2. Requirements to AQ monitoring in Europe

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2.1. EU Legislation

Requirements to how monitoring and assessment of air pollution should be carried out is, for the member states of EU and associated countries, given in EU Directives and Decisions.

There are also national requirements to monitoring which may, or may not, agree fully with the EU requirements. The national requirements are, if available or formulated, described in the country summaries (Appendix A).

The Directives stating requirements on the air pollution monitoring and assessment, are (see Tables 2.1-2.3):

- The compound-specific directives: SO2 and SPM, Pb, NO2, O3 (1980-95).
- The Exchange of Information (EoI) Decisions of 1976, 1982 and 1995.
- The draft Council Directive on ambient air quality assessment and management ("Framework Directive, FWD") of 1995.

The EoI Decision only sets reporting requirements, no monitoring requirements. The requirements are summarised in the following paragraphs. Tables 2.1 to 2.3 specifies the requirements further.

The present compound-specific Directives for SO2, TSP/Black Smoke (BS), Pb, NO2 and O3, issued during the period 1989-95, require in principle that all exceedances of the limit values are detected, and thus require that a thorough assessment process should support the selected sites of the monitoring system.

The statistics to be reported, in addition to the exceedances, are mean, median, 98-percentile and maximum values (for either 1h or 24h basic sampling resolution) (and 99.9-percentile for 1h sampling resolution).

The data should be reported within 6 months of the next reporting year. (Calendar year for Pb, NO2 and O3; Tropical year (April to March) for SO2, TSP, BS).

For ozone, the Directive requires that exceedances of alarm values are reported without delay to the public, and within 1 month to the Commission.

The present Draft Exchange of Information (EoI) Decision requires a similar extent of reporting, and specifies in addition:

- Detailed network and site description.
- Reporting of 31 compounds in addition to those of the compound-specific directives, to the extent that they are measured. The additional compounds include for instance CO, NOx, acidity, VOC and specific organic compounds, heavy metals (7 of them), organic contents of particles.
- The data files, of specified format, should be delivered to the data base manager within 1 October of the next year.

The Draft Framework Directive on Ambient Air Quality (FWD) requires that the air quality is assessed relative to the limit values which are in effect at any time. The required reporting relative to the draft FWD is as follows:

- The member states shall provide annually a list of all areas of exceedance of limit values, within 9 months of the next year.
- The Commission shall annually publish the list referred to above. Information shall be given on the nature and origin (sources) of the pollution, and assessment techniques used, and also on the measures in place, or planned, to improve air quality to within acceptable limit values.
- The compounds are those for which EU limit values are given, plus additional compounds:

*** pollutants covered by directives: SO2, NO2 and NOx, BS, SPM (PM10), Pb, O3**

*** other pollutants for consideration: CO, Cd, Acid.dep., benzene, PAH(BaP), As, F, Ni.**

The current monitoring practices, as summarised for each country in Appendix A, are evaluated in Chapter 3 relative to the EU requirements. The influence on the monitoring practices of the national requirements is taken into account.

Table 2.1: Requirements from compound-specific directives (CSD).

Compound	Coverage		Reporting	
	Spatial	Time	Parameters	Time schedule
SO2, SPM (89/427/EEC)	In principle, full coverage, since all exceedances should be detected. - where there is exceedance - where prevention of further increase is necessary - in specially protected areas	Year round	24h average, median,98 percentile, annual average	6 months after reference year
Pb (82/884/EEC-(Lead)	As above	Year round	Annual average	6 months after new year
NO2 (85/203/EEC-NO2)	As above	Year round	As for SO2, SPM	As above

O3 (92/72/EEC) (Simultaneous measurements of NOx and VOC recommended)	■ Selected sites of expected highest exposure ■ Additional sites, to provide info on O3 formation	Year round	1 h, 8 h, 24 h: maximum, mean, 98 percentile, no., date, duration of exceedances	■ Immediate info to the public ■ Report 6 months after new year

The CSD Directives also require reporting of the reasons for exceedances, and implemented policies to avoid reoccurrence ("Article 3 zones").

