Chapter 3
Air Pollution laws and regulations

Air pollution control philosophies and regulations
Major industrial facilities (smelters, steel mills, chemical plants) need special permits to operate.

The permits have several origins:
- Local authorities = municipalities
- State (centralized)
- Federal (country scale)

Permits enforce regulations such as:
- The emission of pollutant “X” – from the stack of factory “Y” – shall not exceed “Z” mg/h
- Reporting emissions data to regulatory agencies
- Detail test procedures
Regulation hierarchy in the U.S.A.

1. Constitution regulates all
2. Clean Air Act provides the legal basis of air pollution
3. The US EPA publishes detailed regulations for laws application
4. Some regulations are applied nationwide (NSPS, NESHAP)
5. Regulations also include instructions on how to prepare State Impl. Plans (SIP)
Regulatory details

- Federal regulations direct the state to enforce permits for potential emitters
  - Of more than 100 tons/yr of criteria pollutants
  - Of more than 25 tons/yr of hazardous pollutants
- Potential = even if they apply control technologies at 99% efficiency
- If the facility (emitter) is located in a severely polluted area = then the values become smaller
- Automobiles and gasoline emissions are directly regulated by the EPA
- Automobile industry needs State and EPA permits

How to control emissions ??
The ultimate goal is to have a clean environment without paying extra costs.

The costs should be appropriately distributed between:

- **Industries** (large emitters pay more)
- **Car owners** (large cars pay more)
- **Residents** (large consumers pay more)

**HERE** the control philosophy is a set of ideas which help in determining:

- **The characteristics of a clean environment**
- **The costs associated with reducing emissions**
- **The distribution of these costs in an equitable manner**

The regulations can be applied in a strict (control) or a lax way (minimum cost).
What is a perfect philosophy??

- **Cost effective**
  - Gains maximum benefits = i.e. control
  - Balances with the costs of pollution control technologies

- **Simple**
  - Easy setup of control technologies
  - Low and simple maintenance of emission control operations

- **Enforceable** = clarifies the responsibilities of all parties concerned

- **Flexible**
  - Deals with special difficulties like delay in delivery of equipments
  - Equipment break down

- **Evolutionary**
  - Enables adjustments based on new information
  - Allows adjustments without major revisions in plant structure
The 4 philosophies

- Actual regulations rely on several philosophies = 4 in total

- Emission standards
- Air quality standards
- Emission taxes
- Cost-benefit standards
The emission standard philosophy
The emission standard philosophy

- It defines a maximum (possible or practical) degree of emission control
  - It varies with the nature of the emitter = autos, cement plant,…etc.
  - It can determine a maximum control for each emitter
- Every member is required to limit emissions to this max allowed
- This way the emission rate will be the lowest possible
- One gains the cleanest possible air: “cleanest possible air philosophy”
- Example: England 1863
  - Leblanc factory for soda ash (Na₂CO₃)
  - Large amounts of byproduct (HCl) were emitted as vapor
  - HCl devastated the vegetation = problems with the industry
  - Alkali-inspectors found the best technique to reduce emissions at the factory level
  - The technique was enforced on all other factories emitting HCl
The emission standard philosophy

- This application is the “best technology” type of emission standard
- It is used nowadays when a safe emission rate is not determined
- Examples on emission standards:
  - Prohibiting open burning of garbage and agricultural wastes
    - It has more emissions than closed incineration
    - More than land fills
    - More than composting
  - Regulating visible stack and vents emissions
  - Regulations defining
    - Maximum contents of fuel sulfur (less SO\textsubscript{2}) and gasoline olefin (smog)
    - Minimum gasoline oxygen contents (less CO)
  - Numerical standards
    - Automobiles made after 1993 should not emit more than 0.25 g/mile of hydrocarbons
Air pollution control philosophies

- The emission standard philosophy
  - This philosophy was the basis of most air pollution control activities between 1863 and 1970
  - Recent air pollution laws – 2 sections are pure emission standards

New Source Performance Standard (NSPS)  National Emissions Standards for Hazardous Air Pollutants (NESHAP)

- 1. It blocks a firm from “pollution shopping” = searching for the least stringent air pollution standard state
- 2. Any regulation standard below the NSPS leads to a polluted air

- 1. This regulation covers pollutants which causes harm without any threshold
- 2. Better to apply the toughest control procedures to limit emissions
Air pollution control philosophies

- The emission standard philosophy
  - Table of the NSPS for stationary sources

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**TABLE 3.1**

Federal standards of performance for new stationary sources (commonly called new source performance standards [NSPS])

This list is an excerpt from the 1998 version of 40 CFR 60. Standards are listed there for 68 industrial categories. New categories are regularly added, and existing ones modified. This excerpt shows the kind of regulations that are contained in that much larger compilation.

