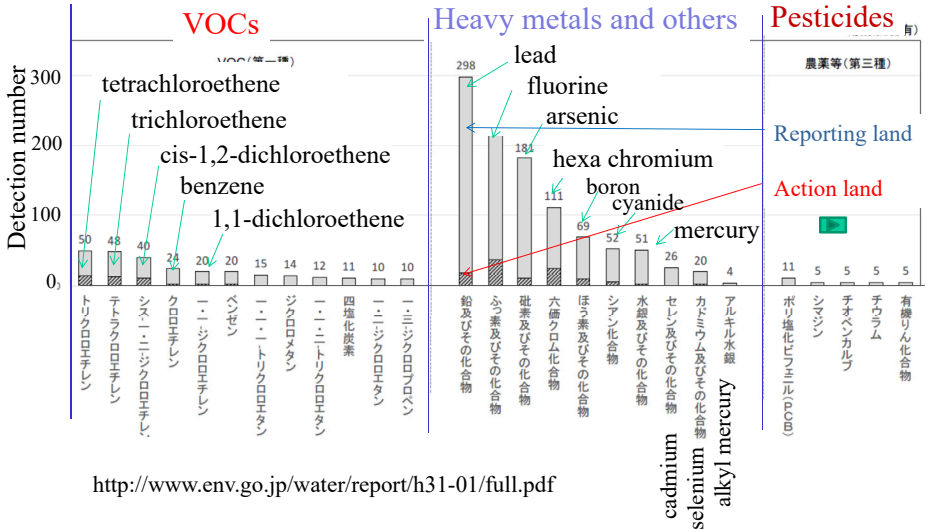
Total number of IV: 26,506 (6,480 by SCPL)
exceeding EQS: 12,663 (4,451 by SCPL)




http://www.env.go.jp/water/report/h31-01/full.pdf

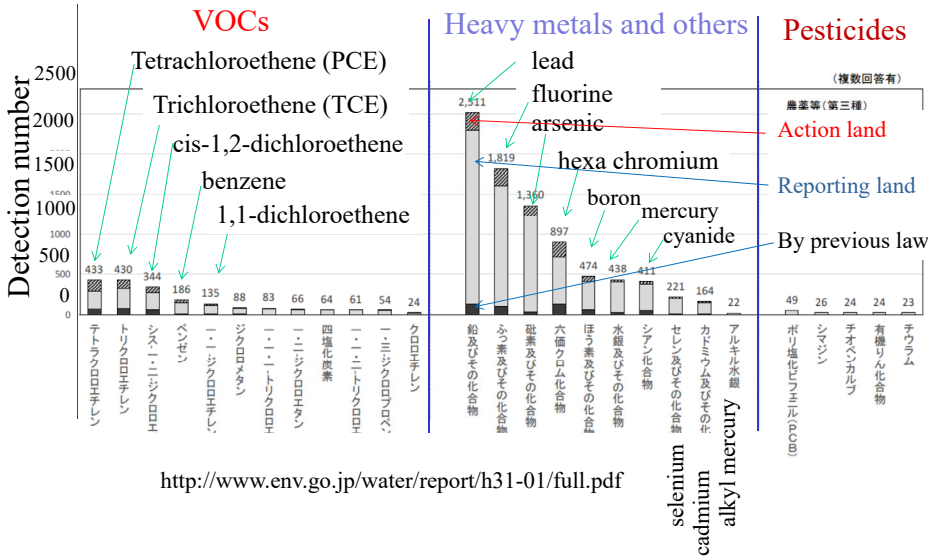


## Types of pollutant of soil contamination found in 2017




http://www.env.go.jp/water/report/h31-01/full.pdf

## Types of pollutant of soil contamination
**cumulative** number 2002-2017




http://www.env.go.jp/water/report/h31-01/full.pdf

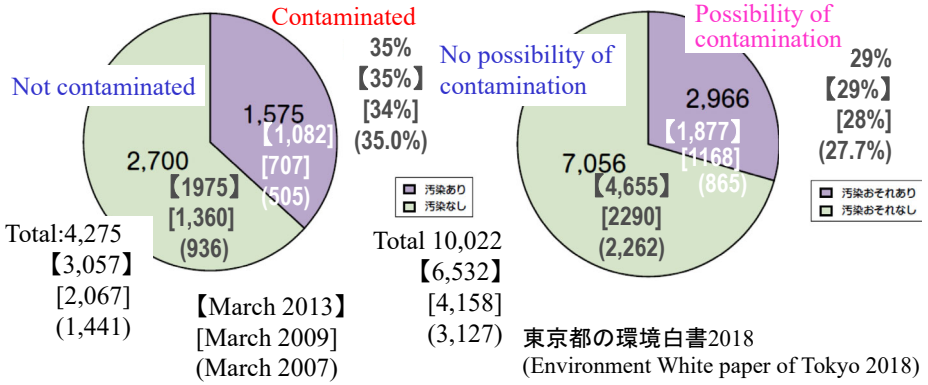


## Ground contamination of MGT

2001 the Tokyo Metropolitan Environmental Security Ordinance
東京都環境確保条例

Conditions of Contamination at the Time of Closing Factories (Article 116)
(Period: October 2001–March 2017)

