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Measurement as basis for emission reductions: VOC, PAH, PCB and dioxins in air in Ostrava

Sluttrapport

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Sluttrapport

1. Innledning

1.1 Workshop, Ostrava, høsten 1991

Som et ledd i miljøvernsamarbeidet Norge-Tsjekkoslovakia ble det i tidsrommet 22. til 25. oktober 1991 arrangert en "workshop" i Ostrava. Workshop'en ble kalt "Environment in industrial region of Northern Moravia" og ble arrangert av Mining University Ostrava ved Konstantin og Helena Raclavsky.

Workshop'en var delt i følgende tre sesjoner:

- A: Water pollution aspects
- B: Air pollution
- C: Waste minimization

Norsk institutt for luftforskning (NILU) deltok på sesjon B ("Air pollution") med tre personer: Steinar Larssen, Trond Bøhler og Ole-Anders Braathen.

Rapporten som ble utarbeidet ved avslutningen av workshop'en er vist i vedlegg A.

1.2 Etablering av prosjektet

En del av programmet på workshop'en var å planlegge aktuelle prosjekter. Dette ble gjort ved at deltakere med interesse og kunnskap innenfor de aktuelle fagområdene ble samlet og fikk tid til å diskutere seg fram til hovedinnhold i en rekke prosjekter.

Et av disse prosjektene var "Measurement as basis for emission reduction: VOC, PAH, PCB and dioxins in air in Ostrava". Følgende personer deltok i planleggingen av dette prosjektet:

- Dr. Václav Dombek, Institute of Industrial Landscape Ecology
- Ing. Libor Janca, Regional Hygienic Institute
- Dr. scient Ole-Anders Braathen, NILU

Gruppen diskuterte seg fram til innholdet i prosjektet. Et prosjektforslag basert på denne planleggingen ble utarbeidet av Ole-Anders Braathen 16. desember 1991. Prosjektforslaget ble deretter sendt som søknad til Den Norsk-Tsjekkoslovakiske styringsgruppen for miljøvernsamarbeidet Norge-Tsjekkoslovakia. Søknaden ble innvilget våren 1992 (mai) og arbeidet kunne starte.

I perioden som gikk fra workshop'en ble avholdt til prosjektarbeidet kunne starte, hadde det skjedd store forandringer i det tsjekkoslovakiske samfunnet. Blant annet var det blitt et mye friere økonomisk system og dette førte til mange nye jobbmuligheter. De to tsjekkerne som hadde deltatt i planleggingen av prosjektet, hadde tatt konsekvensen av dette og gått over til nye stillinger. De var dermed ikke aktuelle som deltakere i prosjektarbeidet og det ble nødvendig å etablere kontakt med nye personer i Ostrava som kunne utføre den nødvendige innsatsen.

Siden NILU ikke kunne etablere slike kontakter på egenhånd, ble Konstantin og Helena Racslavsky bedt om å hjelpe oss med å etablere kontakt med egnete personer eller institusjoner i Ostrava.

I en telefax 3. november 1993 opplyste Helena Raclavsky at Ing. Jiri Svrcula i firmaet ELCOM i Ostrava skulle være den som utførte den tsjekkiske delen av arbeidet i dette prosjektet. Han hadde, som ansatt i The Water Research Institute i Ostrava, allerede deltatt i et samarbeidsprosjekt med Norsk institutt for vannforskning (NIVA). Helena Raclavsky opplyste videre at firmaet ELCOM var brukbart utstyrt med kjemisk analyseutstyr og ville være en god samarbeidspartner.

I begynnelsen av desember 1993 ble det dermed opprettet kontakt mellom NILU og firmaet Elcom i Ostrava.

2. Besøk

2.1 1. besøk til NILU

I tidsrommet 14. til 18. mars 1994 var Jiri Svrcula og Lionel Dolezal fra firmaet ELCOM på besøk ved NILU. Formålet med besøket var å gå gjennom de mulighetene for prøvetaking og analyse av luftprøver som på det tidspunktet fantes i Ostrava. Det viste seg at det stort sett ikke ble gjort noe for å kartlegge luftkvaliteten i Ostrava med hensyn på VOC, PAH, PCB eller dioksiner. Svrcula og Dolezal var derfor svært interessert i å gjennomføre det planlagte samarbeidsprosjektet.

I løpet av besøket ble det diskutert hvordan ELCOM selv skulle bli i stand til å ta luftprøver og analysere dem med hensyn på lette hydrokarboner. Det ble planlagt å oppgradere en av ELCOMs gasskromatografer. Dette skulle gjøres ved at NILU, som hadde erfaring med slik oppgradering av gasskromatografer, skulle utarbeide en liste over utstyr som måtte anskaffes. Kostnadene til denne anskaffelsen skulle dekkes over prosjektet. Når alt utstyr var klart, skulle NILU utføre selve oppgraderingen av gasskromatografen og gi nødvendig opplæring til ELCOM-ansatte.

Tidligere, før kontakten med ELCOM var blitt etablert, var det blitt anskaffet 10 elektropolerte stålflasker og to høyrene pumper som skulle benyttes til prøvetaking av hydrokarboner i luft. Dette utstyret var allerede blitt sendt til Ostrava, men det ble bestemt at ELCOM skulle overta utstyret.

Under besøket ble det også planlagt at ELCOM skulle settes i stand til å ta luftprøver som skulle kunne analyseres med hensyn på PAH, PCB eller dioksiner. Dette skulle gjøres ved at NILU bygget en høyvolumsprøvetaker basert på adsorpsjon med polyuretanskum (PUF-prøvetaker). Prøvetakeren skulle deretter sendes til Ostrava. Kostnadene til dette skulle også dekkes av prosjektet.

2.2 Besøk til Praha

NILU hadde allerede, som et ledd i instituttets EMEP-aktiviteter, samarbeidet i en tid med Dr. Jiri Honcak ved The Hydrometeorological Institute i Praha når det gjaldt prøvetaking og analyse av lette hydrokarboner i luft. Som en del av dette samarbeidet, hadde NILU bistått Honcak ved å oppgradere en gasskromatograf i Praha. Sommeren 1994 var en av NILUs prosjektdeltakere, forsker Norbert Schmidbauer, i Praha for å rette opp endel problemer med analyseutstyret. Svrcula og Dolezal fra Ostrava ble invitert og kom til Praha for selv å se hvordan utstyret fungerte og for å opprette kontakt mellom Praha og Ostrava.

2.3 2. besøk til NILU

Svrcula og Dolezal gjennomførte sitt andre besøk til NILU i perioden 13. til 15. desember 1994. Denne gangen var det konkrete oppgaver som ble gjennomført under besøket: Oppgraderingen av gasskromatografen ble diskutert i deltalj, Svrcula og Dolezal fikk inngående opplæring i bruken av NILUs PUF-prøvetaker og det ble diskutert hvordan analysene av prøvene kunne gjennomføres. I tillegg ble Aksel Jebens fra Jebens Miljøteknikk invitert til å delta på et møte for å diskutere hvordan utslippsmålinger skal gjennomføres.

2.4 Besøk til Ostrava

Våren 1996 reiste to av NILUs prosjektdeltakere, forsker Norbert Schmidbauer og ingeniør Adler Mikalsen, til Ostrava. Schmidbauer foretok i løpet av dette besøket den endelige oppgraderingen av den utvalgte gasskromatografen. Mikalsen gikk på nytt gjennom håndteringen av PUF-prøvertakeren og diskuterte hvordan det kunne gjennomføres en begrenset kvalitetssikring av de PAH-analysene som ELCOM skulle utføre.

Under dette besøket ble også avslutningen av samarbeidsprosjektet diskutert.

3. Utstyr

I en tidlig fase ble det anskaffet 10 innvendig elektropolerte stålflasker og to høyrene pumper som skulle benyttes til prøvetaking av lette hydrokarboner i luft.

NILU bygde en høyvolum luftprøvetaker basert på adsorpsjon med polyuretanskum (PUF-prøvetaker).

Det ble innkjøpt en lang rekke utstyr og deler som ble benyttet til å oppgradere en gasskromatograf slik at den kunne benyttes til å bestemme lette hydrokarboner i luftprøver.

Alt utstyret er blitt overlevert til firmaet ELCOM i Ostrava.