1. **Coal-fired power plants** whose construction started after September 18, 1978, may not emit the following to the atmosphere:
   a. Particulate matter more than 0.03 lb/10^6 Btu, or 1% of the ash solids in the fuel, whichever is less.
   b. Sulfur dioxide more than 1.2 lb/10^6 Btu, or more than 30% of the SO_2 that would be formed if all the sulfur in the coal were converted to SO_2, whichever is less.
   c. Nitrogen oxides more than 0.6 lb/10^6 Btu for most coals, or 0.5 lb/10^6 Btu for sub-bituminous coal.

2. **Large incinerators** shall not emit to the atmosphere gases that contain more than 27 mg/dry standard cubic meter of particulates. There are also limits of opacity, cadmium, lead, mercury, and acid gases.

3. **Portland cement plants** shall not emit to the atmosphere the following:
   a. Gases from the kiln containing more than 0.30 lb/ton of kiln feed (dry basis).
   b. Gases from the clinker cooler containing more than 0.10 lb/ton of feed to the kiln (dry basis).

4. **Nitric acid plants** shall not emit gases containing more than 3.0 lb of NO_2 per ton of nitric acid produced.

5. **Sulfuric acid plants** shall not emit gases containing more than 4 lb of SO_2 and/or 0.15 lb of sulfuric acid mist/ton of acid produced (100% basis).

The above regulations also limit the opacity of the plumes from these plants, mostly as a control measure, and have very detailed discriptions of testing and monitoring requirements.
Air pollution control philosophies

The emission standard philosophy – REVIEW

- **Cost-effectiveness** = very bad
  - In remote areas = high costs with low benefits (small population)
  - Industrial areas, less stringent enforcement = not enough decrease

- **Simplicity** = excellent
  - Well defined emission rates to respect
  - Test methods are well described

**Example on the use of cost-effectiveness:**

- In 1967 automobile manufacturers petitioned the US Congress to legislate a uniform standard for all the country
- They feared that they might have to build multiple cars = multiple legislations will affect them more
- In 1973 they petitioned Congress to change legislation to two types of cars:
  - One old and One new less stringent legislation for cars used in rural areas
  - The Congress REFUSED
The emission standard philosophy – REVIEW

- **Enforceability = excellent**
  - How and what to monitor are very well defined
  - Violation criteria and penalties are easily formulated

- **Flexibility = poor**
  - If pollution control equipments fail to meet the manufacturer’s performance criteria = how authorities will deal with this?
    - Closing the factory – politically impossible
    - To fine its operators – politically very difficult
    - Give variance to operate until equipment is fixed – invitation to infinite delays

- **Evolutionary ability = fair**
  - If new technology sets lower standards – it can be enforced on sources built after a certain date
    - Works fairly with automobile industry – lifetime of about 10 years
    - Works poorly with large industries – lifetime between 30 – 50 years
The emission standard philosophy – REVIEW

- A progress in air pollution control can be achieved only by using tougher control strategies

- The emission standard philosophy is useless as a guide to decide how strong the controls must be
  - Expensive electrostatic precipitators used for large emitters
  - For coal-fired electric power plants its efficiency vary between 90% to 99%
    - If the cost to achieve 90% is X $
    - One will need 2X $ to achieve 99%
    - And about 3X $ to achieve 99.9%
    - About 4X $ to achieve 99.99%
Air pollution control philosophies