Conditions of Contamination at the Time of Land Reform (Article 117) (≦3,000m²)
(Period: October 2001–March 2017)




東京都の環境白書2018
(Environment White paper of Tokyo 2018)



# Environmental laws and regulations

Protection and preservation of environment should be properly done artificially, i.e., by means of **new technology** and **regulations** in the most countries, where the power of nature cannot solve the threads to the environment from the human activities. **Environmental laws** 環境法 have been introduced and modified to meet this purpose.

Normally public awareness on a specific problems, which might be initiated by some incidents (e.g.Love Canal,1978), or publication (e.g., "Silent Spring" by Rachel Carson,1962), becomes a driving force to the introduction of laws and regulation. *For examples, design standards have been revised after severe accident or disaster.* Not only laws but also, the governmental agency plays important roles.

**Environmental Protection Agency (EPA)** in US was formed to administer environmental programs and establish standards to protect the environment in 1970.

In Japan, **Ministry of the Environment**, former Environment Agency
**THE BASIC ENVIRONMENT LAW** (環境基本法,1993)



## Environmental laws and regulation on geoenvironment

*Motivation??*

- **Basic law for environment pollution control (公害対策基本法,1967=>ended 1993 廃止)**
- **THE BASIC ENVIRONMENT LAW** (環境基本法,1993)
- **National Environmental Policy Act** (USA) 1970
  **Environmental Impact Statement (EIS)** before taking any action that may have a significant environmental impact.
  =>**Environmental Impact Assessment Law**（環境アセス法）1997
- Occupation and Safety and Health Act (USA) 1970
- Clean Air Act (USA) 1963, 1970,1977 and 1990
  =>Environmental Quality Standards in Japan -Air Quality-1973,1997,1999
- Clean Water Act (USA) 1972, 1977,1981, 1987, 1990
  =>Environmental Quality Standards for water Pollution, 1993
  =>Environmental Quality Standards for Soil Pollution, 1991, 1994
  =>National Effluent Standards (**排出基準**)in Japan
- Safe Drinking Water Act (USA) 1974. http://www.env.go.jp/en/lar/index.html
  =>Standard for drinking water in Japan (not by MOE but *MOHLW*)
- Federal Insecticide, Fungicide, and Rodenticide Act (USA) 1947,1983

**•Comprehensive Environmental Response, Compensation, and Liabilities Act (CERCLA) =" Superfund Act" (USA) 1980, 1986**

Liability, compensation, cleanup and emergency response for hazardous substances released to the environment and for the cleanup of inactive hazardous disposal sites.

EPA is given the authority and fund to cleanup the site to respond to emergencies. Money for the Superfund came from a trust fund created using taxes on crude oil and chemical companies. EPA can sue any responsible parties which compensates the cleanup cost. Superfund covers the cost if the responsible parties cannot be detected or cannot have enough resources.

*Onset of Superfund Act is Love Canal episode.*

•Emergency Planning and Community Right-to –Know Act (USA) 1986

•Oil pollution Act (UAS) 1924, 1990

•Pollution Prevention Act (USA) 1990



**•Solid Waste Disposal Act and Resource Recovery Act(UAS)** 1965,1970
emphasizing better management of waste disposal: reduction, recycling, energy recovery

=>**Waste Management and Public Cleansing Law** in Japan,1970-2000
(**廃棄物の処理及び清掃に関する法律:廃掃法**)

•Toxic Substance Control Act (USA) 1976
regulation of manufacturing, processing and distribution toxic substance, PCB was banned under TSCA.

=>Law Concerning Reporting, etc. of Releases to the Environment of Specific Chemical Substances and Promoting Improvements in Their Management in Japan 1999

(**化学物質排出把握管理促進法:PRTR制度(Pollutant Release and Transfer Register**)

**•Resource Conservation and Recovery Act (USA)** 1976, 1980,1984
controlling nonhazardous waste and regulating hazardous waste

=> **Waste Management and Public Cleansing Law** in Japan

**•Hazardous and Solid Waste Amendment (USA)** 1984



## Amendment of Soil Contamination Countermeasures Law

**土壌汚染対策法(土対法)** Enforced 2003.2.15 Amended 2010.4.1

①Lands or factories with terminated special facilities dealing with hazardous compounds specified by water pollution control law(水濁法).

