COMMISSION OF THE EUROPEAN COMMUNITIES

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Proposal for a

DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air

(presented by the Commission)

DRAFT EXPLANATORY MEMORANDUM

1 INTRODUCTION

Council Directive 96/62/EC of 27 September 1996[1] on ambient air quality assessment and management (the Air Quality Framework Directive) provides the framework for future EC legislation on air quality. The four objectives of the Air Quality Framework Directive are to:

– define and establish objectives for ambient air quality in the Community designed to avoid, prevent and reduce harmful effects on human health and the environment as a whole;

– assess ambient air quality in Member States on the basis of common methods and criteria;

– obtain adequate information on ambient air quality and ensure that it is made available to the public inter alia by means of alert thresholds;

– maintain ambient air quality where it is good, and improve it where it is not.

The proposed Directive relates to Annex I of the Air Quality Framework Directive, which lists atmospheric pollutants to be taken into consideration in the assessment and management of ambient air quality. Directive 1999/30/EC relating to limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead[2], Directive 2000/69/EC relating to limit values for benzene and carbon monoxide[3] and Directive 2002/3/EC relating to ozone in ambient air[4] are already in force. In addition to this legislation, there is provision in Annex I of the Air Quality Framework for regulating ambient air quality of arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons (PAH) by setting out criteria and techniques for assessing ambient air quality, and laying down provisions for forwarding information to the Commission and the public. Thereby the proposal incorporates the objectives of the Sixth Community Environment Action Programme[5].

2 THE NEED FOR COMMUNITY ACTION

The present proposal introduces Community legislation on arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in fulfilment of obligations under Directive 96/62/EC. The explanatory memorandum accompanying that Directive (COM(94)109 final) sets out the reasons for and the scope of the framework for action on ambient air quality.

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[1] OJ L 296, 21.11.1996, p.55.
[2] OJ L 163, 29.6.1999, p. 41.
[3] OJ L 313, 13.12.2000, p. 12.
[4] OJ L 67, 9.3.2002, p. 14.
[5] OJ L 242, 10.9.2002, p. 1

Arsenic, cadmium, mercury, some nickel compounds and PAH are known human carcinogenes for which no threshold for adverse effects on human health can be identified. The present proposal considers the obligation under the Treaty to apply the principle that exposure to such pollutants should be as low as reasonably achievable.

There is a number of existing legislation, international conventions and policies (cf. Section 3) which regulate the emissions of heavy metals and PAH to air. As a result heavy metals and PAH emissions are expected to decline significantly across the EU. However in some areas current ambient air concentrations are still posing a risk to human health. Economic evaluation of the costs and benefits shows that in urban and residential areas PAH emissions from domestic heating and road transport can be reduced to a concentration level, which would minimise harmful effects on human health, without entailing excessive costs. A target value is introduced for benzo(a)pyrene (BaP) to enforce the necessary regulations in Member States, in particular relating to non-industrial sources.

However, near some specific industrial installations the attainment of ambient air concentration levels, which would minimise harmful effects on human health , would entail excessive costs for any of the named pollutants except mercury. Regulations are in place to reduce industrial emissions of heavy metals and PAH to the air as far as economically possible.

So far the monitoring of the abatement measures relating to improving ambient air quality is not explicitly regulated, in particular where diffuse and fugitive emissions are concerned. Where ambient air concentrations and deposition give rise to harmful effects on human health and the environment harmonised monitoring is essential

– to assess the implementation and achievement of abatement measures in particular near fugitive and diffuse sources,

– to get information on local air quality and where improvement shall be envisaged,

– to monitor the state of the environment also with a view to soil degradation,

– to implement the UN/ECE Protocols on Heavy Metals and Persistent Organic Pollutants and the conclusions from the UNEP Global Mercury Assessment.

To combat problems of air pollution related to concentrations of heavy metals and PAH in ambient air the proposed Directive complements abatement strategies undertaken across the EU to comply with existing legislation and encourages further measures, where appropriate. Member States are responsible for determining and taking the specific actions, which are best suited to local circumstances.

3 EXISTING LEGISLATION AND POLICIES

3.1 National thresholds

There is at present no EC or US ambient air quality limit value for arsenic, mercury, nickel or PAH compounds. Some Member States set guide or target values that are not legally binding, ranging from 0.5 to 12.5 ng/m³ for arsenic, 0.25 to 5 ng/m³ for

nickel and 0.1 to 1.3 ng/m³ for BaP, which is a marker for the total polycyclic aromatic hydrocarbons (PAH) mixture. Italy has a legally enforceable ambient air quality standard of 1.0 ng BaP/m³. Sweden also has a guidance value of 2 ng/m³ for fluoranthene.

For cadmium, Belgium and Germany have introduced an ambient air quality standard of 40 ng/m³ as an annual mean. Germany has set a target value of 1.7 ng/m³. Austria and Germany have deposition limit values of 2 µg/(m²day), respectively 5 µg/(m²day). Switzerland has adopted an ambient air quality standard of 1.5 ng/m³ and a deposition value of 2 µg/(m²day). Target values for deposition in different Member States range from 0.27 to 20 µg/(m²day). There is at present no US ambient air quality or deposition limit value for cadmium.

3.2 Community legislation and policies

The following policies are considered to contribute to the reduction of emissions of arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons.

3.2.1 Directive 96/61/EC concerning integrated pollution prevention and control[6]

The IPPC Directive aims to achieve a high level protection of the environment by means of a permit system applicable to specified industrial activities. These include industrial sources of arsenic, cadmium, mercury, nickel and PAH. Among other items the permit shall address emissions to the air and must be based on the application of Best Available Techniques (BAT), i.e. it must take into consideration the costs and advantages of the techniques. The Directive applies to new installations since 1999, existing installations have to comply until October 2007.

3.2.2 Directives setting emission limit values

– Directive 2001/80/EC,[7] the new Large Combustion Plant Directive (LCP Directive), is likely to have some impact on heavy metal emissions from existing coal- and oil-fired LCPs as it will set limit values for total dust emissions. It will apply to new plants licensed after 1987 while older plants have to comply from 2008 onwards. The review due in 2004 could have even more of an impact on heavy metal emissions.

– Directive 2000/76/EC on the incineration of waste[8] covers a wide range of incineration and co-incineration processes. The Directive has potentially significant implications for heavy metal emissions, as there will be directly applicable emission limit values for specific metals and also for particulate matter (PM).

3.2.3 Other relevant Community legislation

– Directive 2000/60/EC establishing a framework for Community action in the field of water policy[9] sets out a further integrated approach to reducing, where

[6] OJ L 257, 10.10.1996, p.26.
[7] OJ L 309, 27.11.2001, p.1.
[8] OJ L 332, 28.12.2000, p.91.
[9] OJ L 327, 22.12.2000, p.1.

necessary, discharges of, among others, cadmium, nickel, mercury and PAH into the environment. Article 16 of that Directive classifies cadmium, mercury and PAH as priority hazardous substances.

– The limit values for PM_{10}[10] and lead set by the first Air Quality Daughter Directive 1999/30/EC are also relevant to emissions of other metals and PAH.

– Directive 98/70/EC relating to the quality of fuels limits the PAH content in diesel fuels. EU regulations on new vehicles that meet the EURO 4 emission standards will bring about a reduction of PAH as an important side-effect.

3.2.4 Related Community strategies

– Thematic Strategy for Soil Protection[11]

To avoid the loss of the function of soils and possible cross contamination of water the introduction of contaminants, such as heavy metals and persistent organic compounds must not exceed certain levels. The Commission's Communication on a Soil Strategy mentions, among others, local and diffuse soil contamination by deposition as a relevant cause for soil degradation. Deposition and accumulation of the named pollutants in soils lead to oral uptake via the food chain.

There is no evidence of significant reversal in negative trends in the degradation of soils. Detailed and comparable information on soil contamination will be necessary to devise a strategy to prevent further degradation. Besides soil monitoring the assessment of deposition would be necessary.

– Strategy on Health and Environment[12]

The strategy aims to develop a Community system that will provide the necessary information for assessing the overall environmental impact on human health. A key objective is to reduce exposure to priority environmental pollutants, such as heavy metals, having a significant health impact.

Long time scales are needed to account properly for persistent pollutants that accumulate in the environment. Some environmental burdens are present in the environment in very low doses. They accumulate in the environment, in the food chain and in human bodies. Their accumulative effects will only be visible after several years.

3.3 International action

3.3.1 The UN/ECE Protocol on Heavy Metals

The objective of the Protocol is to control emissions of heavy metals that are subject to long-range transboundary atmospheric transport and are likely to have significant adverse effects on human health or the environment. The Parties to the Protocol are

[10] particulate matter with an aerodynamic diameter of less than 10 m
[11] COM(2002) 179, 16.4.2002
[12] COM…

encouraged to reduce their emissions of heavy metals and to monitor the concentration and deposition by harmonised methodologies.

Entry into force of the Protocol can be expected soon as fourteen out of the required minimum sixteen Parties have ratified the Protocol among them the European Community[13].

3.3.2 The UN/ECE Protocol[14] and the UNEP Convention[15] on Persistent Organic Pollutants

Parties to the Protocol are obliged to reduce their emissions of, among other pollutants, PAH. The Convention requires the Parties to implement control measures on releases of persistent organic compounds, to facilitate exchange of information and public awareness as well as access to information. PAH emissions are subject to release reduction provisions.