The emission standard philosophy – REVIEW

- If the philosophy lead to its logical conclusion = societies will have to commit all resources to this particular kind of pollution control
- This is impossible = that’s why we created new defined values for:
  - Best available control technology (BACT)
  - Reasonably available control technology (RACT)
  - Maximum available control technology (MACT)
  - Lowest achievable emission rate (LAER)
The air quality standard philosophy
The air quality standard philosophy

- It sets a “Zero” damage philosophy
- In this philosophy – the dose response of major air pollutants is of a threshold value situation
- The application of this strategy implies:
  - Determining the threshold values for pollutants
  - Regulate time, location, and emissions of pollutants so that it doesn’t exceed the TLV
  - RESULTS = air pollutant [conc] < TLV = no effects
- The implementation attempts of this philosophy by the state ensures that standards are not exceeded
The air quality standard philosophy

- If ambient air quality is not met = then the state prepares a SIP

- Many standards have not yet met their standards

- The reasons may be:
  - Underestimated emissions
  - Overestimated controls
  - Used optimistic models
The air quality standard philosophy

- This philosophy was applied for the 6 criteria pollutants and in each Air Quality Control Region (AQCR) within each state.

- In some states—some pollutant standards have not been met yet = they are defined as “nonattainment areas”.

- In these areas the SIP goes into the processing and looping until goals are achieved.
The air quality standard philosophy – REVIEW

- **Cost-effectiveness = good (but not excellent)**
  - It concentrates pollution control expenses in highly polluted areas
  - It allows higher emissions in areas with less pollution
  - If NAAQS are set = they must be enforced everywhere – even in remote areas with low pollution (low benefit)

- **Simplicity = poor**
  - Complexity of sources
    - Many emitters should be taken into account
    - Meteorological conditions (transport, dispersion) should be included
    - Atmospheric reactions are also to be considered

- **Enforceability = fair**
  - The responsible is generally not obvious in this philosophy
    - It is ambient air
    - If we face secondary pollutants = then assigning responsibilities will be extremely difficult
Air pollution control philosophies

- The air quality standard philosophy – REVIEW

  o **Flexibility = fair**
    - **Multiple ways by which the standards can be met**
      - Decreasing emissions through controls
      - Decreasing emissions through less production
  
  o **Evolutionary ability = fair**
    - **With new data acquisition = standards can be changed**
      - It will require new emission regulation
      - And enforcement of new regulations

  ➢ **Ex:** when the US EPA added the PM\(_{2.5}\) standards on the existing PM\(_{10}\) standards = states had to write new SIPs

  ➢ +Expensive
  ➢ +Time consuming
Air pollution control philosophies

The air quality standard philosophy – REVIEW

1. If there is no damage at \([\text{pollutant}] < \text{TLV}\)
   - Then no objections to polluting up to the TLV limit
   - This is a false strategy because:
     - TLVs are based on limited data
     - We cannot be sure that we will not cause any harm
       - Visibility for example is not a TLV factor ???
       - Some physiological responses might be undetectable by recent methods

2. This issue was settled by the Congress the 1977 amendments to the C.A.A. = the Prevention of Significant Deterioration (PSD)
   - It allowed a small regulated amounts of \([\text{pollutant}]\) increase
The emission tax Philosophy
The emission tax Philosophy

- It is a possible future alternative
  - It employs taxes on emitters of major pollutants according to its emission rate = $X$ per $Y \mu g/m^3$
  - Emitters will find that deploying controls over emissions will be less expensive than paying taxes on emissions
    - There will be no moral or legal sanctions against emitters who choose to pay the taxes
  - If this philosophy is combined to “ambient air standard” = the emissions should be reduced below the NAAQS levels

- The taxes will not clean the air
  - This philosophy considers that the environment have natural removal mechanisms
  - Exceptions are considered for certain pollutants (like CFCs)
The emission tax Philosophy

- This philosophy also assume that for any contamination = the environment has a renewable absorptive /or/ dispersive capacities
  - These capacities are viewed here as public property
  - This capacity should be rented to private users (factories, plants...)
  - The money paid for this rental should go back to the public treasury

- If we apply this philosophy:
  - Degree of pollution control becomes an internal economic decision
  - It minimizes the misallocation of pollution control sources
    - Small emitters pay taxes
    - Large emitters pay for sophisticated control equipments
The emission tax Philosophy – REVIEW

- **Cost-effectiveness = fair**
  - Emitters have the choice between controlling or paying taxes
  - Uniform emission taxes on different emitters will force remote plants to install control equipment at high cost/low benefit

- **Simplicity = excellent**
  - Taxes only on large sources
  - Complications may arise in certain cases
    - $SO_2$ taxes for autos, home-heating fuels is easy = tax the S content
    - In the case of $NO_x$ = ??????