②Land with potential risk to human health by soil contamination authorized by governor.
③ Notification of land reform more than 3,000m$^2$ + contamination is likely to exist, determined by governor(new)

Self - investigation

Investigation by appointed organization(指定機関)

Once contamination is detected

①Detailed classification of "***designated contaminated site***"
- likely to harm human health => ***Action land***(要処置区域)
- unlikely to harm human health => ***Reporting land***(形質変更届け出区域) =>future land reform must be reported.

② ***everybody access the details***

- remediation, *clean-up, containment*
- control the modification of the site, e.g. restriction of excavation



# Brownfield

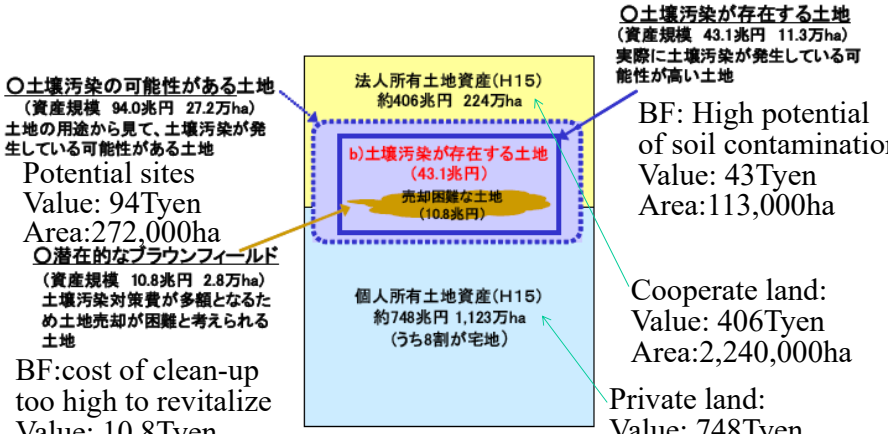
**Definition**:
(**US_EPA**:http://www.epa.gov/brownfields/index.html)
Real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. Cleaning up and reinvesting in these properties protects the environment, reduces blight, and takes development pressures off greenspaces and working lands.

**Small Business Liability Relief and Brownfields Revitalization Act**
= "the Brownfields Law", 2002. S4_2
Increasing the value of BF, creating business chance, and job
(1$=>18$, 61,000 jobs)

**Japan**:土壌汚染をめぐるブラウンフィールド問題の実態等について中間とりまとめ
http://www.env.go.jp/houdou/gazou/8300/9506/2641.pdf
「土壌汚染の存在、あるいはその懸念から、本来、その土地が有する潜在的な価値よりも著しく低い用途あるいは未利用となった土地」

# Survey about BF in Japan

http://www.env.go.jp/houdou/gazou/8300/9506/2641.pdf




BF: High potential of soil contamination
Value: 43Tyen
Area:113,000ha

Potential sites
Value: 94Tyen
Area:272,000ha

BF:cost of clean-up too high to revitalize
Value: 10.8Tyen
Area:28,000ha

Cooperate land:
Value: 406Tyen
Area:2,240,000ha

Private land:
Value: 748Tyen
Area:11,230,000ha



# Dioxin：ダイオキシン

Dioxin is generic name of these three chlorinated hydrocarbon

Co-PCB (coplanar polychlorinated biphenyl)
PCDF(polychlorinated dibenzofuran)
PCDD(polychlorinated dibenzo-p-dioxin)

***carcinogen, endocrine disruptors (environmental hormone)***

Most toxic: 2,3,7,8 PCDD: Agent Orange in Vietnam War
*Herbicide(枯葉剤、除草剤)*

**"Dioxin Special Measures Law"**
**ダイオキシン類対策特別措置法(1999.12)**

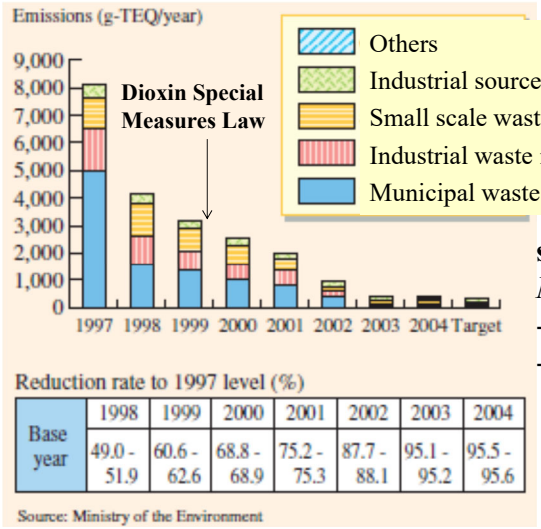
***Tolerable daily intake by human body*:**
in Japan 4pg/kg by **TEQ (pg=$10^{-12}$g)**