So far the Protocol has been ratified by fourteen Parties out of the necessary sixteen. It can therefore be expected to come into force in 2003. The Convention has been ratified by 26 Parties; it enters into force after the fiftieth ratification which may be expected in 2004. Ratification of both, the Protocol and the Convention by the European Community is under preparation.

3.3.3 The UNEP Global Mercury Assessment Report[16]

The report summarises existing information on the chemistry, toxicology, and impacts of mercury on human health and the environment and on the global natural and anthropogenic sources of mercury. It consolidates and analyses information regarding relevant environmental long-range transport and the origin, pathways, deposition and transformation of mercury on a global scale. It summarises information about prevention and control technologies and practices, and their associated costs and effectiveness, that could reduce and/or eliminate releases of mercury, including the use of suitable substitutes, where applicable.

The report concludes that there is sufficient evidence of significant global adverse impacts to warrant international action to reduce the risks to human health and/or the environment arising from the release of mercury into the environment. Nonetheless, further research and other activities would be useful to improve the understanding and coordination in a number of areas; this includes assessment and monitoring of mercury levels and impacts on humans and ecosystems.

The Council has agreed to the conclusions of the report.[17]

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[13] COM …
[14] POP protocol
[15] Stockholm Convention
[16] UNEP mercury report
[17] Nov Council 2002

4 STAKEHOLDER INVOLVEMENT AND INFORMATION SOURCES

The Air Quality Framework Directive provides that daughter legislation should have solid technical and scientific justification in accordance with the Treaty. Technical Working Groups of experts from Member States, industry, non-governmental organisations, the European Environment Agency, the World Health Organisation and other representatives of international scientific groups and the Commission have met to assess the current state of knowledge and to prepare technical position papers on each pollutant. These Working Groups were chaired by experts from the Member States. They came up with three position papers, one on arsenic, cadmium and nickel, one on polycyclic aromatic hydrocarbons (PAH) and another on mercury. The latter not only covers mercury in ambient air but addresses the whole cycle of mercury in the environment. The position papers are available on the Commission's website.[18]

The Commission signed a Common Agreement with the World Health Organisation's Regional Office for Europe to work co-operatively on air quality and in particular on a revision of the Guidelines. The updated Air Quality Guidelines for Europe[19] were made available to the Working Groups, and experts from the WHO European Centre for Environment and Health participated in the Working Groups referred to above. The Scientific Committee for Toxicity, Ecotoxicity and Environment (CSTEE) was consulted to give its view on the assessment of desirable concentration levels based on cancer and non cancer effects.[20]

Two separate studies entitled "Economic evaluation of air quality targets for heavy metals" and "Economic evaluation of air quality targets for PAH", respectively were undertaken by consultants for the Commission. These studies have included the EU 15 Member States plus to a large extent Accession Candidate Countries, i.e. Cyprus, Czech Republic, Estonia, Hungary, Poland and Slovenia. Data from Accession Candidate Countries were considered to the extent possible, thereby taking into account the situation in these countries. Both studies are also available on the Commission's website[18]. They took as their baseline a "business-as-usual" scenario taking into account policies at EU and international level that are expected to secure significant further reductions of emissions until 2010. They paid particular attention to the key policies listed in section 3.2.

The proposal was subject to consultations at several meetings of the Clean Air for Europe (CAFE)[21] Steering Group, where representatives from Member States, Accession Candidate Countries and other stakeholders had the opportunity to comment.

[18] http://www.europa.eu.int/comm/environment/air/ambient.htm#2
[19] Air Quality Guidelines for Europe, Second Edition, WHO, Copenhagen, Denmark, 2000.
[20] http://europa.eu.int/comm/food/fs/sc/sct/index_en.html
[21] COM (2001) 245

5 AMBIENT AIR CONCENTRATIONS AND EMISSION DATA

5.1 Arsenic

Arsenic is a metalloid that forms a variety of inorganic and also organic compounds. Arsenic in ambient air is mostly found in the fine particle fraction PM2.5.

Current ambient air concentrations of arsenic at rural sites generally do not exceed 1.5 ng/m³, with lowest values of 0.2 ng/m³. Urban background levels show a range of 0.5 to 3 ng/m³. Arsenic concentrations monitored near industrial installations may be up to one order of magnitude higher depending on the type of installation and the distance and position of the monitoring site.

Total arsenic emissions in the Community in 1990 are estimated to be 575 tonnes, 86 % of which is emitted by stationary combustion. However, in general the emissions from this sector do not result in relevant ambient air concentrations as they are released via sufficiently high stacks. Due to their fugitive character emission from the iron and steel and non-ferrous metals industry, mainly in copper and lead production, are more relevant to ambient air quality though they contribute only 9 % to the arsenic emissions.

In general anthropogenic sources outweigh natural sources; the global natural share is estimated at 25 %, mainly from volcanoes. On a local scale there may be more significant contributions up to 60 % from weathering processes in regions rich in sulphidic ore deposits.

5.2 Cadmium

Cadmium is a relatively rare element, which occurs mainly in association with sulphide ores of other metals. Cadmium in ambient air is mostly found in the fine particle fraction PM2.5. There are no data available on the speciation of cadmium in suspended particulate matter.

Current ambient air levels of cadmium at rural sites generally do not exceed 0.4 ng/m³, with lowest values of 0.1 ng/m³. Urban background levels show a range of 0.2 to 2.5 ng/m³. Cadmium concentrations near industrial installations may be up to one order of magnitude higher, depending on the type of installation and the distance and position of the monitoring site.

Total emissions in the Community amounted to 203 tonnes in 1990. The iron and steel industries, stationary combustion and transport each contribute around 20 % to the total anthropogenic emissions of cadmium.

Relevant ambient air concentrations result from the non-ferrous metals industry, which contributes about 14 % of the emissions. Same as for arsenic, cadmium compounds are released into the atmosphere from copper and lead production processes. However, zinc production is the most relevant non-ferrous metals sector regarding cadmium emissions. Zinc is associated with cadmium and the concentrates are a source of this metal.

Anthropogenic sources considerably outweigh natural sources such as volcanogenic aerosols and windblown dust. Estimates for global natural share amount to 10 %.

5.3 Mercury

Mercury may occur in several stable isotopes. In the environment it is mainly found as elemental mercury and methyl mercury. In ambient air elemental mercury vapour is the most common compound. Due to its long lifetime in the atmosphere, mercury is transported over large distances. Deposition plays a major role in the transfer of mercury from the atmosphere to surface waters and soil or vegetation, and there is now steady accumulation of mercury in soils. In the aquatic environment, mercury is transformed into methyl mercury.

Mercury is monitored only at a few sites and in general not on a continuous basis. Concentrations of total gaseous mercury vary between less than 2 ng/m³ at European background locations to a maximum of about 35 ng/m³ at heavily impacted locations. No trends are available for ambient air concentrations of total gaseous mercury. However concentrations of mercury in precipitation show a constant downward trend since 1995.

Natural emissions contribute about one third of total mercury emissions in Europe mainly in gaseous elemental form. Volcanoes are seen as one of the major natural sources of mercury together with exhalation of the element from aquatic and terrestrial ecosystems.

Anthropogenic emissions of mercury are mainly from coal combustion and waste incineration (about 50 %). In 1990, it was estimated that the chlor-alkali industry contributed 12 % of the total of 245 tonnes in the Community. The EU-15 contribute about one third of total European anthropogenic emissions. As much as 60 % of anthropogenic emissions of mercury in Europe are estimated to be in a gaseous elemental form, 30 % as gaseous bivalent mercury and 10 % as elemental mercury on particles.

The accuracy of emission estimates for anthropogenic sources is within 30 %, except for waste incineration where it is believed to be much higher. Emission estimates for natural sources are thought to be much less accurate than emission estimates for anthropogenic sources.

5.4 Nickel

Nickel exists in a variety of species which can be classified as metallic, oxidic and sulphidic nickel, or soluble nickel salts.

Current ambient air concentrations of nickel at rural sites generally do not exceed 2 ng/m³, with lowest values of 0.4 ng/m³. Urban background levels show a range of 1.4 to 13 ng/m³. Nickel concentrations monitored near industrial installations may be up to one order of magnitude higher depending on the type of installation and the distance and position of the monitoring site.

Which nickel compounds are predominant in ambient air depends on their origin. Although around 50 % of nickel from combustion sources may be soluble, this applies to less than 10 % of sulphidic nickel. Indicative measurements show oxidic

nickel to be the main fraction in ambient air. As regards size distribution, nickel in ambient air has significant shares of coarse particles with a diameter around 10 μm.

Major anthropogenic sources of nickel are stationary combustion (55 %) and mobile sources and machinery other than road transport (30 %). The latter figure is not confirmed by national inventories, which attribute only a few percent to this source. Total emissions from the Community in 1990 were 4860 tonnes. With a view to air quality the relevant sources are petroleum refining and fugitive emissions from the electric arc furnace steel works.

Important natural sources of nickel are windblown soil and volcanoes. Anthropogenic sources considerably outweigh natural sources. Globally, they are estimated at 35 %, but in Europe may be presumed to be lower as there are hardly any significant nickel deposits.

5.5 Polycyclic aromatic hydrocarbons

Polycyclic aromatic hydrocarbons (PAH) are a large group of compounds, consisting of two or more fused aromatic rings made entirely of carbon and hydrogen. While the physico-chemical properties of PAH vary considerably, the semi-volatile property of some PAH makes them highly mobile throughout the environment, with deposition and re-volatilisation processes distributing them between air, soil and water. Some PAH are subject to long-range transport through the atmosphere making them a transboundary environmental problem.