4. Kompetanseoverføring, VOC

Prosjektdeltakerne fra ELCOM, Svrcula og Dolezal, har fått opplæring i bruk av prøvetakingsutstyret og i bruk av den oppgraderte gasskromatografen. De skulle nå være istand til å gjennomføre prøvetaking og analyse.

Den kontakten som er opprettet mellom institusjonene i Ostrava og Praha skulle bidra til å opprettholde og utvikle videre denne analysekompetansen i Tsjekkia. NILU har dessuten sagt seg villig til å yte noe bistand, via telefon/telefax, dersom det skulle oppstå problemer.

5. Kompetanseoverføring, PAH

Firmaet ELCOM disponerer nå en prøvetaker som kan benyttes til å ta luftprøver som kan analyseres med hensyn på PAH, PCB eller dioksiner. Prøvetakeren kan også benyttes til å ta luftprøver som skal analyseres med hensyn på en rekke andre middelsflyktige organiske forbindelser i luft.

Det er blitt gitt opplæring i håndtering av prøvetakeren og NILU har anskaffet et antall poyuretanskumpropper som benyttes som adsorbent.

Analyseprosedyrer for PAH er blitt diskutert og gjennomgått og NILU har utstyrt ELCOM med metodeforskrifter på engelsk.

6. Kvalitetssikring

For å gjennomføre en begrenset kvalitetskontroll av ELCOMs PAH-analyser, har NILU tatt 5 luftprøver i Oslo. NILU har ekstrahert disse prøvene og delt ekstraktene i to. Den ene delen har NILU analysert og den andre delen er sendt til Ostrava for analyse. Når resultatene er klare, er det meningen å sammenlikne resultatene og eventuelt finne ut hvorfor det er forskjeller. Så langt har imidlertid ELCOM ikke rapportert noen resultater.

7. Økonomi

Tabellen viser forbruket pr. år i den perioden det er blitt arbeidet med prosjektet.

	1992	1993	1994	1995	1996	Totalt
Time-kostnader	2384	21600	83690	56505	69215	233394
Direkte utlegg	32840	20045	58928	78694	28080	218587
Analyser	0	0	51500	0	12250	63750
Totalt	35224	41645	194118	135199	109545	515731

NILUs økonomiske egenandel på prosjektet blir dermed kr 15 731,-.

8. Vurdering

Prosjektet har gitt firmaet ELCOM en betydelig oppbygging av kompetanse når det gjelder prøvetaking og analyse av luftprøver. Det er viktig at det finnes slik kompetanse i Ostrava i den oppryddings- og utviklingsfasen som Tsjekkia nå er inne i.

Vi føler oss imidlertid ikke sikre på at ELCOM vil utnytte denne kompetansen fullt ut. Blant annet har det vært noe vanskelig å få innblikk i firmaets virksomhet og NILU har sett få, om noen, av firmaets analyseresultater fra Ostrava. Vi har heller ikke klart å avslutte kvalitetssikringen av PAH-analysene fordi vi foreløpig ikke har mottatt noen analyseresultater fra ELCOM.

Vedlegg A

Workshop report

International Workshop

ENVIRONMENT IN INDUSTRIAL REGION OF NORTHERN MORAVIA

REPORTS

22. - 25. October 1991

Mining University Ostrava, Czechoslovakia

NILU OR 78/96

REPORT FROM SESSION A:

WATER POLLUTION ASPECTS

A.1 Basic considerations

The water pollution problems in the northern Moravia Region have been highlighted by representatives from national institutions and one representative from the pulp and paper industry in a series of nine papers presented under Session A. In order to give some ideas about the Norwegian approach to the water managemet issue this session also included three papers presented by delegates from the Norwegian Institute for Water Research, NIVA. The presented papers were not supposed to cover all aspects and levels regarding the water pollution situation in the region. However, for the purpose of the workshop the scope of subjects is believed to fully cover the basis needed to initiate a fruitful cooperation between the two countries.

All papers will be printed by the organizers of this workshop in due course. Some of the papers are still in the process of completion, and the printing is supposed to be completed when all submissions have been finished.

The purpose of the workshop is to generate project proposals for joint projects between Czechoslovakian and Norwegian institutions under the bilatheral agreement.

The main criteria for establishment of projects are understood to be:

- The projects shall be result orientated interms of pollution abatement in the region
- Each project shall be carried out as a joint project between Norwegian and Czechoslovakian institutions
- The funds allocated to the cooperation are limited, hence they shall be carefully directed towards activities which can justify direct improvements.
- The projects should preferably be concentrating on improvement of the environmental situation in the Northern Moravia Region.

A.2 The most urgent water pollution problems

In general the presentations reflected the serious pollution problems of the aquatic environment in the region according to the prevailing Czechoslovakian Water Quality Standard.

A substantial amount of water quality data from surveys and monitoring programmes has been produced. There is, hovever, a lack of assesments and feasibility studies showing a ranking of the water pollution problems, and strategies on how to solve them. Hence, this subject has been identified as one of the aspects to be included under the cooperation programme. The abatemnent strategy will have to address a complex and probably controversial issue. It will involve legal, institutional, economical and other issues leading to priorities and implementation plans for pollution control investments.

According to the presentations by the Czech delegates major emphasis shall be placed on the river pollution problems. These problems are i.a. caused by discharge of wastewater from overloaded treatment plants, effluents from industrial plants and runoff from agriculture activities. The main pollutants are the nutrients, organic matters (influencing the oxygen regime), and numerous industrial pollutants. Regarding the micro pollutants, metals and organic contaminants it is necessary to gain more data in order to estimate the impacts in the catchment area of Odra river.

In rivers flowing through the coal mining areas discharge of saline water causes considerable increase in ion concentrations. The river Odra has the worst quality of all rivers flowing out of the Czech Republic.

Another factor leading to reduced self purification capacity is the extended chanalization of the rivers.

A standardized system is used to classify rivers in terms of pollution. As an example at this stage a classification based on the oxygen regime has been attached in the figure overleaf.

The organization of the water quality monitoring programme in the Odra river system has been developed since the start in the 50 ies and the present system is being based on a partly automatic monitorin arrangement.

A.3 The most important obstacles for water pollution abatement in the region

The Czech and Slovak Federal Republic is in the process of economic reforms and restructuring. The opening up towards market economy and Western countries investments will also draw more attention to the environmental conditions. The new government has given high priority to solve the environmental problems and this should eliminate the political obstacles which used to be one of the main constraints for pollution control. Under the new system there will be possible to establish a legal framework designed to carry forward the political intentions.

The lack of a proper discharge licence policy and a pollution control organisation represent other factors hampering implementation of pollution abatement measures.

The Workshop pointed out the importance of that the water management shall serve as a framework identifying the need for the surveys and monitoring programmes. An applicable system for water management have to be proposed and adapted to the prevailing legislation and political system in Czechoslovakia.

Pollution abatement will require substantial investments and funds for operation and maintenance. Because of the prevailing economical situation there is obviously not enough domestic funds to carry the required investments.

One way of releasing the economical pressure will be to implement cost efficient measures during the first phase. This could be internal improvement of industrial production processes, reduced loss of raw materials, improved cultivation methods in the agriculture etc. The treatment works could be improved by limited augmentation of the existing plants or improved operation performance.

Among other obstacles which should be taken into consideration are the interests and conflicts connected to the use of the water resources. These are factors like water supply, fishfarming, fisheries, recreation & sports etc.

A.4 Recommendation of cooperation projects

Possible cooperation projects to be included under the bilatheral agremment were discussed after the sessions.

The proposed subjects for these projects have been listed in the table below.

Project no. Title

1. Upgrading of existing treatment plants *)
2. Monitoring programme Odra river
3. Monitoring programme Labe river
4. Biomonitoring systems
5. Nitrogen transformation in rivers
6. Bio-manipulation in dams
7. Strategy for water pollution abatement
8. Evaluation of water quality on the basis of international standards
9. Solution of environmental problem associated with the metallic mines
10. Planning of reclamation of streams
11. Programme of collaboration among NIVA, Mining University and Institute of Landscape Ecology, (including the Centre of Scientific information)

*) this project has already been approved. The proposal is concerning its extension.