TEQ:toxicity equivalent to 2,3,7,8PCDD

***Environmental quality standards***
Air: 0.6pg-TEQ/$m^3$
Water: 1.0pg-TEQ/L
Sediment under water: 150pg-TEQ/g
Soil:1,000pg-TEQ/g



# Change in total emission of Dioxin




Reduction rate to 1997 level (%)

| | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|---|---|---|
| Base year | 49.0 - 51.9 | 60.6 - 62.6 | 68.8 - 68.9 | 75.2 - 75.3 | 87.7 - 88.1 | 95.1 - 95.2 | 95.5 - 95.6 |

Source: Ministry of the Environment

http://www.env.go.jp/en/wpaper/2006/index.html

**sources:**
*Not naturally existing*
-incineration of plastic material
-chlorinate breaching of paper

- new law banning old type incinerator
- **opposition to incineration**



# Basic Environmental Law: Chap1 General Provisions

Article 1 (purpose：目的 Chap.1*) *Chap. of the former law

The purpose of this law is to comprehensively and systematically promote policies for environmental conservation to ensure healthy and cultured living for both the **present** and **future generations** of the nation as well as to contribute to the welfare of mankind, through articulating the basic principles, clarifying the responsibilities of the State, local governments, corporations and citizens, and prescribing the basic policy considerations for environmental conservation.

Article 2 (Terminology：定義 Chap.2*)

"**global environmental conservation**:地球環境の保全"
environmental conservation regarding such phenomena as global warming, the ozone layer depletion, marine pollution, decrease in wildlife species and others which are caused by human activities and affect the environment of the entire globe or a large part of it, which contributes to the welfare of mankind as well as to the healthy and cultured living of the people.

**Seven "environmental pollutions: 7つの公害"**

Air pollution(大気汚染), Water pollution(水質汚染), Soil contamination(土壌汚染)
Noise(騒音), Vibration(振動), ground subsidence(地盤沈下), offensive odors（異臭）

# Basic Environmental Law: Chap1 General Provisions

Article 3: Enjoyment and Future Success of Environmental Blessings
（環境の恵沢の享受と継承等：）
Article 4: Creation of A Society Ensuring **Sustainable Development** with Reduced Environmental Load（環境への負荷の少ない持続的発展が可能な社会の構築等）
Article 5:Active Promotion of Global Environmental Conservation through International Cooperation （国際的協調による地球環境保全の積極的推進）
Article 6: Responsibility of the State（国の責務：Chap.4*）
Article 7: Responsibility of Local Governments（地方公共団体の責務：Chap.5*）
Article 8: Responsibility of Corporations （事業者の責務：Chap.3*）
Article 9: Responsibility of Citizens （国民の責務：Chap.6*）
Article 10: Environment Day（環境の日） => ***when?***
Article 11: Legislative Measures etc.（法制上の措置等）
Article 12: Annual Report（年次報告等：Chap.7*）
Article 13: Prevention of Air Pollution and the like by Radioactive Substances
（放射性物質による大気の汚染等の防止：Chap.8*）



# 公害対策基本法 vs 環境基本法

**公対法第一条（目的）** この法律は、**国民の健康で文化的な生活を確保**するうえにおいて公害の防止がきわめて重要であることにかんがみ、事業者、国及び地方公共団体の**公害の防止**に関する責務を明らかにし、並びに公害の防止に関する**施策の基本となる事項を定める**ことにより、**公害対策**の総合的推進を図り、もつて**国民の**健康を保護するとともに、生活環境を保全することを目的とする。
***現在の公害対策***

**環基法第一条(目的)** この法律は、**環境の保全**について、**基本理念**を定め、並びに国、地方公 共団体、事業者及び国民の責務を明らかにするとともに、環境の保全に関する**施 策の基本となる事項を定める**ことにより、環境の保全に関する施策を総合的かつ 計画的に推進し、もって**現在及び将来の国民の健康で文化的な生活の確保**に寄与 するとともに**人類の福祉**に貢献することを目的とする。
***環境全般、現在、将来、日本、世界***