Comparable and consistent ambient PAH concentration figures for the whole of the EU region are sparse and do not allow a detailed analysis of either total or species-specific concentrations. The figures which do exist centre on concentrations of BaP.

In the 1990s, typical annual mean concentrations for BaP in ambient air varied between 0.1 and 1 ng/m^3 in rural background areas; between 0.5 and 3 ng/m^3 in urban areas (traffic sites are included at the upper part of this range); and up to 30 ng/m^3 in the immediate vicinity of certain industrial installations. There is little measurement data for rural communities burning coal and wood domestically, but those measurements do suggest levels similar to those found in cities. Concentrations can be high close to large industrial sites and busy roads.

PAH are emitted from a number of industrial, agricultural and domestic sources, major contributors being combustion of solid fuels (best estimate: 50 % of total Benzo(a)pyrene (BaP) emissions), and to a much lesser extent primary aluminium production (15 % in 1990)and cokeries (5 % in 1990) . A further source is the exhaust from road transport, i.e. from diesel engines (5 %). Important natural sources are fires and volcanoes. BaP from industrial and mobile sources is largely associated with the PM2.5 fraction. BaP from domestic sources is associated with a larger range of particle size.

Current emission inventories have a high uncertainty because 75 % of the emissions come from diffuse sources. For the relevant industrial sources no reliable emission estimate is possible because of substantial diffuse and fugitive emissions. Moreover emissions inventories are often not directly comparable as some address BaP only, whilst others include additional compounds which are not always specified. Despite current uncertainties in PAH emission inventories, a continued reduction in total

mass emission from 1990 to 2010 is anticipated, predominantly related to industrial and mobile sources.

Agricultural and natural sources such as stubble-burning or accidental burning of forests may contribute significantly to PAH levels in certain locations. Due to uncertainties in the emission factors and the frequency of these events, it is difficult to quantify their contribution.

6 ABATEMENT STRATEGIES

From Section 5 it can be concluded that industrial emissions of arsenic, cadmium, and nickel affecting ambient air quality come from non-ferrous metals industry, electric arc steel works and petroleum refineries.

These industrial activities are all subject to the IPPC Directive and are thereby required to apply BAT by 2007 at the latest. Member States are obliged to take account of the BAT reference documents (BREFs), which provide European level sector benchmarks on what constitutes BAT when setting permit conditions. Several BREFs[22] address fugitive heavy metal emissions from industrial sources and set out the best techniques to reduce these to achieve a high level of environment protection.

It is to mention that in assessing the implementation of the IPPC directive a lack of common understanding and application of BAT and inadequate monitoring were identified among the major shortcomings. With regard to industrial sources the IPPC Directive refers to monitoring as a precondition to assess the abatement measures laid down in the permits. A BREF on the General Principles of Monitoring emphasises the increase in the relative importance of diffusive and fugitive sources and the growing need to monitor those releases. To this purpose the BREF recommends to quantify emissions from down-wind air quality data and from the deposition of relevant pollutants.

The BREF on the non-ferrous metals industry mentions that heavy metals can be emitted from most stages of the production process. It reports fugitive emissions from smelters of the same order of magnitude as stack emissions and mentions storage, handling and pre-treatment of raw materials as a major source of diffuse and fugitive releases. Maintenance is identified as a key abatement measure in this sector.

Petroleum refineries meet different technical standards. Moreover the emission rates depend on whether high or low sulphur crude oil is used. The release of heavy metals occurs mainly via the flue gases from process-fired heaters and boilers. Emission reduction by switching to low sulphur crude oil is restricted by the limited availability of the product and technical requirements. In some places the use of natural gas as a replacement fuel could be a reasonable abatement option. The BREF on Mineral Oil and Gas Refineries lists a limited number of further options to abate releases to ambient air, such as optimisation of catalytic cracking and retrofitting heaters and boilers of older installations.

The BREF on the Production of Iron and Steel refers to an increase of the dust collection efficiency as a major abatement option in electric arc steel works. Besides

[22] http:///eippcb.jrc.es

optimisation of raw material handling and storage it is mentioned that emphasis should be given to waste gas de-dusting by application of a well-designed fabric filter.

As can be seen from Section 5 high ambient air concentrations of PAH are mainly due to domestic heating by solid fuels, but also to a lesser extent to road transport, cokeries and aluminium production.

Emissions from solid fuel consumption for domestic heating, i.e. wood and biomass burning and the use of coal, can be substantially reduced by the application of rules of good practice. They are not regulated through Community legislation and the net size of this source is likely to remain constant up to 2010 without any additional incentive. Increased combustion efficiency in modern stoves could lead to substantial reductions in PAH emissions.

The BREF on the production of iron and steel refers to cokeries. It lists diffuse and fugitive emissions from various sources such as leakages from lids, oven doors and leveller doors, ascension pipes and emissions from certain operations like coal charging, coke pushing and coke quenching as relevant sources of PAH. In addition, fugitive emissions arise from the coke oven gas treatment plant. To abate such emissions the BREF recommends placing emphasis on smooth and undisturbed operation as well as on maintenance of coke ovens.

Emissions from aluminium production are only relevant for air quality near plants still using the Söderberg process. PAH emissions from a Söderberg plant are two orders of magnitude higher than those from one based on anode baking.

The Directive 98/70/EC relates to the quality of fuels limits the PAH content in diesel fuels. A further reduction of total mass emission from road transport could be achieved by introducing measures that would reduce particulate emissions from the diesel engines.

This proposal will monitor the effectiveness of measures implemented under the IPPC Directive by assessing the air quality near industrial installations. Relating to these installations it does not entail any measures beyond the application of BAT as required by IPPC. In particular the concept of BAT, i.e. requiring only such techniques which allow implementation under economically and technically viable conditions, prevents the closure of existing installations to meet air quality standards. Furthermore for sectors not covered by the IPPC Directive, e.g. domestic heating by solid fuels and road traffic, this proposal will require Member States to implement all abatement measures that are not entailing excessive costs.

7 IMPACT ON HUMAN HEALTH

The Working Groups mentioned in Section 4 concluded on ambient air concentration levels, which would minimise harmful effects on human health. The assessment is based on the concept of unit risk, which corresponds to the extra risk to conceive cancer, if continuously exposed to 1 $\mu g/m^3$ for a lifetime. For pollutants where WHO provides a unit risk thresholds relateto an acceptable excess lifetime risk. As WHO provides no recommendation as to what level of risk is acceptable, the approach followed by the Working Groups was the same as that of Directive 98/83/EC on the

quality of water intended for human consumption[23], where an additional lifetime risk of one in a million was used as the starting point. Where no unit risk could be provided the assessment of impacts on human health has regard to non-cancer effects. The proposed protection levels were in general supported by the Scientific Committee for Toxicity, Ecotoxicity and Environment (CSTEE)[24]. The Committee also emphasized, in the case of PAHs, the limitations of current scientific, technical, epidemiological knowledge to assess a level of risk of these concentrations in ambient air and recommended further research.

7.1 Arsenic

Arsenic in ambient air may have important effects on human health. In addition to non-carcinogenic effects the most significant adverse effects from prolonged exposure to arsenic are lung and skin carcinogens. The International Agency on the Risks of Cancer (IARC) classifies arsenic as a known human carcinogen. The Working Group on metals felt that at present there is not sufficient evidence that arsenic may act as a genotoxic[25] agent, implying that for the known mechanisms a safe threshold does exist. On the contrary CSTEE is of the opinion that arsenic should be classified as genotoxic. Oral uptake of arsenic is of minor importance compared to carcinogenic effects due to inhalation.

In presuming arsenic to be a genotoxic human carcinogen, and thereby concluding that there is no threshold level below which no effect would occur, any assessment of the risk to human health should be based on the unit-risk-approach. WHO proposes a unit risk of 1.5×10^{-3} $(\mu g/m^3)^{-1}$ for arsenic. This unit risk is the extra risk of contracting lung cancer, if continuously exposed to 1 $\mu g/m^3$ for a lifetime. Translating this unit risk into an annual average concentration that equates to a lifetime risk of one in a million, gives a concentration of 0.66 ng/m³.

However, with regard to the likely existence of a threshold, the Working Group felt that the unit-risk-approach would overestimate the true risk. The majority of the members supported a "pseudo-threshold" approach concluding that annual mean concentrations of total arsenic below a range of 4 to 13 ng/m³ would minimise harmful effects on human health.

7.2 Cadmium

Though generally the oral uptake of cadmium is the most important route of exposure there is sufficient evidence that cadmium in ambient air constitutes a risk to human health. It may have important cancer as well as non-cancer effects and there is also a reasonable chance that it could be genotoxic. With regard to non-cancer effects the kidney is the critical organ. From occupational studies a LOAEL[26] of 100 µg/m³ times years was identified by WHO in connection with renal dysfunction. Extrapolating this to a NOAEL[27] taking into account lifetime exposure and intraspecies uncertainty WHO recommends a non-cancer limit value of 5 ng/m³.