- **Enforceability = excellent**
  - Emission testing will have to be expanded
  - Installation of emission recording meters in exhaust stacks
Air pollution control philosophies

- The emission tax Philosophy — **REVIEW**
  - *Flexibility = unnecessary*
    - *Simple: pay the tax*
  - *Evolutionary ability = good*
    - *Tax rate changed as necessary*
    - *Raising a tax rate causes less disturbance to economic activities than lowering the emission standards*
The cost-benefit philosophy
The cost-benefit philosophy

- It assumes that
  - There are no thresholds at all
  - Or there are very low thresholds

- In both cases we are not able to set guidelines for Air that is that clean

- It suggests
  - How much damage can we stand
  - How much we are willing to spend to control damage beyond the tolerance level
Air pollution control philosophies

- The cost-benefit philosophy
  - *This philosophy does not define*
    - Whose costs ????
    - Whose benefits ????
  - *Cost distribution*
    - If pollutants are emitted by autos
      - Cost and damages are distributed on the population
    - If the emitter is an industry
      - It can injure the rest of the community
      - Costs will be unequally distributed
Air pollution control philosophies

- The cost-benefit philosophy – REVIEW
  - Cost effectiveness = excellent
    - The aim of this philosophy is to solve cost-benefit minimization
    - If the cost-benefit sketch is adopted = optimal solution
  - Simplicity = terrible
    - Many variables
      - Pollution control costs
      - Pollution damage costs
      - Number of population
  - Enforceability = unknown
    - No attempts to write regulations based on a pure cost-benefit analysis
  - Flexibility = unknown
  - Evolutionary ability = should be good
    - With new control technologies – better cost-benefit analysis
Comparison of the different Air Pollution Control Philosophies

**TABLE 3.2**
Comparison of air pollution control philosophies

<table>
<thead>
<tr>
<th>Desirable quality</th>
<th>Emission standard</th>
<th>Air quality standard</th>
<th>Emission taxes</th>
<th>Cost-benefit analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost effectiveness</td>
<td>Very bad</td>
<td>Good</td>
<td>Fair</td>
<td>Excellent</td>
</tr>
<tr>
<td>Simplicity</td>
<td>Excellent</td>
<td>Poor</td>
<td>Excellent</td>
<td>Terrible</td>
</tr>
<tr>
<td>Enforceability</td>
<td>Excellent</td>
<td>Fair</td>
<td>Excellent</td>
<td>Unknown</td>
</tr>
<tr>
<td>Flexibility</td>
<td>Poor</td>
<td>Fair</td>
<td>Unnecessary</td>
<td>Unknown</td>
</tr>
<tr>
<td>Evolutionary ability</td>
<td>Fair</td>
<td>Fair</td>
<td>Good</td>
<td>Good</td>
</tr>
</tbody>
</table>
Air pollutants Ambient Air limit values U.S.A., EUROPE, and Lebanon
Air pollution limit values