Table 2.2: Requirements from Draft EoI Decision (EU, The Council, no. 12122/2/95, Rev. 2).

The exchange of information concerns:

- networks and station descriptions
  - geographic representativity
  - local influences
  - methods
  - data logging, transfer, etc.
- measurement data and statistics.

Compounds to be reported

		No.
Classic, 24 hour:	SO2, acidity (AF), SPM, PM10, black smoke, Pb	6
Classic, 1 hour:	NOx, NO2, CO, O3	4
Inorganic gases, 24 hour:	H2S, CS2, NH3	3
Metals, 24 hour:	Hg, Cd, Ni, Cr, Mn, As	6
Organic gaseous, 24 hour:	VOC(T), VOC(NM), benzene, toluene, styrene, butadiene 1,3	6
	formaldehyde, PAN, CH2-CH-CN, C2HCl3, C2Cl4, CH2Cl2, VC	7
Organic particles, 24 hour:	BaP, PAH	2
Wet deposition, 1 month:	N- and S-deposition, acid dep.	3
Total		37

Sites to be reported

- All sites established under the compound-specific Directives.
- Additional sites, selected by member states, for additional compounds.

- Sites operated under the 1982 EoI Directive.

Statistics

- Concentrations in air: average, median, 98%ile (99.9%ile for 1-hour values), maximum
- For ozone: as above, but statistics for 8-hour values in addition (99.9%ile not required)
- Deposition: monthly averages.

Reporting timeframe

Data files should be transferred to the Commission before October 1 the year after the reference year.

Table 2.3.: Requirements to monitoring and reporting from the Draft Framework Directive (FWD) (Council Directive 95/9514/EC).

Air Quality Assessment

The FWD requires that Air Quality Limit Values (AQLV) are set. Once they are set, the air quality in member states should be assessed as follows:

- Measurement is mandatory
  - in agglomerations with more than 250,000 inhabitants (or population density >xxx inhabitants per km2. xxx to be decided by the member states).
  - in zones with conc. >x % of AQLV. (x to be determined).
  - in other zones with conc. >AQLV.
- If levels are < x% of the limit values, combined measurement and modelling may be used.
- If levels are < y% of the limit values, techniques of modelling or objective estimation might be used alone. (y to be determined).

"Assessment" is here understood as involving full description of the air quality, i.e. spatial coverage to detect exceedances.

Reporting

Members states shall provide

- annually a list of areas with AQ exceeding AQLV, within 9 months of a calendar year.

The Commission shall publish

- annually, the list of areas referred to above
- a report on air quality in the EU, every 3. year.

Compounds

Pollutants covered by EU Directives: SO2, NO (and NOx), BS, SPM (PM10), Pb, O3

Other pollutants of consideration: CO, Cd, benzene, PAH(BaP), As, Ni, Hg

Information to be reported on Action Plans

- Localisation of exceedances
- General information of those areas
- Responsible authority
- Nature and assessment of pollution
  - **previous concentration trends**
  - **assessment techniques**
- Origin of the pollutants (sources)
- Analysis of the situation
  - **factors responsible for excess**
  - **details of possible measures**
- Details of previous measures (before FWD)

- Details of present measures (after FWD)
- Details of planned measures
- References to information, data, and reports.

2.2. International conventions and monitoring programmes

2.2.1. ECE-EMEP

The main objective of the EMEP programme is to provide information on the transport and deposition of pollutants on the European scale. This is accomplished through the combination of monitoring and modelling. The transboundary fluxes are to be determined by model calculations. The monitoring network is to provide data for model control. The purpose of the EMEP monitoring network is to (ECE, 1994):

- provide information on the spatial distribution of air pollutants over Europe,
- provide a basis for comparison with model calculations,
- provide a basis for evaluation of time trends.