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[23] OJ L 330, 5.12.1998, p.32.
[24] http://europa.eu.int/comm/food/fs/sc/sct/index_en.html
[25] genotoxic substances are capable of causing damage to DNA
[26] Lowest-observed-adverse-effect level, as defined by the WHO Air Quality Guidelines for Europe
[27] No-observed-adverse-effect level, as defined by the WHO Air Quality Guidelines for Europe

Though cadmium and its compounds are classified as a human carcinogen by IARC, WHO felt unable to recommend a reliable unit risk due to the influence of confounding exposure to arsenic in the available epidemiological studies. Without taking account of possible confounding, the US EPA recommends a unit risk of 1.8 10^{-3} $(\mu g/m^3)^{-1}$. By accepting an excess risk of one in a million this results in a concentration of 0.24 ng/m³.

The Working Group on metals and the CSTEE considered the US EPA approach to be overprotective, though they agree that there is not sufficient evidence to classify cadmium as non-genotoxic. They recommend that an annual mean of the total concentration of cadmium in ambient air of 5 ng/m³ should not be exceeded to prevent adverse non-cancer effects. This corresponds to accepting at most an excess life-time risk of 20 cases per million.

7.3 Mercury

The impact of mercury on human health and the environment results from different toxicokinetic mechanisms depending on the chemical form, i.e. elemental mercury, and organic and inorganic mercury compounds.

The major exposure route to mercury is via ingestion. Chronic exposure to mercury through any route can produce central nervous system damage and have adverse effects on the kidneys. It may damage developing foetuses and decrease fertility in males and females. Methylmercury is classified as a possible human carcinogen by IARC, while elemental mercury is considered not classifiable. Metalllic mercury is not classifiable as to carcinogenity according to IARC. Mercury may cause muscle tremors, personality and behaviour changes, memory loss, metallic taste, loosening of the teeth, digestive disorders, skin rashes, and brain and kidney damage. It can cause skin allergies and accumulates in the body.

Exposure to elemental mercury, i.e. Hg(0), is mainly from dental fillings and only to a minor extent from inhalation or ingestion. Based on a LOAEL-approach it was found that an annual average concentration of 50 ng Hg(0) per m³ should not be exceeded in ambient air.

Inorganic mercury compounds are only poorly absorbed and the majority of the inhaled or ingested dose is excreted in faeces.

7.4 Nickel

The non-cancer effects on human health of nickel in ambient air are in the respiratory tract, the immune system and endocrine regulation. Effects depend on the form of the nickel, soluble nickel compounds having the greatest impact.

The Working Group on metals and the CSTEE found that no NOAEL could be identified from available studies. Starting from a LOAEL of 0.06 mg/m³, taking into account inter- and intraspecies uncertainties and extrapolating from non-continuous to life-time exposure the Working Group recommended that a total concentration of between 10 and 50 ng/m³ of nickel in ambient air as an annual average should not be exceeded. The CSTEE regards the lower value as appropriate, but proposes to work on the assumption that soluble nickel compounds in general form no more than 50 %

of total nickel in ambient air. Accordingly CSTEE recommends that to prevent non-cancer effects from nickel a concentration of 20 ng/m³ should not be exceeded.

IARC classified several nickel compounds as carcinogens and metallic nickel as possible carcinogen . As there is not sufficient evidence that nickel is non-genotoxic the Working Group on metals and the CSTEE felt that no threshold could be set. The WHO recommends a unit risk of 3.8 10^{-4} $(\mu g/m^3)^{-1}$. Based on this number an excess lifetime risk of one in a million corresponds to a concentration of 2.5 ng/m³. CSTEE considers this to be a conservative estimate as even sulphidic nickel, the most prevalent compound, contributes only 10 % of the total nickel concentration in ambient air. CSTEE therefore considers that a concentration of 20 ng/m³ provides reasonable protection from carcinogenic effects.

7.5 Polycyclic aromatic hydrocarbons

Humans are never exposed to single PAH compounds, so it has not been possible to classify individual PAH compounds as proven human carcinogens. Ambient PAH include substances which are classified by IARC as probable or possible carcinogens. Several PAH are genotoxic as well. The exposure route is via inhalation into the lungs of PAH compounds associated with airborne particles.

Occupational studies exist which can be used as the basis for estimating the risk to human health posed by ambient levels of PAH. On the balance of current evidence, the Working Group has adopted BaP as an indicator compound for assessing the risks associated with ambient mixtures of PAH compounds. On the other hand, CSTEE is of the opinion that present evidence only allows BaP to be used as a semi-quantitative marker for the presence of carcinogenic PAH. Because there are insufficient data available, CSTEE recommends further research.

Extensive mechanistic studies have shown that many PAH compounds - including some present in ambient air - are complete carcinogens, i.e. they can both induce and promote cancer. These effects are referred to as genotoxic and epigenetic effects, respectively. In presuming BaP to be a genotoxic human carcinogen, and thereby concluding that there is no threshold level below which no effect would occur, any air quality standard should be based on the unit-risk-approach. However the dose-response relationship of promotion is better described by an S-shaped curve - it being accepted that there is a threshold of effect below which promotion will not take place.

The WHO proposes a unit risk of 8.7 x 10^{-5} $(ng/m^3)^{-1}$ for BaP. This unit risk is the extra risk of contracting cancer if continuously exposed to 1 $\mu g/m^3$ for a lifetime. The WHO provides no recommendation as to what level of risk is tolerable. Translating the unit risk given above into an annual average concentration, which equates to a lifetime risk of one in a million, gives a concentration of 0.01 ng/m³. The Working Group and CSTEE are both of the opinion that given the presumed S-shape of the dose response, a linear extrapolation of this kind most likely overestimates the carcinogenic risk.

8 DEPOSITION – IMPACT ON SOIL, WATER AND CROPS

Local and diffuse soil contamination by deposition is a relevant cause for soil degradation. Deposition and accumulation of heavy metals and persistent organic pollutants in soils lead to oral uptake via the food chain. For systemicly acting pollutants like cadmium, the oral uptake from food or soil (children) can be more important than the inhalation. In the long term, accumulation of metal compounds and PAH in soil can cause problems by increased uptake and contamination of plants. In the short term, dust deposits also cause contamination of above-ground plant parts. This can enhance transfer to humans via contact, e.g. children having contact with plants and bare soil and taking up heavy metals via contaminated hands, or by the consumption of vegetables.

Taking into account the levels of arsenic, cadmium and nickel compounds in the environment, the Working Group on Metals (see Section 4) found that cadmium is without any doubt the most relevant metal for oral uptake.

Cadmium compounds act as systemic pollutants and their transfer into the food chain is of particular relevance. The Working Group therefore recommends that deposition of cadmium should not exceed 2.5 to 5 µg/(m²day) as an annual mean. This range is based on a tolerable daily dose of 0.75 to 0.95 µg per kg body weight and day. The recommendation does not pay particular regard to the evidence that cadmium has been accumulating in soils for recent decades. A thematic strategy for avoiding further degradation of soils due to the contamination is currently prepared by the Commission.

Furthermore the Working Group found that the oral uptake of arsenic is the most important route of exposure, however regarding its carcinogenic effect inhalation is of major importance. For nickel the Working Group found that the risk evaluation is clearly dominated by effects on the respiratory system.

Whilst the physico-chemical properties of PAH vary considerably the semi-volatile property of some PAH makes them highly mobile throughout the environment, deposition and re-volatilisation distributing them between air, soil and water bodies. Same as for other persistent organic pollutants accumulation of PAH promotes degradation and the functioning of the soil.

The most important exposure route of methylmercury (MeHg) is oral uptake through diet, in particular through fish. Methylmercury is the most important organic mercury compound as it is rapidly and extensively absorbed through the gastrointestinal tract. A reference dose of 0.1 µg MeHg per kg body weight and day is recommended by the US EPA and is considered appropriate for Europe as well.

Elemental mercury emitted into the atmosphere is deposited, thus entering terrestrial and aquatic ecosystems where it is converted into MeHg. However major parts of the mercury cycle in the environment are still unknown and subject to further research. This applies to emissions, transport, deposition, transformation and bioaccumulation. The Working Group on Mercury (see Section 4) stated that there is no universal relationship between the anthropogenic emission of mercury and MeHg concentrations in fish.

To assess the effectiveness of control measures and overall input into aquatic and terrestrial ecosystems a mandatory monitoring network for total gaseous mercury in ambient air and mercury in deposition should be established in the Community.

9 COSTS AND BENEFITS

The purpose of the economic studies mentioned in Section 4 was to estimate the additional costs and the likely benefits of actions required to meet the range for ambient air concentration levels, which would minimise harmful effects for human health, as recommended by the Working Groups mentioned earlier.

The studies took a sector-specific approach, investigating the profile of each sector by analysing sources of emissions and how they could be reduced. A comparison of future air quality in 2010 under "business-as-usual" against the considered concentration levels led to an investigation of packages of additional emission reduction techniques to enable compliance. Finally a cost assessment was done to identify the least costly package.

The studies considered impacts on mortality from exposure. Benefits were quantified in monetary terms in order to allow them to be compared with the costs of meeting the considered concentration levels.

It must be stated that secondary benefits have not been taken into account, as it is not yet possible to monetise them. These benefits include for example reductions in adverse impacts on ecosystems and crops or reductions in occupational exposure.

Economic aspects relating to mercury were not studied as there is no indication that current ambient air concentrations pose a significant risk to human health.

The costs associated with the monitoring of air quality concentrations and deposition have been assessed concluding from current operation costs in selected Member States.