It was agreed to work out project proposals for joint projects between Czech and Norwegian institutions. For project no 2 to 7 the Water Research Institute in Czechoslovakia will make draft project proposals to be forwarded to NIVA within a 4 weeks time. For projects nos 8 to 11 the Institute of Landscape Ecology will have the responsibility for submitting draft proposals to NIVA within the same time limit as above.

NIVA will follow up by preparing final versions of the applications and forward them to the Norwegian authorities. It will also be necessary to make a list of priority of the proposed projects. In order to facilitate an

efficient and uniform project implementation the projects within the same fields will be arranged under appropriate umbrella programmes.

ABOUT THE PROJECT PROPOSALS

Project no 1 : Updating of existing treatemnet plants

Cooperating institutions: NIVA and Water Research Institute, VUV

Contact Persons: Mr S.S. Johansen, NIVA

Mr Just, VUV

Comments: The project has been described in a separate paper, and has been approved.

Project no 2 : Monitoring programmes Odra and Labe rivers

Cooperating Institutions: NIVA and VUV

Contact persons: Mr B. Faafeng, NIVA

Dr. Nemerak, VUV Prague (Odra)

Dr. Nemerak, VUV Prague (Labe)

REPORT FROM SESSION B:

AIR POLLUTION

1. THE MOST URGENT AIR POLLUTION PROBLEMS IN OSTRAVA

Air quality

The Ostrava district is heavily industrialized with several industrial activities such as steel mills, coking plants, power plant and chemical industry. All these activities lend to high emissions of compounds such us sulphur dioxide, nitrogen oxides, pesticides and hydrocarbons. The most important sources are located inside the urban area south and west of the city centre. The most prevailing wind direction in Ostrava air from southwest which transport the emission over highly populated areas.

The Czech Hydrometeorological Institute in Ostrava and the Hygienic Institute of Ostrava are performing an air quality monitoring program in the area. The program report on a daily basis concentrations of SO2, NOx, NO2, aerosols and lead from more than thirty stations in the northern Moravia region. In Ostrava, daily averaged values of the compounds are reported from six stations.

The measurements show that Ostrava is highly polluted with exceedences of air quality standards for SO2, NOx and aerosols for both daily and annual average values. The highest concentrations occurred during the winter due to poor dispersion conditions in this period. On days with stagnant air (low wind speed and inversion), the daily average concentrations of SO2 and suspended particles can raise to about 700 - 800 g/m3 in Ostrava. Even higher values are measured in other locations in the area. Typical maximum daily NOx concentrations are around 300 g/m3. Annual average concentrations of SO2, NOx and suspended particles are 40 - 70 g/m3, 60 - 90 g/m3 and 100 - 130 g/m3, respectively. These concentrations must be considered very high, and is likely to cause effects on the healths of the population, as well as on vegetation.

Emission sources

Critical situation of atmosphere pollution in Ostrava region is caused mostly by several main sources of pollution - New Metallurgical Plant (Nova hu) Ostrava, Vtkovice Metallurgical Plant, Power Plant Tebovice, Coking Plants of Ostrava-Karvin Mines, Power Plant Tebovice, Steel and Wire Factory Bohumn and few others. The main sources are listed in table.

Source	Particles	SO	NO	CO	Other
Nova Hut	15424	17289	13124	114173	4082
Vitkovice	6517	12208	10634	62569	1031
Power Plant Trebovice	6046	6295	2057	-	-
Heating Plant Ostrava	1291	2358	879	-	-
Power Plant J.Sverma	1597	1910	685	-	-
Coking Plant Svoboda	752	1083	328	801	1684
Coking Plant J.Sverma	885	1857	441	717	1670
Moravian Chemical Factory Dukla	69	2800	45		81
Moravian Chemical Factory		568	427		122
Ostramo Oil Recycling Plant	1110	284			211
Road Contruction Enterprice	772	800	4390	-	-
Cement Factory Ostrava	398	107	323	-	-
Heat Suply Enterprice Ostrava	386	368	92	-	-
Railways Repair Enterprice	693	250	107	14	-
Other	2032	2144	718	138	194
Total	36862	51147	34534	178412	9075

Approximately one half of territory of town Ostrava is the most polluted part of northern Moravia. Besides metallurgy, energy generation is second largest source of air pollution. The pollution from six higgest energetic sources (Power Plants at Nov hu, Vtkovice, Power Plant Tebovice, Heating Plant Ostramo, Power Plant verma, Ostrava) is 18 000 tons per year of suspended particles, 28 000 tons per year of sulphur dioxide and 13 000 tons per year of nitrogen oxides. In addition to these largest sources; smaller sources are contributing by 4 000 tons per year of suspended particles, 3 000 tons per year of sulphur dioxide and 1 000 tons per year of nitrogen oxides. The rough estimate for local heating is 8 000 tons per year of suspended particles and 4 000 tons per year of sulphur dioxide.

2. PROPOSED PROJECTS FOR COOPERATION

The need for reduction of emissions to air from industrial sources in the Ostrava region is obvious. Financing of abatement of emissions, which require process modifications and changes, modernization and installation of cleaning equipment is beyond the scope of this cooperation. However, a program which aims at the starting of a process in each industrial company towards more efficient utilization of energy, raw materials and waste to minimize emissions, might be of targe benefit to the air pollution situation. This is reflected in one of the proposals for cooperation. This proposal we should be estimated on the basis of other proposals from Session C.

The other proposals from Session B reflects the need felt by the Czech participants to form a necessary basis for air quality management in the Ostrava region. This basis does not differ from what is needed in any air basin. Such a basis will allow:

- making decisions on necessary reduction of emissions to achieve acceptable air quality, with a view to effects on health, vegetation, etc.
- making decisions on the most cost-effective way to improve air quality.

The selection of proposals are based on the following criteria:

- The most urgent air pollution problems in the Ostrava region, as presented by the Czech participants in the Session
- Norwegian expertise and experience, represented by the Norwegian participants
- Common interests between individual partners in the session.

The following topics for further cooperation was proposed:

1. **Cooperation on industrial air pollution reduction.**
2. **Air Quality Assessment Program.**
3. **Basis for reduction of pollution by dust particles in Ostrava.**
4. **Measurements as basis for emission redustions.VOC, PAH and Dioxins in Ostrava.**
5. **Assessment of air pollution from road traffic in Ostrava.**

Project proposal outlines are enclosed.

The proposals will be worked out in more detail, including estimates of costs.

COOPERATION INDUSTRIAL AIR POLLUTION REDUCTION

It is obvious that the emissions are rather high at many factories in the Ostrava region.

These problems can best be solved by an integrated approach where water, air and waste problems are considered - this leading up to a cleaner production with less waste/emissions before traditional cleaning equipment is installed as "end-of-pipe" solution.

The group suggests that industry people are invited to participate in a Cleaner Production Training Program. This will include a "cradle-to-grave" thinking process to consider:

- changes in raw materials,
- changes in products,
- changes in technology,
- recycling/reuse of materials traditionally considered as waste, with the aim to reduce overall pollution before one starts to install whatever cleaning equipment that still will have to be used.

Norwegian partners would take part in starting such a program, and one could presumably also benefit from experiences of the Norwegian-Polish program on cleaner production presented in Section C of this seminar.

AIR QUALITY ASSESSMENT PROGRAM

The main objectives of this program are:

- to provide information of the pollution situation in the area
- establish a basis for strategies to reduce air pollution.

To obtain the main objectives, the following elements have to be studied:

- emission inventory
- meteorological measurements
- air quality measurements
- dispersion modelling.

Local institutes are performing air quality measurements in the Ostrava region. The concentration distribution of SO2. NOx and particulates seems to be well documented in the area. The emission inventory carried out by the Institute of Industrial Landscape Ecology have to be improved to improve the quality of the model calculations. Emission data from industry, household and traffic have to be collected by local personel.

The most important subject for understanding the relation between emissions and impact is the meteorological measurements. Wind measurements are carrying out on a routine basis at the airport and at Poruba. Information about dispersion conditions such as turbulence intensity and stability of the atmosphere is not available at this stage. A meteorological tower measuring wind and temperature at several levels in addition to turbulence intensity is critical for carrying out model calculations for the area.