The U.S. Environmental Protection Agency

<table>
<thead>
<tr>
<th>Pollutant [final rule cite]</th>
<th>Primary/Secondary</th>
<th>Averaging Time</th>
<th>Level</th>
<th>Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Monoxide [75 FR 54294, Aug 31, 2011]</td>
<td>primary</td>
<td>8-hour</td>
<td>9 ppm</td>
<td>Not to be exceeded more than once per year</td>
</tr>
<tr>
<td></td>
<td>secondary</td>
<td>1-hour</td>
<td>35 ppm</td>
<td></td>
</tr>
<tr>
<td>Lead [73 FR 66964, Nov 12, 2008]</td>
<td>primary and secondary</td>
<td>Rolling 3 month average</td>
<td>0.15 μg/m$^3$</td>
<td>Not to be exceeded</td>
</tr>
<tr>
<td>Nitrogen Dioxide [75 FR 6474, Feb 9, 2010] [61 FR 52852, Oct 8, 1996]</td>
<td>primary</td>
<td>1-hour</td>
<td>100 ppb</td>
<td>98th percentile, averaged over 3 years</td>
</tr>
<tr>
<td></td>
<td>primary and secondary</td>
<td>Annual</td>
<td>53 ppb</td>
<td>Annual Mean</td>
</tr>
<tr>
<td>Ozone [73 FR 16436, Mar 27, 2008]</td>
<td>primary and secondary</td>
<td>8-hour</td>
<td>0.075 ppm</td>
<td>Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years</td>
</tr>
<tr>
<td>PM$_{2.5}$</td>
<td>primary</td>
<td>Annual</td>
<td>12 μg/m$^3$</td>
<td>annual mean, averaged over 3 years</td>
</tr>
<tr>
<td></td>
<td>secondary</td>
<td>Annual</td>
<td>15 μg/m$^3$</td>
<td>annual mean, averaged over 3 years</td>
</tr>
<tr>
<td></td>
<td>primary and secondary</td>
<td>24-hour</td>
<td>35 μg/m$^3$</td>
<td>98th percentile, averaged over 3 years</td>
</tr>
<tr>
<td>PM$_{10}$</td>
<td>primary and secondary</td>
<td>24-hour</td>
<td>150 μg/m$^3$</td>
<td>Not to be exceeded more than once per year on average over 3 years</td>
</tr>
<tr>
<td>Sulfur Dioxide [75 FR 35520, Jun 22, 2010] [38 FR 25678, Sept 14, 1973]</td>
<td>primary</td>
<td>1-hour</td>
<td>75 ppb</td>
<td>99th percentile of 1-hour daily maximum concentrations, averaged over 3 years</td>
</tr>
<tr>
<td></td>
<td>secondary</td>
<td>3-hour</td>
<td>0.5 ppm</td>
<td>Not to be exceeded more than once per year</td>
</tr>
</tbody>
</table>
Air pollution limit values

- The U.S. Environmental Protection Agency (projected PM standards)

EPA Projections Show 99% of U.S. Counties with Monitors Would Meet the Annual Fine Particle Health Standard of 12 µg/m³ in 2020

7 counties are projected not to meet 12.0 µg/m³ in 2020.

All of these are already under requirements to reduce PM2.5.

Source: PM NAAQS RIA
For more information: www.epa.gov/pm25
Air pollution limit values

The European Union standards - A

**Air Quality Standards**

Humans can be adversely affected by exposure to air pollutants in ambient air. In response, the European Union has developed an extensive body of legislation which establishes health based standards and objectives for a number of pollutants in air. These standards and objectives are summarised in the table below. These apply over differing periods of time because the observed health impacts associated with the various pollutants occur over different exposure times.

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Concentration</th>
<th>Averaging period</th>
<th>Legal nature</th>
<th>Permitted exceedences each year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fine particles (PM2.5)</td>
<td>25 µg/m³***</td>
<td>1 year</td>
<td>Target value entered into force 1.1.2010</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td>350 µg/m³</td>
<td>1 hour</td>
<td>Limit value enters into force 1.1.2015</td>
<td></td>
</tr>
<tr>
<td></td>
<td>125 µg/m³</td>
<td>24 hours</td>
<td>Limit value enters into force 1.1.2005</td>
<td>24</td>
</tr>
<tr>
<td>Sulphur dioxide (SO2)</td>
<td>200 µg/m³</td>
<td>1 hour</td>
<td>Limit value entered into force 1.1.2010</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>40 µg/m³</td>
<td>1 year</td>
<td>Limit value entered into force 1.1.2010*</td>
<td>n/a</td>
</tr>
<tr>
<td>Nitrogen dioxide (NO2)</td>
<td>50 µg/m³</td>
<td>24 hours</td>
<td>Limit value entered into force 1.1.2005**</td>
<td>35</td>
</tr>
<tr>
<td>PM10</td>
<td>40 µg/m³</td>
<td>1 year</td>
<td>Limit value entered into force 1.1.2005**</td>
<td>n/a</td>
</tr>
</tbody>
</table>
## Air pollution limit values