9.1 Arsenic

Following discussions in the Working Group on metals, costs and benefits were estimated with regard to emissions from relevant sources for five possible concentration values, namely 20 ng/m³, 13 ng/m³, 5 ng/m³, 4 ng/m³, and 1 ng/m³. It was considered technically impossible to attain the lowest value at nearly all sites by the target year 2010. For one copper production site and one lead production site, plant closure was considered the only way of achieving even the highest of these values. In order to achieve the recommended range of concentrations from 4 to 13 ng/m³, the study concluded that where compliance techniques could be applied costs clearly outweigh the specific quantifiable benefits.

Application of BAT to the nine major copper refineries in the EU-15 is presumed to result in maximum ambient air concentrations in the range of 10 to 20 ng/m³. An estimate of €19 million per year is given for attainment costs in the copper sector. Benefits resulting from lower mortality due to the attainment of a concentration in the range of 4 to 13 ng/m³ were estimated to amount to only €0.1 million per year.

There were insufficient data available to quantify costs at lead production sites. Compliance at nickel and nickel alloy production sites would be achieved through investment in abatement measures for nickel (see Section 9.3).

9.2 Cadmium

Following discussions in the Working Group on metals, costs and benefits were estimated for three possible concentration values, namely 15 ng/m³, 5 ng/m³ and 0.5 ng/m³. The lowermost value was considered unlikely to be attainable at nearly all sites by the target year 2010. For one copper production site and one lead production site, plant closure was considered the only way of achieving even the highest of those values. In order to achieve the recommended concentration level of 5 ng/m³, the study concluded that where compliance techniques could be applied costs would clearly outweigh the specific quantifiable benefits.

Monitoring data from the 1990s show cadmium concentrations of 30 ng/m³ or even higher near zinc production sites. Application of BAT is supposed to achieve the recommended concentration level at 14 out of the 19 major zinc production sites. For the remaining five sites a best estimate of a total of €24 million per year is given for attainment costs. Benefits from lower mortality due to the attainment of the named concentration level would amount to only €0.2 million per year.

At two copper production sites it was considered technically impossible to achieve the named concentration level, mostly due to resuspension, whereas at the remaining sites compliance could be achieved by investing in abatement measures for arsenic (see section 9.1). There were insufficient data available to quantify costs at lead production sites.

9.3 Nickel

Following discussions in the Working Group on metals, costs and benefits were estimated for four possible concentration values: 50 ng/m³, 30 ng/m³, 10 ng/m³ and 3 ng/m³. The lowest value was considered unlikely to be attainable by the target year 2010 at nearly all sites, while 50 ng/m³ was considered to be attainable at all sites without any additional costs. For concentrations in the range of 20 ng/m³ the study concluded that where compliance techniques could be applied, costs would clearly outweigh the specific quantifiable benefits. Moreover, the study concluded that it was technically impossible to attain a value of 10 ng/m³ near the nine copper production sites in the EU-15.

Substantial investment costs would be necessary beyond implementation of existing legislation to attain a concentration of 10 ng/m³ near specific industrial installations. A best estimate of €405 million per year is given for costs at 48 petroleum refineries in the EU-15; costs for compliance techniques to be applied at 11 petroleum refining sites to achieve a value of 30 ng/m³ are estimated to €136 million. Attainment costs were estimated at between €54 and 73 million per year at the 34 out of about 250 electric arc furnaces and at €6 million per year at the four nickel and nickel alloy production sites. Benefits resulting from lower mortality due to the attainment of a concentration of 20 ng/m³ were estimated at only €0.3 million per year.

There were insufficient data available to quantify attainment costs at zinc and lead production sites, and the costs for emissions from shipping in the vicinity of ports.

9.4 Polycyclic aromatic hydrocarbons

Following discussions in the Working Group on PAH, costs and benefits were estimated with BaP serving as a marker. Five possible concentration values - 5.0 ng/m³, 1.0 ng/m³, 0.5 ng/m³, 0.05 ng/m³ and 0.01 ng/m³ - were investigated with a view to attainment by 2010. The lowest of these standards is clearly far exceeded by current background concentrations and could not be attained by 2010 if ever.

At present, ambient air concentrations of more than 5 ng/m³ can be observed in the vicinity of cokeries and aluminium plants using the Söderberg process. In 2010 these PAH ambient air levels are still to be expected, even using BAT. To attain a concentration value in the range of 1 to 5 ng/m³, the only alternative to plant closure would be conversion into a new plant. However, the best cost estimate – of about € 10 million for a plant conversion from the Söderberg process to a pre-bake technology plant - would clearly outweigh the total benefits for all plants, which work out at €3 million in terms of lower mortality.

According to estimates, solid fuel consumption for domestic heating, i.e. wood and biomass burning and the use of coal, is expected to be the cause of 86 % of the lung cancers in the EU 15 which will be attributable to PAH in 2010. An economic study carried out for the Commission estimates the benefits of reducing emissions to meet a concentration value of 1 ng/m^3 BaP to be approximately €150 million a year and total costs for stove optimisation in the EU 15 at € 2,5-€ 3,7 billion over 10 years. The study points out that these cost estimates are uncertain and should be regarded as a maximum. The report concludes that annualised costs will be of a broadly similar magnitude to the estimated benefits. The ratio between costs and benefits varies between Member States, because of different ambient air concentrations, penetration rates and replacement costs for new stoves etc. Therefore, to decide on which measures to implement in regions where the target value is exceeded, the competent authorities concerned should base themselves on a specific assessment of which measures will be appropriate in their region.

Many of the measures that could be introduced to reduce PAH emissions from traffic will follow from legislation on other pollutants, and from measures to reduce congestion in towns and cities. But it will clearly be difficult to define baseline concentrations for 2010 because of uncertainty over the extent to which these measures will be implemented. A best estimate of the benefits of meeting 1 ng/m³ BaP for traffic emissions would be €7 million per year.

9.5 Costs for monitoring air quality and deposition

Based on data from selected Member States who are running monitoring stations on an operational base the average analysing costs per sample are estimated to €15 for each of the heavy metals and €100 for BaP. The total number of samples is calculated based on the provision that monitoring would be mandatory where ambient air concentrations pose a significant risk to human health.

Concluding from the economic study on PAH BaP monitoring would be required around most of the cokeries, in some residential areas and in several agglomerations. Overall about 100 sites for fixed measurement may be required within the EU 15. Based on time coverage of 33 % and 24-hour sampling. Including also the background monitoring of BaP concentration and deposition at about 40 sites taking

20 samples per year, total costs for BaP monitoring would amount to about €1,5 million per year.

Concluding from economic assessment about 100 monitoring sites for arsenic, cadmium and nickel would have to be operated in the EU 15. Based on a sampling period of no more than one week and a time-coverage of 50 % the overall annual costs can be estimated to €250 000.

From a background monitoring of ambient air concentrations and deposition rates of arsenic, cadmium and nickel at about 40 sites with a lower sampling frequency, i.e. 20 samples per year, there would result costs of about €80 000 per year.

10 THE SITUATION IN AN ENLARGED EUROPEAN COMMUNITY

Information on the situation in the Accession Countries (AC) is available from data reported under the Convention on Long-Range Transboundary Air Pollution[28]. From data submitted for 1999 it may be concluded that total cadmium and PAH emissions from the ten AC exceed those from the EU 15 while emissions of arsenic and nickel are some 50 % of EU 15 levels.

As in the European Community, the iron and steel and non-ferrous metals industries are the major contributors to arsenic, cadmium and nickel emissions in the enlargement area. Because of its industrial structure, up to half of the emissions come from Poland; with further major contributions from Bulgaria and Romania. Lithuania has significant nickel emissions. As in the EU 15 a downward trend has been observed since 1990. Implementation of the a*cquis communautaire* will ensure a further reduction of environmental emissions.

BaP emissions in the enlargement area exceeded Community figures for 1999, major contributors being Poland, Romania and the Czech Republic. Since 1990 the trends has been only slight downwards. Although no sectoral analysis is available for PAH emissions, it may be assumed from general emission patterns that major sources are domestic heating and cokeries.

There is little monitoring data on ambient air concentrations of heavy metals and PAH for the accession countries. From the information available it may be concluded that in large areas air concentration levels, which would not pose a significant risk to human health, are exceeded. Due to the lack of data it has not been possible to include the enlargement area in the cost-benefit analyses. It can be assumed, however, that in most exceedance areas attainment of the mentioned concentration levels would not be possible without closing industrial plants. At the same time the benefits from some basic improvements towards best available techniques would probably offset the costs.

[28] http://www.emep.int/emis_tables/tab1.html

11 THE COMMISSION'S PROPOSAL

11.1 Target value

As there are no cost-effective measures to attain everywhere the concentration levels that would not give rise to harmful effects on human health the proposal does not follow Directive 96/62/EC, which foresees to set binding limit values.

In particular with a view to the risk to human health posed by PAH emissions from domestic heating and road traffic a target value of 1 ng BaP /m³ in ambient air is proposed, which must be attained as far as possible and without entailing excessive costs. This target value refers to an annual average of the PM10 particle fraction in ambient air. Attainment of these concentrations would ensure a reasonable protection of the population from carcinogenic effects.

To ensure the best protection of human health all proportionate abatement measures should be taken where the target value is exceeded. In this context the proposal complements the IPPC directive by raising awareness of any exceedance of the target value given above and by ensuring that achievements with regard to improvement of air quality are adequately monitored.

11.2 Air quality and deposition monitoring

The proposal foresees mandatory monitoring where concentrations exceed the following assessment thresholds,

– 6 ng arsenic /m³,

– 5 ng cadmium /m³,

– 20 ng nickel /m³,

– 1 ng BaP /m³.