To understand and explain the source contribution to the pollution impact in the area, dispersion models must be applied for the area. The set of models should perform calculations of short term and long term average concentration distribution from different source categories (industry, traffic, house-hold) in the area. These models can at a later stage be used for planning purposes.

Relevance to the air pollution situation in Ostrava

Model calculations can explain how much each source category contribute to the pollution impact in the area. The models can also be used to evaluate the importance of each single source to the impact of air pollutions. Information of emissions and meteorology can be used in model calculations to perform a priority list of measures to be carried out to reduce the air pollution impact in the area. This system will be an important tool for future planning purposes to improve the air quality in the Ostrava region.

The collaboration will take place between NILU and the following institutes in Ostrava:

- The Czech Hydrometeorological Institute, Ostrava Branch (meteorology, models)
- Town Council of Ostrava (models)
- Institute of Industrial Landscape Ecology, Czechoslovak Academy of Sciences, Ostrava (emission inventory, consumption data).

The project plan will be as follows:

- local institutes carries out the emission inventory and NILU install the meteorological tower;
- NILU applies the models for the Ostrava region (20 km x 20 km);
- Czech personell visit NILU to learn the models;
- the models are implemented in the local computer in Ostrava;
- NILU visit Ostrava for follow up of the project and if necessary hold lectures.

BASIS FOR REDUCTION OF AIR POLLUTION BY PARTICLES IN OSTRAVA

Objectives

- Provide information on concentrations of particles in air
- Determine size distribution and elemental composition, and mineralogical characteristics of particles in air and from sources
- Study the impact of particle pollution on soils and vegetation
- Identify contribution from individual emission sources.

Relevance to air pollution situation in Ostrava

The particle pollution is considered to be the main air pollution problem in Ostrava. The pollution concentrations are very high. Maximum concentrations of over 1000 g/m3 has been measured as 24 hour average, and annual average concentration up to 130 g/m3 has been measured. There are several sources of importance , including metallurgical industry sources (Vítkovice and Nová huť) power plants, cement factories, house heating by coal slurry, road traffic.

This project aims at producing data which are necessary in order to make decisions on cost-effective measures to reduce the effects of the particle emissions in the area. The effects include health effects (pulmonary system), soil contamination and consequently contamination of food chain and added stress on vegetation.

Partners

- Mining University of Ostrava, dpt. of geology and mineralogy (Helena Raclavská)
- Institute of Industrial Landscape Ecology, Ostrava (Konst. Raclavský)
- Czech Hydrometeorological Institute (Rostislav Sochorec)
- Norwegian Institute of Air Research (Steinar Larssen)

Project outline

The objectives will be met by means of using some or all of the following techniques :

- dispersion models, based on existing emission inventory (same as Project 1)
- receptor models, based on elemental analysis of samples taken in air (several locations) and from emission sources

- wind-direction controlled sampling for separation between influence from different industrial sources.

The measurement programme in ambient air will include at least 40 12-hours samples from each of a few selected receptor locations. The samples will be taken during a 3-4 month winter period. Samples for analysis of elemental composition from the main source categories should also be provided. Particles will be separated in 2-3 size fractions plus sampling of deposition.

Particle samples will be analyzed for elemental and mineralogical composition. Soil and vegetation samples will be collected and analyzed for chemical and mineralogical (soils) composition.

Form of cooperation

- Manual samplers for measurements in ambient air will be provided by NILU.
- Particle analysis will be done in Ostrava, or at NILU if suitable analysis techniques are not available in Ostrava.
- Dispersion modelling will be performed in Ostrava, based on the models provided under a different project ("Air quality assessment program").
- Receptor modelling will be performed at NILU and at the Mining University in Ostrava.
- Visits at NILU and Ostrava for instruction in sampling/analysis techniques and discussion of results.

MEASUREMENTS AS BASIS FOR EMISSION REDUCTIONS VOC, PAH AND DIOXINS IN AIR IN OSTRAVA

Objectives

To reduce the pollution of organic compounds in air in Ostrava, information is needed on air concentrations and source emission. The objectives of the first phase of this project is to get information on the concentration levels of VOC, PAH and dioxins in air, and to establish gas chromatograph analysis methods for VOC and PAH in Ostrava.

Relevance to the air pollution situation in Ostrava

VOCS are emitted to air from dumps and probably to some extent from coking plants.

There are many sources that emit PAH to air in Ostrava. The main ones are probably the four coking plants and traffic, but uncontrolled burning in landfills containing waste from mining may also contribute substantially.

House heating is probably not a main source for PAH emissions in Ostrava but it might be of importance in the neighbouring villages and cities. All these sources probably lead to high PAH-concentrations in air in Ostrava.

There is also a plant for oil recyclating in Ostrava. Waste from this recycling is deposited in landfills and the recycled oil itself is used as motor oil. Since the oil is probably containing PCBs, use of this oil and emissiong from the landfills might lead to high dioxin-concentrations in air in this area of the city.

Partners

In Czechoslovakia:

- Dr. Dombek Vclav, Institute of Industrial Landscape Ecology
- Ing. Jana Libor, Regional Hygienic Institute

In Norway:

- Dr. Braathen, Ole-Andeo, Norwegian Institute for Air Research

Project outline

Steel flasks for sampling of VOC will be acquired and samples of air in Ostrava will be taken. These samples will then be brought to NILU for analysis by Czechoslovakian partners. While the analysis are carried out, detailed information on the analysis method will be given.

In Norway, a GC-based method for PAH-analysis is used. This method is of interest to institutions in Czechoslovakia, and therefore they are interested in detailed information. NILU has developed a sampler that is well suited for air measurements of concentrations of PAH and dioxins, and one such sampler will be made available for the Czechoslovakian partners.

With this sampler PAH measurements will be carried out and air samples for dioxin measurements will be taken. These dioxin samples will then be sent to NILU for analysis and the concentration levels of dioxins will indicate if this constitutes a real problem in Ostrava.

Form of cooperation

Persons from the Czechoslovakian partners will visit NILU to get information about the VOC and PAH analysis method and to get used to operating the PAH/dioxin sampler. The necessary equipment for the GC-analysis of PAH and VOC is probably currently available in Ostrava if not additional equipment must be acquired. The sampler will then be transported to Ostrava, and PAH measurements will be started. The sampler will also be used to collect samples which will be analyzed for dioxins at NILU.

Measurements of VOC-concentrations will also be started.

ASSESSMENT OF AIR POLLUTION FROM ROAD TRAFFIC IN OSTRAVA

Objectives

Provide models to the Czech partners for the calculations of airí pollution caused by road traffic in Ostrava.

Relevance to air pollution problems in Ostrava

Road traffic contributes to the air pollution in Ostrava,í probably mainly to concentrations of CO, NO2, lead and aerosolsí in the vicinity of roads. An estimate of the road trafficí contribution is necessary to get a full view of the air pollutioní situation.

Project outline

An analysis of road traffic air pollution must be based uponí knowhelp of the distribution of traffic on the road network.í These data already exist for the town of Ostrava.

As a start of the analysis of the road traffic contribution, suchí data on road traffic and road geometry should be supplied toí suitable models to calculate trafficactivity emissions and airí concentrations. NILU has suitable models which will beí transferred to the Czech partner in Ostrava.

This model is a tool for analyzing the presentí pollutioní situation, and it can be used to project the future situation,í based on traffic projections.

Road is of particular interest in Ostrava. The model is suitableí also for estimating the road traffic contribution to leadí pollution.

Partners

- Town Council of Ostrava, Department of Transport Engineeringí (M. Škrobánek, Jana Jurajdová)
- Norwegian Institute for Air Research (Steinar Larssen)

Form of cooperation

- Transfer of models to Czech partners
- Training in model use, in Oslo or in Ostrava

REPORT FROM SESSION C

WASTE MINIMIZATION

Chairman: Olav S. NEDENES

Reporter: Svein STORDAHL

Olav Nedenes introdused the topic of cleaner production and some definitions.

Lecture by Ing. Florian - APES
- partly outside the frame of the conference (his comment)

Lecture by Ing. J. Vysloužil
- National and international information system on hazardous waste

Lecture by Dr. Vít
- Main target: Categorization of hazardous waste

Lecture by Ing. Hlavatá
- Summing up the landfills and dumps

Definition of waste: All types of pollution to air, water, land not just solid waste.