Following is a listing of the major recommendations concerning the EMEP monitoring programme (EMEP, 1995; EMEP, 1996):

Compounds/averaging time

Precipitation: SO4, NO3, NH4, Ca, pH (H+) (all 24 h)

Air: SO2 (24h), SO4 (24h), NO2 (24h), O3 (1h) VOC (10 min. for light HC, 8 h for aldehydes and ketones)

Inclusion of heavy metals and POPs is considered. It is considered to allow precipitation sampling to extend for up to 7 days (weekly samples).

Spatial coverage

Assumed adequate coverage:

Central parts of Europe : 150-200 km between sites

Other areas : 300 km or more betweensites

This spatial density is considered adequate to provide a basis for comparison with models, but not necessarily sufficient to cover more local gradients.

Site location

The quality of the site location is considered very important. The site must be chosen so that samples are representative of the region of interest, and not unique to that particular site.

Quality of measurements

Quality control of the measurements is strongly emphasised in the programme. A long-term goal is a combined sampling and analysis uncertainty of 15-25%, depending upon component.

Temporal coverage and resolution

The programme recommends year-round operation. A 90% data completeness is considered a realistic objective.

It is under consideration to limit O3 measurements to the summer half year (April 1-September 30).

2.2.2. Other European Conventions

These comprise the regional marine conventions in Europe, which are:

- The Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention, replacing the Oslo Convention and the Paris Convention).
- The Convention on the Protection of the Marine Environment of the Baltic Sea Area (Helsinki Convention, HELCOM).
- The Convention for the Protection of the Mediterranean Sea against Pollution (Barcelona Convention, MEDPOL, under the UNEP Regional Seas Programme).

The monitoring programmes under these conventions focus on the marine environments, but also cover atmospheric input to the waters. Thus, both concentrations in air, and deposition of relevant compounds are covered by the monitoring programmes. Nutrients (N-compounds), heavy metals and persistent organic pollutants are covered, as well as ozone to some extent. The monitoring programs are described in Chapter 3.3.2.

OSPAR

The comprehensive atmospheric monitoring programme (CAMP) of OSPAR, established in 1980, is joined by the following countries, which report measurements from coastal stations:

Belgium, Denmark, France, Germany, Iceland, Ireland, Netherlands, Norway, Portugal, Spain, Sweden, United Kingdom.

The monitoring requirements were established in at the beginning of the 1980□s and revised during the Third International Conference on the Protection of the North Sea, held in March 1990.

With respect to atmospheric inputs to the North Sea, The Hague Declaration adopted the following measures, which in effect also set the monitoring requirements:

For an agreed group of 17 substances, North Sea states should seek a reduction of 50% in atmospheric emissions by 1995, or by 1999 at the latest, provided that the application of Best Available Technology, including the use of strict emission standards, enables the reduction, and

For substances that cause a major threat to the marine environment, and at least for dioxins, mercury, cadmium and lead, to achieve reductions between 1985 and 1995 of total inputs (via all pathways) of the order of 70% or more provided that the use of Best Available Technology or other low waste technology measures enable such reductions.

HELCOM

The HELCOM Convention came into force in 1980, and was revised in 1992. The nine Baltic states, Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, the Russian Federation and Sweden participate as signatories, as does the European Union. Belarus, the Czech Republic, Norway and Slovakia also participate in the work.

Most of the decisions of the Commission are made as recommendations for implementation by the contracting parties through their national legislation. Regarding monitoring and evaluation of the effects of the pollution, there is a recommendation to "Monitor(ing) the marine environment, airborne pollution and radioactive substances".

MEDPOL

The Long-term Programme for Pollution Monitoring and Research in the Mediterranean Sea (MEDPOL-II) was launched in 1981 within the framework of the Mediterranean Action Plan (MAP) adopted by the governments in the region, in Barcelona in 1975. The MEDPOL airborne pollution monitoring and modelling programme was prepared in 1987, with WHO and UNEP as lead agencies.

The MEDPOL monitoring program is joined by France, Italy, Croatia, Greece, Spain, Cyprus, Turkey, former Yugoslavia, Morocco and Israel.