As concentrations below these levels would minimise harmful effects on human health only indicative monitoring of concentrations of arsenic, cadmium, mercury, nickel and specific PAH at a limited number of sites is required where the assessment thresholds are not exceeded. The objective of this background monitoring would be to assess the impact on human health and the environment For the same purpose the monitoring of total deposition of arsenic, cadmium, mercury and PAH is required.

11.3 Assessment and reporting of air quality and deposition

Member States would be required to inform the Commission and the public on any exceedance of the target value, the reasons thereof and any measures taken. After 2007, application of BAT would be required for any industrial installation contributing to the exceedance.

The proposal lays down provisions for the siting and number for the monitoring sites. Member States would have to inform the Commission and the public on the air

quality and deposition. Decision 97/101/EC on reciprocal exchange of information[29] shall be amended with a view to ensure mandatory reporting of the monitoring data.

11.4 Report on the implementation

The Commission considers its proposal both ambitious and practical in the light of the balance of evidence available. It is intended to assess the effectiveness of the abatement measures, which can reasonably be taken by Member States to reduce the emissions of arsenic, cadmium and nickel and PAH.

The Commission considers it essential however that the objectives should be reviewed in due course. This review should give particular emphasis to new evidence on the genotoxicity of arsenic, cadmium and nickel and the suitability of BaP as a marker for the total carcinogenicity of PAH as well as its dose response. Moreover progress to meet the target value should be reviewed giving special attention to the comparison of the emissions at locations that are similar with respect to the contributing sources.

With regard to mercury, the Commission considers it essential that the evidence for total exposure should be reviewed in due course. This review should give particular emphasis to source-receptor relationships and the transformation of mercury in the environment.

The proposal will require the Commission to report by 2008 at the latest on implementation of this Directive.

11.5 Legal base

The legal basis for the proposal is Article 175 (1)of the Treaty. The objectives of the proposed directive relate to conservation, protection, and improvement of the quality of the environment, and the protection of human health.

12 EXPLANATION OF THE DETAILED PROVISIONS OF THE PROPOSAL

Article 1 and 2

These Articles set out the aims of the present proposal and set out definitions necessary for the interpretation of the present proposal.

Articles 3

Provisions for regulating PAH in ambient air are laid down. In particular a target value is set for BaP. Provisions are given for the case when the target value is exceeded.

Articles 4 incl. Annexes

Requirements for the monitoring of air quality and deposition are given. Annex I lays down the corresponding assessment thresholds. Provisions for the minimum number

[29] OJ L 35, 5.2.97, p. 14, as amended by Decision 2001/752/EC, OJ L 282, 26.10.2001, p. 69.

and the location of monitoring sites are laid down where Annexes II and III set out full details. Reference methods are defined in Annex IV.

Article 5

Member States will be required to forward to the Commission information on zones and agglomerations where a target value is not met or where an assessment threshold is exceeded. The Commission must make this information available to the public.

Article 6

This Article establishes a committee to assist the Commission according to Article 12(2) of Directive 96/62/EC.

Article 7

This Article requires Member States to supply regular information to the public and appropriate organisations about arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons, and in particular on the respective target value for BaP.

Article 8

This Article requires the Commission to report to Council and the European Parliament no later than 31 December 2008 on implementation of this Directive and progress in understanding of the pollutants with which it deals.

Articles 9 to 12

These are standard provisions.

2003/0164 (COD)

Proposal for a

DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air

THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty establishing the European Community, and in particular Article 175(1) thereof,

Having regard to the proposal from the Commission[1],

Having regard to the opinion of the European Economic and Social Committee[2],

Having regard to the opinion of the Committee of the Regions[3],

Acting in accordance with the procedure laid down in Article 251 of the Treaty[4],

Whereas:

(1) On the basis of principles enshrined in Article 175(3) of the Treaty, the Sixth Community Environment Action Programme[5], adopted by Decision No. 1600/2002/EC of the European Parliament and of the Council[6], establishes the need to attain levels of pollution, which minimise harmful effects on human health and the environment and to improve the monitoring and assessment of air quality including the deposition of pollutants, and to provide information to the public.

(2) Article 4(1) of Council Directive 96/62/EC of 27 September 1996 on ambient air quality assessment and management[7], foresees that the Commission would submit proposals for regulating the pollutants listed in Annex I to that Directive taking into account the provisions laid down in paragraphs 3 and 4 of that Article.

(3) Scientific evidence shows that arsenic, cadmium, nickel and some polycyclic aromatic hydrocarbons are human genotoxic carcinogens and that there is no identifiable threshold below which these substances do not pose a risk to human health. Impact on human health and the environment occurs via concentrations in ambient air, and via

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[1] OJ C , , p. .
[2] OJ C , , p. .
[3] OJ C , , p. .
[4] Opinion of the European Parliament of (not yet published in the Official Journal), Council Common Position of ……(not yet published in the Official Journal) and Decision of the European Parliament of ……. (not yet published in the Official Journal).
[5] OJ L 242, 10.9.2002, p. 1
[6] OJ L 242, 10.9.2002, p. 1
[7] OJ L 296, 21.11.1996, p. 55.

deposition. With a view to economic and technical feasibility, ambient air concentrations of arsenic, cadmium, nickel and polycyclic aromatic hydrocarbons, which would not pose a significant risk to human health, cannot be achieved in specific areas.

(4) Benzo(a)pyrene shall be used as a marker for the carcinogenic risk of polycyclic aromatic hydrocarbons in ambient air and a target value shall be set, to be attained as far as possible.

(4bis) The target value for benzo(a)pyrene would not require any measures entailing excessive costs. Regarding industrial installations it would not involve any measures beyond the application of BAT as required by Directive 96/61/EC and in particular would not lead to the closure of any installations. However it would require Member States to take all cost-effective abatement measures in the relevant sectors, e.g. domestic heating by solid fuels.

(5) Where concentrations exceed certain assessment thresholds monitoring of arsenic, cadmium, nickel and benzo(a)pyrene shall be mandatory. Further monitoring of background ambient air concentrations and deposition is foreseen.

(6) In accordance with Article 176 of the Treaty, Member States may maintain or introduce more stringent protective measures relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons provided that they are compatible with the Treaty and that they are notified to the Commission.

(7) Methylmercury is a possible human carcinogen, while elemental mercury is considered not to be classifiable in terms of carcinogenicity. The main exposure route to mercury is via ingestion; in Europe concentrations in ambient air are below a level where they have adverse effects on human health. As ambient air is the major transfer medium of mercury in the environment, deposition of airborne mercury contributes to the accumulation of toxic methylmercury in water and soil. At present, not enough is known about the cycle of mercury in the environment, particularly transfer rates and exposure routes, so it is not appropriate to set target values at this stage.

(8) In order to facilitate review of this Directive in 2008, the Commission and the Member States should consider promoting research into the effects of arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons on human health and the environment, particularly via deposition.

(9) Standardised accurate measurement techniques and common criteria for the location of measuring stations are important elements in assessing ambient air quality so that the information obtained is comparable throughout the Community.

(10) Information on the concentrations and the deposition of the regulated pollutants should be forwarded to the Commission as a basis for regular reports.

(11) Up-to-date information on ambient air concentrations and deposition of regulated pollutants should be readily available to the public.

(12) The Member States should lay down rules on penalties applicable to infringements of the provisions of this Directive and ensure that they are implemented. Those penalties must be effective, proportionate and dissuasive.

(13) The measures necessary for the implementation of this Directive should be adopted in accordance with Council Decision 1999/468/EC of 28 June 1999 laying down the procedures for the exercise of implementing powers conferred on the Commission.[8]

(14) The amendments necessary for adaptation to scientific and technical progress should relate solely to criteria and techniques for the assessment of concentrations and deposition of regulated pollutants or detailed arrangements for forwarding information to the Commission. They should not have the effect of modifying the target value or the assessment thresholds either directly or indirectly.

HAVE ADOPTED THIS DIRECTIVE:

Article 1

Objectives

This Directive:

(a) establishes a target value for the concentration of benzo(a)pyrene in ambient air so as to avoid, prevent or reduce harmful effects of polycyclic aromatic hydrocarbons on human health;

(b) ensures that ambient air quality is maintained where it is good and that it is improved in other cases with respect to polycyclic aromatic hydrocarbons;

(c) determines common methods and criteria for the assessment of concentrations of arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air as well as of the deposition of arsenic, cadmium, mercury and polycyclic aromatic hydrocarbons;

(d) ensures that adequate information on concentrations of arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air as well as on the deposition of arsenic, cadmium, mercury and polycyclic aromatic hydrocarbons is obtained and ensures that it is made available to the public.

Article 2

Definitions

For the purposes of this Directive the definitions in Article 2 of Directive 96/62/EC, with the exception of the definition of "target value", shall apply.

The following definitions shall also apply:

(a) "target value" means a concentration in the ambient air fixed with the aim of minimising harmful effects on human health and the environment;

[8] OJ L 184, 17.7.1999, p. 23.

(b) "assessment threshold" means a level specified in Annex I, requiring the monitoring of air quality when exceeded, in accordance with Article 4 of this Directive;

(c) "fixed measurements" means measurements taken at fixed sites either continuously or by random sampling;

(d) "arsenic", "cadmium", "nickel" and "benzo(a)pyrene" mean the total content of these elements in the PM_{10} fraction;

(e) "PM_{10}" means particulate matter, which passes through a size-selective inlet as defined in ISO 7708 with a 50 % efficiency cut-off at 10 μm aerodynamic diameter;

(f) "polycyclic aromatic hydrocarbons" means those organic compounds, composed of at least two fused aromatic rings made entirely from carbon and hydrogen;

(g) "total gaseous mercury" means elemental mercury vapour (Hg^0) and reactive gaseous mercury, i.e. water-soluble mercury species with sufficiently high vapour pressure to exist in the gas phase.