An hours lecture to put up the targets and thinking up on the wall was necessary.

Priority:

1. Waste generation.
   Where, how, when, type effects, why
2. Handling of waste.
   Priorities of today.
   Priorities of tomorrow.
3. Environmental effects. (This is well known?)
   Mixing/separation internal and external.
   Mixing of industrial waste andmunicipal.
   Wrong governmental priorities.
   Production values.
   Pulverization of decision - making process and responsibilities.
   Real cost of pollution is not encountered.
   Liability cost.
   Conservative ways of thinking.
   Financing is not critical or sometimes (coking plant).
   Not allowed to restructure in the past.
   Ecological propaganda (pressure groups).
   Monitoring inadequate.
   Restructure or die.
   Bureaucratic resistance (inside).
   Obstruct to creativity.

Survive

1. Waste management
2. W.M. Handling
3. Reconstruction

Organizational matters

- workers participation in the creation of options

RECOMMENDATIONS FROM SESSION C

1. 3-4 model projects in Waste minimization Assessment/Cleaner production in 3-4 different branches of Czechoslovakian industry should be started as soon as possible. A priority list should be set up from the Federal Committy of Environment together with the Ministries of Industry and the Association of Czechoslovakian Industry.The 7 proposals from participants in Session C. Should be considered as possible candidates on line with others. A final report from these assessements with action plan for implementation should be ready by 1. July 1992. Norwegian advisors for the assessments and analyses and nessesary pilot plant tests in these factories is payed from the bilateral programme budget (budget = 100 000 USD).

2. An interactive training programme

An interactive training programme (mostly in company project work) in strategic planning, Waste Minimization Assessments is started Sept. 1. 1992. This will be similar to the Polish-Norwegian Programme. Minimum 25 industrial companies in more than 10 different and relevant branches shall participate in the first 2-3 cycles of the 240 hr. programme with English language as base (budget approximately 850 000 USD). The english speaking programme shall be completed by the end of 1993. This programme shall, besides the economic savings and payback on cleaner production investments and large reductions of serious pollution from these 25 factories, also secure that minimum 25 highly qualified Czechoslovakian teachers and in company advisors haves been authorized to carry on and spreading the programme (mass training).

3. A mass training interactive programme in Czechoslovakian language with Czechoslovakian teachers and in company advisors will follow the 2-3 English speaking cycles from 1993 to 1996. The aim of this programme is to complete Waste minimization Assessments and analysis in min. 400 Czechoslovakian Companies with min. 800 participants going through the 240 hr. programme taking part in the in-company project work and completing project reports. In addition more than 1000 leaders shall have participated in shorter (1-2 days) branch seminars in cleaner production (these activities shall be run on self-finance basis from fees payed by the participants except for start up coordinating activities - see next paragraph).

4. A cleaner production Center of Czechoslovakia consisting of the authorized in company advisors and instructors in cleaner production and Waste Minimization Assessments shall be established in 1993 with one of authorized advisors as payed leader and coordinator on full time basis. The center shall act as a coordinating organization for all activities of the mass training programme but shall on contract bases use professional post graduate societies or schools for arranging seminars etc. The center shall have well equipped library. The cleaner production center shall after a start up period of 2 years be financed from a 10 % royalty on all advisory-fees payed by companies for the in-company advice (from the authorized advisors). Budget for the start up period approximately 150 000 USD.

THE ENVIRONMENTAL AND ECONOMICS RESULTS OF THE TOTAL PROGRAMME SHALL BE:

* Between 20-50 % reduction in discharge from each factory of at least one serious pollutants and/or energy or water demand with very small costs involved (housekeeping actions) within one year from project start up. Financed from the factories operating budget. Payback period 1 year IRR - more than 10 % higher than normal bank interest rate.
* Between 30 and 100 % reduction in discharge from each factory of at least one serious pollutants within 2 years from project start up. This should in most cases be moderate investments financed by the operating budget in each company or with loans from local banks. Payback period 2 years IRR - more than 10 % higher than normal bank interest rate.

Vedlegg B

Prosjektforslag

NORWEGIAN INSTITUTE FOR AIR RESEARCH
Our ref.: OAB/MAa/P-820/16 December 1991

PROJECT PROPOSAL

MEASUREMENT AS BASIS FOR EMISSION REDUCTIONS: VOC, PAH, PCB AND DIOXINS IN AIR IN OSTRAVA

1 BACKGROUND

There are a number of sources that presumably emit organic compounds to air in the Ostrava area in Moravia in Czechoslovakia. However, measurement data of concentrations of organic compounds in air in the city are at present rather limited, and it is thus difficult to assess the impact of these compounds on the public health. Additional measurements are therefore needed.

At a workshop held in Ostrava 22-25 October 1991, draft proposals for a number of projects concerning the air quality in Ostrava, were prepared. These projects were to be organized as joint projects between Czechoslovakian and Norwegian partners. The present project proposal is a more detailed version of a proposal prepared at the workshop with Dr.Václav Dombek, Institute of Industrial Landscape Ecology and Ing. Libor Janca, Regional Hygienic Institute as Czechoslovakian representatives and Ole-Andres Braathen, Norwegian Institute for Air Research as Norwegian representative.

2 OBJECTIVES

In order to reduce the pollution of organic compounds in air in Ostrava, information is needed on air concentrations and source emissions. The objectives of this project is to get information on the concentration levels of VOC, PAH, PCB and dioxins in air, and to establish gas chromatographic analysis methods for VOC and PAH in Ostrava.

3 SCOPE OF WORK

The project will include visits by the Czechoslovakian partners to NILU, one visit to Ostrava by two of NILUs employees, acquisition of steel flasks and one of NILUs PUF-samplers which will be made available for the Czechoslovakian partners, sampling in air in Ostrava and analysis of the samples both in Ostrava and at NILU.

3.1 VISITS TO NILU AND TO OSTRAVA

NILU has developed analysis methods for VOCs in air which is based on gas chromatography with flame ionization detection (FID). Sampling is done by taking "grab samples" of air in internally electropolished steel flasks. It is of interest to start measuring the concentrations of VOCs in air in Ostrava. It is considered most efficient that two persons from the co-operating institutions in Ostrava shall visit NILU in order to study the analysis method in detail.

NILU's method for analysing the concentrations of PAH in air is also of interest to the Czechoslovakian partners. An additional visit to NILU by persons from the co-operating institutions in Ostrava in order to study the PAH-method, is therefore planned. At the same visit, one of NILUs samplers, which is used for sampling PAH, PCB or dioxins in air, will be made available to the Czechoslovakian partners and necessary information will be given on operation of the sampler.

When NILU's analysis methods for VOC and PAH have been used for a while in Ostrava, two of NILUs employees will visit Ostrava in order to discuss problems and modifications.

3.2 ACQUISITION OF EQUIPMENT

Sampling of VOC in air is done with internally electropolished steel flasks. 10 such flasks will be acquired and used in Ostrava. Possibly, it will also be necessary to modify the existing gas chromatographs in Ostrava and spare parts, columns and other vital parts must therefore be purchased.

NILU will prepare one of the institute's specialized PUF-samplers for sampling PAH, PCB and dioxins in air, and the sampler will be used by the Czechoslovakian partners.

3.3 SAMPLING AND ANALYSIS

Two samples of soil from the most polluted areas in Ostrava, presumably around the oil recycling plant, will be taken and sent to NILU for dioxin analysis. The results from these analyses will indicate if dioxins constitute a problem in Ostrava or not.

The steel flasks will be sent to Ostrava, and air samples will be taken. The two persons from Ostrava that shall visit NILU in order to study the VOC-method, will bring the flasks to NILU where the analyses will be carried out. Subsequent analyses will be done in Ostrava.

NILU's PUF-sampler will be used to sample PAH, PCB and dioxins in air. The analyses of PAH will be done in Ostrava, and the PCB and dioxin samples will be analysed at NILU.

4 COST ESTIMATE

The cost estimate includes expenses for equipment acquisition and travels for both the Czechoslovakian and Norwegian partners, and the cost of the work done by Norwegian persons taking part in the project. The cost of the work done by the Czechoslovakian partners is not included.