2.2.3. Other international monitoring programmes

Global Air Quality Monitoring System (GEMS/AIR) of WHO

The GEMS/AIR Programme is a global programme for urban air quality management. Since 1975 the World Health Organization (WHO) and the United Nations Environment Programme (UNEP) have jointly operated the programme as a component of the United Nations Environment Monitoring System (GEMS). This again is a component of the UN Earthwatch System. During the 20 years of operation, the programme has developed activities in a number of areas, including

- support for the establishment of a global network of over 250 monitoring sites in about 80 cities in 40 countries.
- support of monitoring and assessment operations through training, expert advice, and logistical support.
- support of quality assurance procedures through collaborative reviews of city monitoring networks.
- development and publication of methodology handbooks.
- publication of air quality trends in selected cities around the world.

Since the beginning GEMS/AIR has sought to facilitate the monitoring and awareness of urban air quality particularly in developing countries.

In the participating countries, it was recommended to operate at least 3 stations located in city centre, in areas representative for commercial, industrial, residential areas respectively.

The GEMS/AIR network in Europe has through the last couple of decades consisted of up to 22 cities in 20 countries. The network is at present being reactivated after a period of very little reporting activity. For 1993 and/or 1994, only 9 countries/cities have reported data to the GEMS/AIR data base.

Global Atmospheric Watch (GAW) program of WMO

GAW was established in 1989 as an integration of the Global Ozone Observing System (GO3OS, established in the 1950s) and the Background Air Pollution Monitoring Network (BAPMoN, established in the 1960s).

The network consists of two categories of stations: global (baseline) and regional stations. Participation in the GAW network is voluntary. Baseline stations are considered as research centres with a very extensive monitoring program, while regional stations have a more flexible, less intensive programme. (The monitoring programme is described in Chapter 3.3.2.)

EUROTRAC Tropospheric Ozone Research (TOR)

The EUROTRAC programme (a joint European project with the main aim to study the impact of human activities on the troposphere over Europe) was established in 1983, and includes 3 subprojects doing field measurements:

- ALPTRAC: High Alpine Aerosol and Snow Chemistry Study.
- TOR: Tropospheric Ozone Research.
- TRACT: Transport of Pollutant over Complex Terrain.

Of these, TOR has a substantial, long-term monitoring program covering most of Europe.

EUROTRAC is a scientific research programme with voluntary participation from research institutes, universities and industry. Participants come from the following 24 countries: Austria, Belgium, Bulgaria, Croatia, Denmark, Germany, Finland, France, Greece, Hungary, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Romania, the Russian Federation, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom, and the EC.

The TOR scientific objectives are to ascertain the increase of ozone in Europe over northern mid-latitudes generally, to determine and model ozone trends, and to try to measure transfer of ozone into the free troposphere.

The monitoring program is describe in Chapter 3.3.2. It includes, in addition to ozone, oxides of nitrogen, CH4, CO, NMHC and meteorological data.

Arctic Monitoring and Assessment Program (AMAP)

The Arctic Monitoring and Assessment Program (AMAP) was established at the beginning of the 1990□s between the following parties: Sweden, Norway, Denmark, Iceland, Finland, the Russian Federation, Canada, and the United States.

The main goal for AMAP is to present the assessment of the Arctic environment contamination by acidic compounds, heavy metals, POPs, radionuclides, as well as to provide information on components contributing to global change of the environment. The assessment includes sources, fluxes, pathways, environmental levels, and environmental and health effects of the above mentioned groups of pollutants in the Arctic.

The program is now in its first phase, during which the assessment of problems have been the main emphasis. Planning of Phase 2 starts early 1997, during which the monitoring activities will be more important.

2.3. National requirements

National requirements to air quality monitoring are described for each country in the country summary texts in Appendix A, to the extent they are available.

For most countries, the national requirements are restricted "to check compliance with national and (for EU member states) EU Limit and Guide Values".

Examples of extended national requirements: In Austria the ozone law regulates the near-real-time information of the public about the ozone pollution situation throughout the country. In Slovakia the national requirements state specifically

the responsibility to "inform the public" about the pollution situation.

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