Article 3

Polycyclic aromatic hydrocarbons

1. Benzo(a)pyrene shall be used as a marker for the carcinogenic risk of polycyclic aromatic hydrocarbons in ambient air. To assess the contribution of benzo(a)pyrene each Member State shall monitor other relevant polycyclic aromatic hydrocarbons at a limited number of measurement sites. The compounds to be monitored in accordance with Article 4 shall include at least: benzo(a)anthracene, benzo(b)fluoranthene, benzo(j)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, dibenz(a,h)anthracene and fluoranthene.

2. Member States shall take all necessary measures not entailing excessive costs to ensure that concentrations of benzo(a)pyrene in ambient air, as assessed in accordance with Article 4, do not exceed a target value of 1 ng/m³ applying to the benzo(a)pyrene content in the PM 10 fraction averaged over a calendar year.

3. Member States shall draw up a list of zones and agglomerations in which the levels of benzo(a)pyrene are below the target value. Member States shall maintain the levels of benzo(a)pyrene in these zones and agglomerations below the target value and shall endeavour to preserve the best ambient air quality, compatible with sustainable development.

4. Member States shall draw up a list of the zones and agglomerations where the target value laid down in Article 3 (2) is exceeded.

For such zones and agglomerations, Member States shall specify the areas of exceedance and the sources contributing to this exceedance. In the areas concerned Member States must demonstrate the application of all necessary measures not entailing excessive costs, targeted in particular at the predominant emission sources, and including the application of best available techniques as defined by Article 2 (11) of Directive 96/61/EC to all industrial installations contributing to the exceedance.

Article 4

Assessment of ambient air concentrations and deposition rates

1. Ambient air quality of arsenic, cadmium, nickel, benzo(a)pyrene and total gaseous mercury shall be assessed throughout the territory of the Member States.

Member States shall also monitor the total deposition of arsenic, cadmium, mercury and polycyclic aromatic hydrocarbons.

Accompanying monitoring of particulate and gaseous divalent mercury is recommended.

2. The assessment thresholds for arsenic, cadmium, nickel and benzo(a)pyrene and the methods for determining their exceedance are those laid down in Annex I. In zones and agglomerations where the assessment thresholds are exceeded fixed measurement of ambient air concentrations is mandatory. To assess the contribution from channeled emissions air quality modelling may be used.

Where the levels are below the assessment threshold indicative monitoring may be used to assess air quality in a zone or agglomeration, with the exemption of benzo(a)pyrene for which fixed measurement shall be mandatory in all agglomerations.

3. The minimum number of sampling points for fixed measurements of concentrations shall be as laid down in Section IV of Annex II, and they shall be installed in each zone or agglomeration within which measurement is required.

4. Irrespective of concentration levels one sampling point should be installed every 50000 km² for the indicative measurement of arsenic, cadmium, total gaseous mercury, nickel, benzo(a)pyrene and polycyclic aromatic hydrocarbons other than benzo(a)pyrene, and of the total deposition of arsenic, cadmium, mercury and polycyclic aromatic hydrocarbons. Each Member State shall at least set up one measuring station. Where appropriate monitoring should be co-ordinated with the EMEP monitoring strategy and measurement programme.

5. The criteria for determining the location of sampling points for the measurement of arsenic, cadmium, nickel and benzo(a)pyrene in ambient air shall be those listed in Annex II.

The sampling sites for monitoring total gaseous mercury and polycyclic aromatic hydrocarbons other than benzo(a)pyrene must be selected in such a way that geographical variation and long-term trends can be identified. Monitoring sites for polycyclic aromatic hydrocarbons shall be co-located with sampling sites for benzo(a)pyrene. Section II and III of Annex II shall apply.

The sampling sites for monitoring deposition must be selected in such a way that geographical variation and long-term trends can be identified. Where appropriate sampling points for deposition should be sited where the highest deposition to agricultural soils occurs. Section III of Annex II shall apply. Co-location with sites for soil monitoring is preferable. The use of bioindicators may be considered where regional patterns of the impact on ecosystems shall be assessed.

6. The monitoring data must meet the data quality objectives laid down in Section I of Annex III. Where air quality models are used for assessment Section II of Annex III shall apply.

7. The reference methods for the sampling and the analysis of arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons shall be as laid down in Annex IV.

8. The date by which Member States shall inform the Commission of the methods used for the preliminary assessment of air quality under point (d) of Article 11(1) of Directive 96/62/EC shall be the date set out in Article 10 of this Directive.

9. Any amendments necessary to adapt the provisions of paragraphs 1 to 6, of Section II of Annex I and of Annexes II to IV to scientific and technical progress shall be adopted in accordance with the procedure referred to in Article 6(2) but may not result in any direct or indirect changes to the target value or the assessment thresholds.

Article 5

Transmission of information and reporting

1. With regard to the zones and agglomerations where any of the assessment thresholds laid down in Annex I is exceeded Member States shall forward the following information to the Commission:

(a) the lists of the zones and agglomerations concerned,

(b) the areas of exceedance,

(c) the concentration values assessed,

(d) the reasons for exceedance, and in particular any sources contributing to it,

(e) the population exposed to concentrations above the assessment threshold.

Member States shall also report all data assessed in accordance with Article 4.

The information shall be transmitted for each calendar year, no later than 30 September of the following year, and for the first time no later than […*].

2. In addition to the requirements laid down in paragraph 1 Member States shall forward any measures taken pursuant to Article 3 (2).

3. The Commission shall ensure that all information submitted pursuant to paragraph 1 is promptly made available to the public by appropriate means.

4. The Commission shall adopt, in accordance with the procedure referred to in Article 6(2), any detailed arrangements for forwarding the information to be provided under paragraph 1 of this Article

* The year following the date given in Article 15

Article 6

Committee

1. The Commission shall be assisted by the committee established by Article 12(2) of Directive 96/62/EC, hereinafter referred to as 'the Committee'.

2. Where reference is made to this paragraph, Articles 5 and 7 of Decision 1999/468/EC shall apply, having regard to the provisions of Article 8 thereof.

3. The period laid down in Article 5(6) of Decision 1999/468/EC shall be set at three months.

Article 7

Public information

1. Member States shall ensure that clear and comprehensible information is accessible and is routinely made available to the public as well as to appropriate organisations, such as environmental organisations, consumer organisations, organisations representing the interests of sensitive populations and other relevant health-care bodies, on ambient air concentrations of arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons as well as on deposition rates of arsenic, cadmium, mercury and polycyclic aromatic hydrocarbons.

2. The information shall also indicate any annual exceedance of the target value for benzo(a)pyrene laid down in Article 3(2). The information shall give the reasons for the exceedance and the area to which it applies. It shall also provide a short assessment in relation to the target value and appropriate information regarding effects on health.

Information on any measures taken pursuant to Article 3 (2) shall be made available to the organisations referred to in paragraph 1 of this Article.

3. The information shall be made available by means of for example press, computer-network services, or teletext.

Article 8

Report and Review

1. The Commission shall, by 31 December 2008 at the latest, submit to the European Parliament and the Council a report based on the experience acquired in the application of this Directive and, in particular, on the results of the most recent scientific research concerning the effects on human health, paying particular attention to sensitive populations, of exposure to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons, and on technological developments including the progress achieved in methods of measuring and otherwise assessing concentrations of these pollutants in ambient air as well as their deposition.

2. The report referred to in paragraph 1 shall take into account in particular as regards arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons:

(a) current air quality, trends and projections up to and beyond 2015;

(b) the scope for making further reductions in polluting emissions from all relevant sources, taking account of technical feasibility and cost-effectiveness;

(c) the relationships between pollutants and opportunities for combined strategies for improving Community air quality and related objectives;

(d) current and future requirements for informing the public and for the exchange of information between Member States and Commission;

(e) the experience acquired in the application of this Directive in Member States, and in particular the conditions under which measurement has been carried out as laid down in Annex II;

3. With a view to achieving levels of ambient air concentrations that would not give rise to harmful effects on human health and would ensure a reasonable protection of the environment, taking into account the economic and technical feasibility of further action, the report referred to in paragraph 1 may be accompanied, if appropriate, by proposals for amendments to this Directive. In the light of the latest scientific and technological developments the Commission shall in particular examine the effect of arsenic, cadmium and nickel on human health with a view to quantifying their genotoxic carcinogenicity and the suitability of benzo(a)pyrene as a marker for the total carcinogenic activity of polycyclic aromatic hydrocarbons. In addition the Commission shall consider regulating the deposition of cadmium, mercury and specific polycyclic aromatic hydrocarbons.

Article 9

Penalties

Member States shall determine the penalties applicable to infringements of the national provisions adopted pursuant to this Directive and shall take all the measures necessary to ensure that they are implemented. The penalties provided for must be effective, proportionate and dissuasive.

Article 10

Implementation

1. Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with this Directive by […*] at the latest. They shall forthwith inform the Commission thereof.

When Member States adopt those provisions, they shall contain a reference to this Directive or be accompanied by such a reference on the occasion of their official publication. Member States shall determine how such reference is to be made.