The total cost estimate is as follows:

Two visits to NILU (two persons each visit):		
Travel	kr 40 000.-	
Living expenses in Norway	" 40 000.-	
Man-hours, NILU	" 60 000.-	kr 140 000.-
One visit to Ostrava (two persons):		
Travel	kr 20 000.-	
Living expenses in Ostrava	" 10 000.-	
Man-hours, NILU	" 60 000.-	kr 90 000.-
Equipment:		
10 steel flasks	kr 50 000.-	
NILUs PUF-sampler	" 30 000.-	
Necessary GC-parts	" 75 000.-	kr 155 000.-
Aanlysis:		
Two dioxin analyses, soil	kr 25 000.-	
Three dioxin analyses, air	" 40 000.-	
Ten PCB analyses, air	" 50 000.-	kr 115 000.-
Total:		kr 500 000.-

The project may be split up in two phases, the first phase will include:

The fist visit to NILU	kr 70 000.-
Acquisition of 10 steel flasks	" 50 000.-
Analysis of two soil samples for dioxins	" 25 000.-
Total:	kr 145 000.-

The second phase will include the rest of the project.

5 TIME SCHEDULE

The first phase of the project may be carried out in the period January-June 1992 with the first visit to NILU to take place in May or June 1992.

The rest of the project may then be carried out in the period from August 1992 to December 1993.

Vedlegg C

Måleresultater VOC

Compound	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Sample 7	Sample 8	Sample 9	Sample 10
Etan	5,10	3,69	2,89	5,63	4,22	8,82	9,12	9,28	15,29	5,85
Eten	4,79	5,25	3,11	6,10	4,58	18,46	17,89	17,72	15,19	6,33
Propan	1,93	1,33	1,19	2,02	1,56	3,97	3,98	6,92	5,13	3,65
Propen	1,76	1,15	0,62	1,45	1,11	7,78	7,52	6,54	3,48	1,45
Propyn (acetylen)	4,54	4,06	2,85	4,13	4,31	20,98	16,51	34,58	19,41	7,39
2-Metylpropan (iso-butan)	0,57	0,68	0,44	1,27	0,65	2,85	1,82	7,41	1,35	8,84
1,3-Propadien	0,08	0,10	0,05	0,12	0,08	0,67	0,58	0,63	0,23	0,31
Butan	1,17	1,07	0,82	1,86	1,08	3,29	2,63	8,08	2,50	6,34
trans-2-Buten	0,10	0,09	0,02	0,24	0,07	0,69	0,50	1,32	0,23	0,74
1-Buten	0,31	0,23	0,11	0,35	0,23	1,48	1,36	1,66	0,67	0,64
2-Metylpropen (iso-buten)	0,35	0,28	0,12	0,29	0,21	1,93	1,93	1,71	0,56	0,63
cis-2-buten	0,07	0,07	0,02	0,15	0,06	0,49	0,38	0,93	0,17	0,42
2-Metylbutan (isopentan)	0,88	1,39	0,67	2,40	1,12	8,02	4,41	25,32	2,67	7,78
Pentan	0,61	0,87	0,46	1,82	0,77	4,73	2,96	11,96	1,61	4,36
1,3-Butadien	0,13	0,18	0,07	0,20	0,14	1,51	1,43	1,25	0,56	0,20
Pentener (sum)	0,31	0,29	0,11	0,72	0,31	2,15	1,67	4,74	0,87	1,41
C6 (sum)	0,65	0,54	0,25	0,69	0,52	7,92	1,91	8,40	1,15	1,47
2-Metylpentan	0,32	0,36	0,16	0,57	0,31	5,57	1,37	6,61	0,76	1,27
3-Metylpentan	0,57	0,28	0,13	0,43	0,24	5,70	1,09	5,50	0,61	1,01
Heksan	1,07	0,27	0,15	0,52	0,27	7,24	1,05	4,86	0,66	1,08
2-Metyl-1,3-butadien (isopren)	0,13	0,70	0,14	0,81	0,22	0,41	0,55	1,16	0,15	0,44
Metylheksaner (sum)	0,23	0,33	0,15	0,45	0,35	3,01	1,47	5,56	1,29	0,88
Heptan	0,10	0,11	0,07	0,18	0,14	0,95	0,49	1,88	0,46	0,30
Benzen	1,85	3,82	0,86	2,03	16,80	4,72	4,00	6,70	3,62	3,15
Oktan	0,05	0,05	0,03	0,08	0,10	0,46	0,23	0,63	0,22	0,10
Metylbenzen (toluen)	1,55	0,54	0,95	3,60	1,78	9,18	5,43	14,68	4,41	4,19
Nonan	0,05	0,04	0,15	0,10	0,07	0,31	0,21	0,30	0,20	0,08
Etylbenzen	0,15	0,23	0,17	0,44	0,22	1,24	0,89	1,88	0,47	0,60
1,3- og 1,4-Dimetylbenzen (m- og p-xylen)	0,43	0,68	0,37	1,37	0,54	4,38	3,11	6,80	1,67	1,91
1,2-Dimetylbenzen (o-xylen)	0,14	0,21	0,14	0,46	0,19	1,40	1,04	1,93	0,54	0,51
Totalt	29,99	28,89	17,27	40,48	42,25	140,31	97,53	206,94	86,13	73,33

Vedlegg D

Måleresultater, dioksiner

Norsk institutt for luftforskning
Norwegian Institute for Air Research

NILU 29

ELCOM
28. rijna 168
709 01 Ostrava - Marianske Hory
The Czech Republic

Attn.: Ing. Jiri Svrcula

Deres ref./*Your ref.*:	Vår ref./*Our ref.*:	Dato/*Date:*
	OAB/MAa/O-92072	18 October 1994

Measurements of organic compounds in air, Ostrava

Dear Ing. Svrcula,

Here, finally, are the final results of the dioxin analysis of the three soil samples from Ostrava.

As a quality assurance measure, ^{13}C-labelled 2,3,7,8-chlorosubstituted isomers were added before the whole clean-up and analysis procedure (the internal standard). The recovery standard was added just before the analysis with the GC/MS. According to our method, the recovery rate of the ^{13}C-labelled internal standard components should be in the range 40 - 120 % in relation to the ^{13}C-labelled recovery standard components.

All results have been corrected according to the recovery rates.

We experienced some problems during this analysis, but now we are mostly satisfied with the quality of the results. However, the recovery rates for TCDD, TCDF and OCDF for the sample Ostrava 1 (93/784) are still not in the range 40 - 120 %.

The result (i-TE) of the sample Ostrava 1 (93/784) was 355 pg/g. This is a high concentration. There are not many limit values or guideline values for the concentration of dioxins in soil, but in Germany such high concentrations would imply severe restrictions on the use of the soil for agricultural purposes and also for use as playgrounds for children etc.. The dioxin concentrations (i-TE) in the other two samples were considerably lower (5,03 pg/g and 0,36 pg/g) and would not lead to any restrictions in Germany.

In all three samples, the contribution of the non-ortho substituted PCB's (PCB-77, PCB-126 and PCB-169) to the toxicity equivalents were lower than the contributions of the dioxins and furans.

Vennligst adresser post til NILU, ikke til enkeltpersoner/Please reply to the institute.

Postal address: P.O. Box 100 N-2007 KJELLER, Norway
Office address: Instituttveien 18 KJELLER
Telephone : +47 63 89 80 00
Telefax : +47 63 89 80 50
Telex : 74854 nilu n
Bank: 5102.05.19030
Postgiro: 0813 3308327
Foretaksnr./Enterprise No. 941705561

We are at the moment carrying out the additional PCB-analysis of the same three soil samples, and will report the results as soon as possible.

Now to the status of our project:

I am told that the PUF-sampler should be ready in the middle of November. You may therefore want to consider a second visit to NILU at the end of November. Such a visit might give you a chance to go through the sampler before it is shipped to Ostrava, and we could also discuss the final part of the project. I think that this would take 2 - 3 days here at NILU. If you are interested in such a visit, please let me know as soon as possible.

Dr. Schmidbauer has informed me that he will have the list of necessary GC-parts ready early next week. He will then contact you in order to discuss the ordering of these parts and also the actual upgrade of your GC.

Please contact me if you have any questions or comments.