The European Union standards-B

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Concentration</th>
<th>Averaging period</th>
<th>Legal nature</th>
<th>Permitted exceedences each year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead (Pb)</td>
<td>0.5 µg/m³</td>
<td>1 year</td>
<td>Limit value entered into force 1.1.2005 (or 1.1.2010 in the immediate vicinity of specific, notified industrial sources; and a 1.0 µg/m³ limit value applied from 1.1.2005 to 31.12.2009)</td>
<td>n/a</td>
</tr>
<tr>
<td>Carbon monoxide (CO)</td>
<td>10 mg/m³</td>
<td>Maximum daily 8 hour mean</td>
<td>Limit value entered into force 1.1.2005</td>
<td>n/a</td>
</tr>
<tr>
<td>Benzene</td>
<td>5 µg/m³</td>
<td>1 year</td>
<td>Limit value entered into force 1.1.2010**</td>
<td>n/a</td>
</tr>
<tr>
<td>Ozone</td>
<td>120 µg/m³</td>
<td>Maximum daily 8 hour mean</td>
<td>Target value entered into force 1.1.2010</td>
<td>25 days averaged over 3 years</td>
</tr>
<tr>
<td>Arsenic (As)</td>
<td>6 ng/m³</td>
<td>1 year</td>
<td>Target value enters into force 31.12.2012</td>
<td>n/a</td>
</tr>
<tr>
<td>Cadmium (Cd)</td>
<td>5 ng/m³</td>
<td>1 year</td>
<td>Target value enters into force 31.12.2012</td>
<td>n/a</td>
</tr>
</tbody>
</table>
Air pollution limit values

- The European Union standards-C

### Air Quality Standards

Humans can be adversely affected by exposure to air pollutants in ambient air. In response, the European Union has developed an extensive body of legislation which establishes health-based standards and objectives for a number of pollutants in air. These standards and objectives are summarised in the table below. These apply over differing periods of time because the observed health impacts associated with the various pollutants occur over different exposure times.

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Concentration</th>
<th>Averaging period</th>
<th>Legal nature</th>
<th>Permitted exceedences each year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nickel (Ni)</td>
<td>20 ng/m³</td>
<td>1 year</td>
<td>Target value enters into force 31.12.2012</td>
<td>n/a</td>
</tr>
<tr>
<td>Polycyclic Aromatic Hydrocarbons</td>
<td>1 ng/m³</td>
<td>1 year</td>
<td>Target value enters into force 31.12.2012</td>
<td>n/a</td>
</tr>
</tbody>
</table>
Air pollution limit values

The Lebanese Ambient Air Quality Standards (AAQS)

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Limit Value (μg/m³)</th>
<th>Duration of exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>SO₂</td>
<td>350</td>
<td>1 hour</td>
</tr>
<tr>
<td></td>
<td>120</td>
<td>24 hours</td>
</tr>
<tr>
<td></td>
<td>80</td>
<td>one year</td>
</tr>
<tr>
<td>NO₂</td>
<td>200</td>
<td>1 hour</td>
</tr>
<tr>
<td></td>
<td>150</td>
<td>24 hours</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>one year</td>
</tr>
<tr>
<td>O₃</td>
<td>150</td>
<td>1 hour</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>8 hours</td>
</tr>
<tr>
<td>CO</td>
<td>30,000</td>
<td>1 hour</td>
</tr>
<tr>
<td></td>
<td>12,000</td>
<td>8 hours</td>
</tr>
<tr>
<td>TSP</td>
<td>120</td>
<td>24 hours</td>
</tr>
<tr>
<td>SPM₁₀</td>
<td>80</td>
<td>24 hours</td>
</tr>
<tr>
<td>Lead</td>
<td>1,000</td>
<td>1 year</td>
</tr>
<tr>
<td>Benzene (ppm)</td>
<td>5 ppm</td>
<td>1 year</td>
</tr>
</tbody>
</table>

http://www.unep.org/dewa/westasia/Assessments/national_SOEs/west%20asia/Lebanon/Chap9Air.pdf
END