* 18 month after entry into force

2. The Member States shall communicate to the Commission the texts of the main provisions of national law, which they adopt in the field covered by this Directive.

Article 11

Entry into force

This Directive shall enter into force on the twentieth day following that of its publication in the *Official Journal of the European Communities*.

Article 12

Addressees

This Directive is addressed to the Member States.

Done at Brussels,

For the European Parliament	*For the Council*
The President	*The President*

ANNEX I

DETERMINATION OF REQUIREMENTS FOR ASSESSMENT OF CONCENTRATIONS OF ARSENIC, CADMIUM, NICKEL AND BENZO(A)PYRENE IN AMBIENT AIR WITHIN A ZONE OR AGGLOMERATION

I. ASSESSMENT THRESHOLDS

Pollutant	Assessment Threshold(1)
Arsenic	6 ng/m^3
Cadmium	5 ng/m³
Nickel	20 ng/m³
Benzo(a)pyrene	1 ng/m³

(1) For the total content in the PM 10 fraction averaged over a calendar year

II. DETERMINATION OF EXCEEDANCES OF ASSESSMENT THRESHOLDS

Exceedances of assessment thresholds must be determined on the basis of concentrations during the previous five years where sufficient data are available. An assessment threshold will be deemed to have been exceeded if it has been exceeded during at least three out of those five years.

In areas where sufficient data during the previous five years are not available but there is reason to believe that exceedances could be expected, Member States may combine measurement campaigns of short duration during the period of the year and at locations likely to be typical of the highest pollution levels with results obtained from information from emission inventories and modelling to determine exceedances of the assessment thresholds.

ANNEX II

LOCATION AND MINIMUM NUMBER OF SAMPLING POINTS FOR THE MEASUREMENT OF CONCENTRATIONS IN AMBIENT AIR AND DEPOSITION RATES

I. MACROSCALE SITING

The sites of sampling points should be selected in such a way as to:

(i) to provide data on the areas within zones and agglomerations where the population is likely to be directly or indirectly exposed to the highest concentrations averaged over a calendar year;

(ii) to provide data on levels in other areas within zones and agglomerations which are representative of the exposure of the general population.

Sampling points should in general be sited so as to avoid measuring very small micro-environments in their immediate vicinity. As a guideline, a sampling point should be representative of air quality in surrounding areas of no less than 200 m² at traffic-orientated sites, at least 250x250 m² at industrial sites and several square kilometres at urban-background sites.

Where the objective is to assess background levels the sampling site should not be influenced by agglomerations or industrial sites in its vicinity, i.e. sites closer than a few kilometres.

For the assessment of pollution in the vicinity of industrial sources, the location of sampling points for fixed measurement should be determined taking into account emission densities, the likely distribution patterns of ambient air pollution and potential exposure of the population.

Where contributions from industrial sources shall be assessed at least one sampling point shall be installed downwind of the source in the nearest residential area. Where the background concentration is not known an additional sampling point shall be situated within the main wind direction. In particular where Article 3(4) applies, the sampling points should be sited such that the application of best available techniques can be monitored.

Sampling points should also, where possible, be representative of similar locations not in their immediate vicinity. Where appropriate they should be co-located with sampling points for PM10.

II. MICROSCALE SITING

The following guidelines should be met as far as practicable:

– the flow around the inlet sampling probe should be unrestricted, without any obstructions affecting the airflow in the vicinity of the sampler (normally some metres away from buildings, balconies, trees and other obstacles and at least 0,5 m from the nearest building in the case of sampling points representing air quality at the building line);

– in general, the inlet sampling point should be between 1,5 m (the breathing zone) and 4 m above the ground. Higher positions (up to 8 m) may be necessary in some circumstances. Higher siting may also be appropriate if the station is representative of a large area;

– the inlet probe should not be positioned in the immediate vicinity of sources in order to avoid direct intake of emissions unmixed with ambient air;

– the sampler's exhaust outlet should be positioned so that recirculation of exhaust air to the sample inlet is avoided;

– traffic-orientated sampling points should be at least 25 metres from the edge of major junctions and at least 4 m from the centre of the nearest traffic lane; inlets should be no more than 5 m from the kerbside.

The following factors may also be taken into account:

– interfering sources;

– security;

– access;

– availability of electrical power and telephone communications;

– visibility of the site in relation to its surroundings;

– safety of public and operators;

– the desirability of co-locating sampling points for different pollutants;

– planning requirements.

III. DOCUMENTATION AND REVIEW OF SITE SELECTION

The site selection procedures should be fully documented at the classification stage by such means as compass-point photographs of the surrounding area and a detailed map. Sites should be reviewed at regular intervals with repeated documentation to ensure that selection criteria remain valid over time.

IV. MINIMUM NUMBER OF SAMPLING POINTS TO MONITOR DIFFUSE SOURCES

Population of agglomeration or zone (thousands)	Minimum number of sampling points in zones and agglomerations. (1)
0 – 249	1
250– 749	2
750 – 999	3
1 000 – 1 999	4
2 000 – 3 749	5
3 750 – 4 749	6
4 750 – 5 999	7
≥ 6 000	8

(1) To include one traffic-oriented station, provided this does not increase the number of sampling points.

ANNEX III

DATA QUALITY OBJECTIVES AND REQUIREMENTS FOR AIR QUALITY MODELS

I. DATA QUALITY OBJECTIVES

The following data quality objectives are provided as a guide to quality-assurance.

	Benzo(a)pyrene	Arsenic, cadmium and nickel	Polycyclic aromatic hydrocarbons other than benzo(a)pyrene, total gaseous mercury, and total deposition
– Uncertainty	50 %	40 %	50 %
– Minimum data capture	90 %	90 %	90 %
– Minimum time coverage:			
Fixed Measurements	33%	50%	-
Indicative measurements	14%	14%	14%

The uncertainty (expressed at a 95% confidence level) of the methods used for the assessment of ambient air concentrations will be evaluated in accordance with the principles of the CEN Guide to the Expression of Uncertainty in Measurement (EN 13005-1999), the methodology of ISO 5725:1994, and the guidance provided in the CEN/TC 264 Report N422. The uncertainties given apply to individual measurements, which are averaged over typical sampling times. The uncertainty of the measurements should be interpreted as being applicable in the region of the appropriate assessment threshold. Until such time as CEN standards with detailed test protocols are fully adopted, the Commission will issue, before the adoption of this Directive, the guidelines for use developed by CEN.

The requirements for minimum data capture and time coverage do not include losses of data due to regular calibration or normal maintenance of the instrumentation. Twenty-four-hour sampling is required for the measurement of benzo(a)pyrene and other polycyclic aromatic hydrocarbons, and for the concentration of total gaseous mercury. It is also advisable for the measurement of arsenic, cadmium and nickel concentrations. Sampling must be spread evenly over the weekdays and the year. For the measurement of deposition rates monthly samples throughout the year are recommended.

II. REQUIREMENTS FOR AIR QUALITY MODELS

Where an air quality model is used to for assessment, references to descriptions of the model and information on the uncertainty shall be compiled. The uncertainty for modelling is defined as the maximum deviation of the measured and calculated concentration levels, over a full year, without taking into account the timing of the events. The uncertainty shall not exceed 50 %.

ANNEX IV

REFERENCE METHODS FOR ASSESSMENT OF
CONCENTRATIONS IN AMBIENT AIR AND DEPOSITION RATES

I. REFERENCE METHOD FOR THE SAMPLING AND ANALYSIS OF ARSENIC, CADMIUM AND NICKEL IN AMBIENT AIR

The reference method for the measurement of arsenic, cadmium and nickel concentrations in ambient air is currently being standardised by CEN and shall be based on manual PM10 sampling equivalent to EN 12341, followed by digestion of the samples and analysis by Atomic Adsorption Spectrometry or ICP Mass Spectrometry. In the absence of a CEN standard method, Member States are allowed to use national standard methods or ISO standard methods.

II. REFERENCE METHOD FOR THE SAMPLING AND ANALYSIS OF POLYCYCLIC AROMATIC HYDROCARBONS IN AMBIENT AIR

The reference method for the measurement of benzo(a)pyrene concentrations in ambient air is currently being standardised by CEN and shall be based on manual PM10 sampling equivalent to EN 12341. In the absence of a CEN standard method, for benzo(a)pyrene or the other polycyclic aromatic hydrocarbons referred to in Article 3(1), the Member States are allowed to use national standard methods or ISO methods such as ISO standard 12884.

III. REFERENCE METHOD FOR THE SAMPLING AND ANALYSIS OF MERCURY IN AMBIENT AIR

The reference method for the measurement of total gaseous mercury concentrations in ambient air shall be an automated method based on Atomic Absorption Spectrometry or Atomic Fluorescence Spectrometry. The reference method for the measurement of deposition of mercury shall be a bulk sampling method using a funnel system. In the absence of a CEN standardised method, the Member States are allowed to use national standard methods or ISO standard methods.

IV. REFERENCE METHOD FOR THE SAMPLING AND ANALYSIS OF THE DEPOSITION OF ARSENIC, CADMIUM, MERCURY AND POLYCYCLIC AROMATIC HYDROCARBONS

The reference method for the sampling of deposited arsenic, cadmium, mercury and polycyclic aromatic hydrocarbons shall be based on the exposition of cylindrical deposit gauges with standardised dimensions. In the absence of a CEN standardised method, the Member States are allowed to use national standard methods.