Sincerely

Ole-Anders Braathen

Ole-Anders Braathen
Head, Organic Analysis

Norwegian Institute for Air Research
P.O. Box 100, N-2007 Kjeller

Measuring report No. O-36

Customer: Ole-Anders Braathen, NILU

NILU Project No.: O-92072

Sampling:

Location: Ostrava, NILU has not received any detailed information.
Responsibility: Co-operators in Ostrava.
Comments: NILU prepared the sampling equipment and discussed sampling with Ostrava. However, the samples were taken by NILUs co-operators in Ostrava.

Sample information:

NILU Sample ID.	Customer's Sample ID	Sample type	Sample received	Sample analysed
93/784	Ostrava 1	Soil	12.11.93	26.11.93-30.06.94
93/785	Ostrava 2	"	"	"
93/786	Ostrava 3	"	"	"

Analyses:

Performed by: Norwegian Institute for Air Research
P.O. Box 100
N-2007 KJELLER

Method: NILU-O-1
Uncertainty: ±25%
Comments: It was necessary to repeat clean-up, due to highly contaminated samples. The recovery rate for sample No. 93/784 was not satisfactory (not in the range 40-120%) for TCDD, TCDF and OCDF.

Accepted: Kjeller, 10 August 1994

Ole-Anders Braathen

Ole-Anders Brathen
Head, Organic Analysis

Enclosures: Results of analyses
Measuring report and enclosures cover 14 pages totally

Results represent only the samples analysed. This report shall not be reproduced except in full, without the written approval of the measuring laboratory

NILU

Results of PCDD/PCDF Analysis

Encl. to measuring report: O-36
NILU sample number: 93/784
Customer: O.A.B.
Customers sample ID: Ostrava 1
:
Sample type: Soil
Sample amount: 8 g dry weight
Concentration units: pg/g
Data files: CD234081-CD234121-CD240081

Kjeller, 09.08.94

Compound	Concentration pg/g	Recovery %	TE (nordic) pg/g	i-TE pg/g
2378-TCDD	10,7	*	10,7	
SUM TCDD	**1 091**			
12378-PeCDD	64,6	72	32,3	
SUM PeCDD	**4 171**			
123478-HxCDD	60,5		6,05	
123678-HxCDD	216	106	21,6	
123789-HxCDD	153		15,3	
SUM HxCDD	**9 808**			
1234678-HpCDD	1 379	120	13,8	
SUM HpCDD	**2 468**			
OCDD	1 720	105	1,72	
SUM PCDD	**19 258**		**101**	
2378-TCDF	774	*	77,4	
SUM TCDF	**1 913**			
12378/12348-PeCDF	541		5,41	27,1
23478-PeCDF	180	64	90,0	
SUM PeCDF	**2 018**			
123478/123479-HxCDF	330	102	33,0	
123678-HxCDF	102		10,2	
123789-HxCDF	25,6		2,56	
234678-HxCDF	87,0		8,70	
SUM HxCDF	**671**			
1234678-HpCDF	379	113	3,79	
1234789-HpCDF	29,6 (i)		0,30	
SUM HpCDF	**591**			
OCDF	425	1	0,43	
SUM PCDF	**5 618**		**232**	**253**
SUM PCDD/PCDF	**24 876**		**333**	**355**

<: Lower than detection limit at signal-to-noise 3 to 1

TE (nordic): 2378-TCDD toxicity equivalents according to the nordic model

i-TE: 2378-TCDD toxicity equivalents according to the international model

(i): Isotope ratio deviates more than 20 % from theoretical value.
This may be due to instrumental noise or/and chemical interference

Results of PCDD/PCDF Analysis
- nonortho-PCB -

Kjeller, 09.08.94

Encl. to measuring report: O-36
NILU sample number: 93/784
Customer: O.A.B.
Customers sample number: Ostrava 1

Sample type: Soil
Sample amount: 8 g dry weight
Concentration units: pg/g
Data files: CD234081-CD234121-CD240081

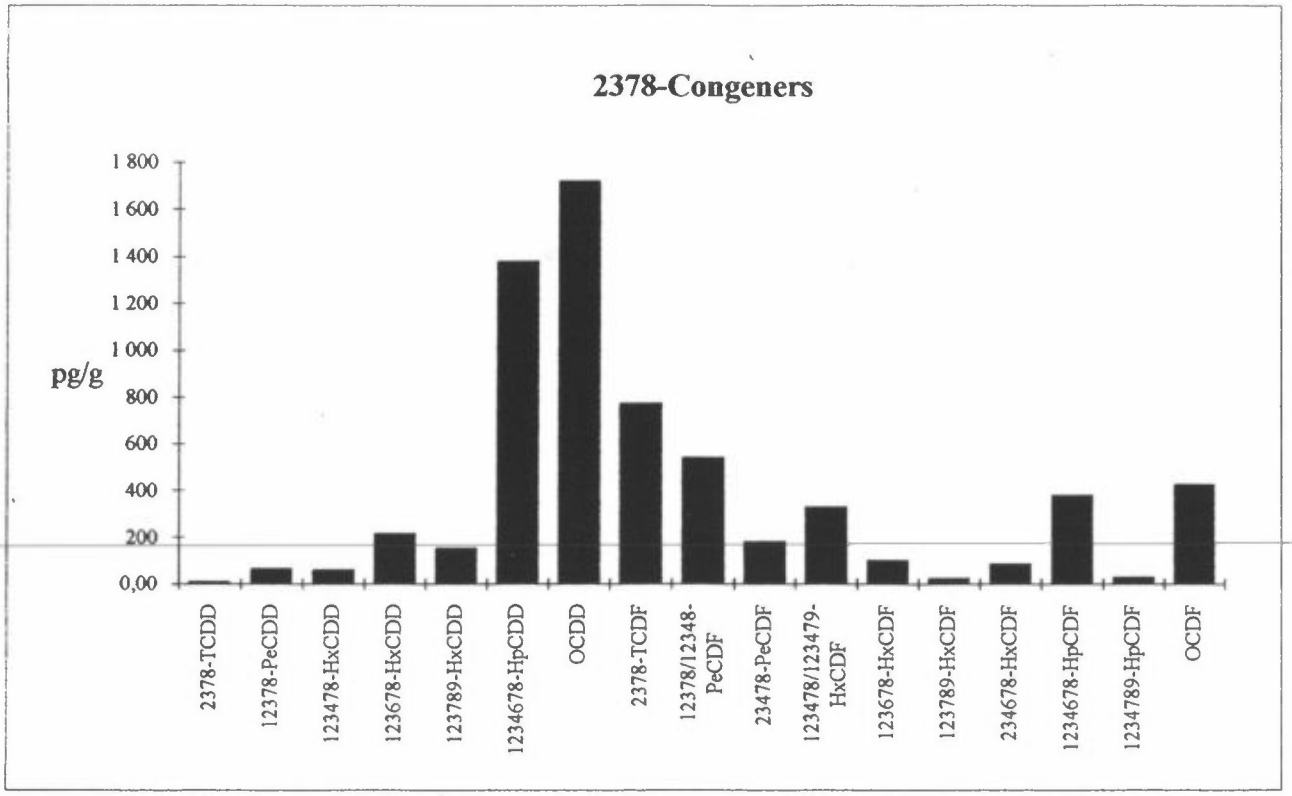
Compound	Concentration pg/g	Recovery %	TE(WHO) pg/g	TE (Safe) pg/g
33'44'-TeCB (PCB-77)	178,00	*	0,09	1,78
33'44'5-PeCB (PCB-126)	111,00	*	11,1	11,1
33'44'55'-HxCB (PCB-169)	156,00	42	1,56	7,80
SUM TE-PCB			**12,7**	**20,7**

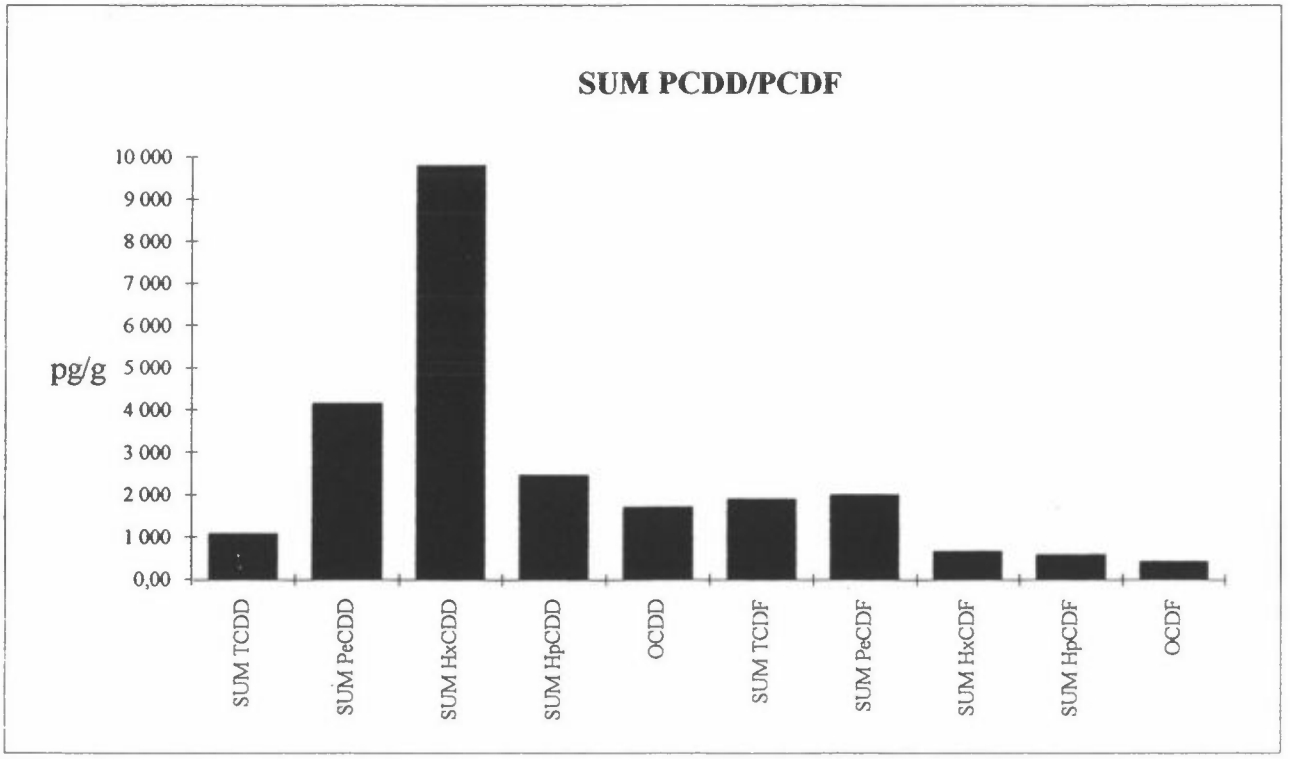
TE(WHO): 2378-TCDD toxicity equivalents according to Ahlborg et al. (1994).
TE(Safe): 2378-TCDD toxicity equivalents according to Safe (1994).
<: Lower than detection limits at S/N=3/1
(i): Isotope ratio deviates more than 20 % from theoretical value.
This may be due to instrumental noise or/and chemical interference

Results of PCDD/PCDF Analysis

Encl. to measuring report: O-36
NILU sample number: 93/784

Kjeller, 10.08.94

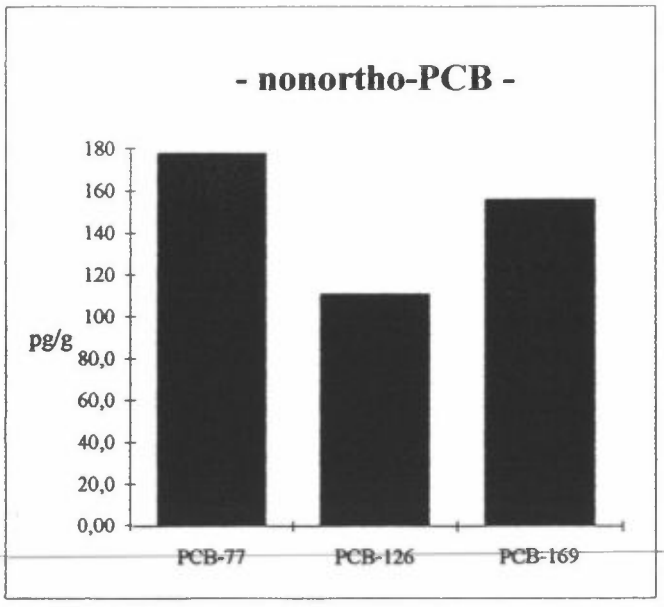


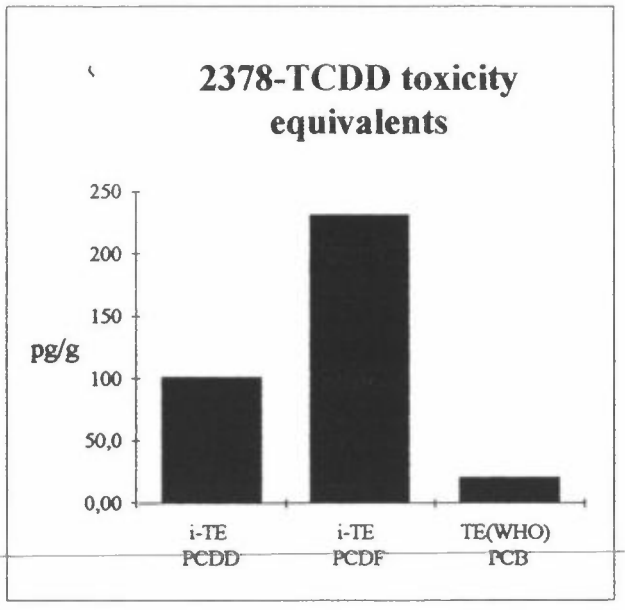


Results of PCDD/PCDF Analysis

Encl. to measuring report: O-36
NILU sample number: 93/784

Kjeller, 26.08.94





Results of PCDD/PCDF Analysis

Encl. to measuring report: O-36
NILU sample number: 93/785
Customer: O.A.B.
Customers sample ID: Ostrava 2
:
Sample type: Soil
Sample amount: 8 g dry weight
Concentration units: pg/g
Data files: CD234071-CD234131-CD240071

Kjeller, 10.08.94

Compound	Concentration pg/g	Recovery %	TE (nordic) pg/g	i-TE pg/g
2378-TCDD	0,29	102	0,29	
SUM TCDD	**8,06**			
12378-PeCDD	0,64	120	0,32	
SUM PeCDD	**8,36**			
123478-HxCDD	0,52		0,05	
123678-HxCDD	0,90	114	0,09	
123789-HxCDD	0,84		0,08	
SUM HxCDD	**13,0**			
1234678-HpCDD	6,79	120	0,07	
SUM HpCDD	**14,8**			
OCDD	24,8	110	0,02	
SUM PCDD	**69,0**		**0,93**	
2378-TCDF	3,79	93	0,38	
SUM TCDF	**32,9**			
12378/12348-PeCDF	4,58		0,05	0,23
23478-PeCDF	3,58	112	1,79	
SUM PeCDF	**38,5**			
123478/123479-HxCDF	5,87	110	0,59	
123678-HxCDF	3,34		0,33	
123789-HxCDF	1,31		0,13	
234678-HxCDF	3,03		0,30	
SUM HxCDF	**23,7**			
1234678-HpCDF	20,2	119	0,20	
1234789-HpCDF	3,57		0,04	
SUM HpCDF	**39,7**			
OCDF	110	106	0,11	
SUM PCDF	**245**		**3,92**	**4,10**
SUM PCDD/PCDF	**314**		**4,85**	**5,03**

<: Lower than detection limit at signal-to-noise 3 to 1

TE (nordic): 2378-TCDD toxicity equivalents according to the nordic model

i-TE: 2378-TCDD toxicity equivalents according to the international model

(i): Isotope ratio deviates more than 20 % from theoretical value.
This may be due to instrumental noise or/and chemical interference

Results of PCDD/PCDF Analysis
- nonortho-PCB -

Kjeller, 10.08.94

Encl. to measuring report: O-36
NILU sample number: 93/785
Customer: O.A.B.
Customers sample number: Ostrava 2
:
Sample type: Soil
Sample amount: 8 g dry weight
Concentration units: pg/g
Data files: CD234071-CD234131-CD240071

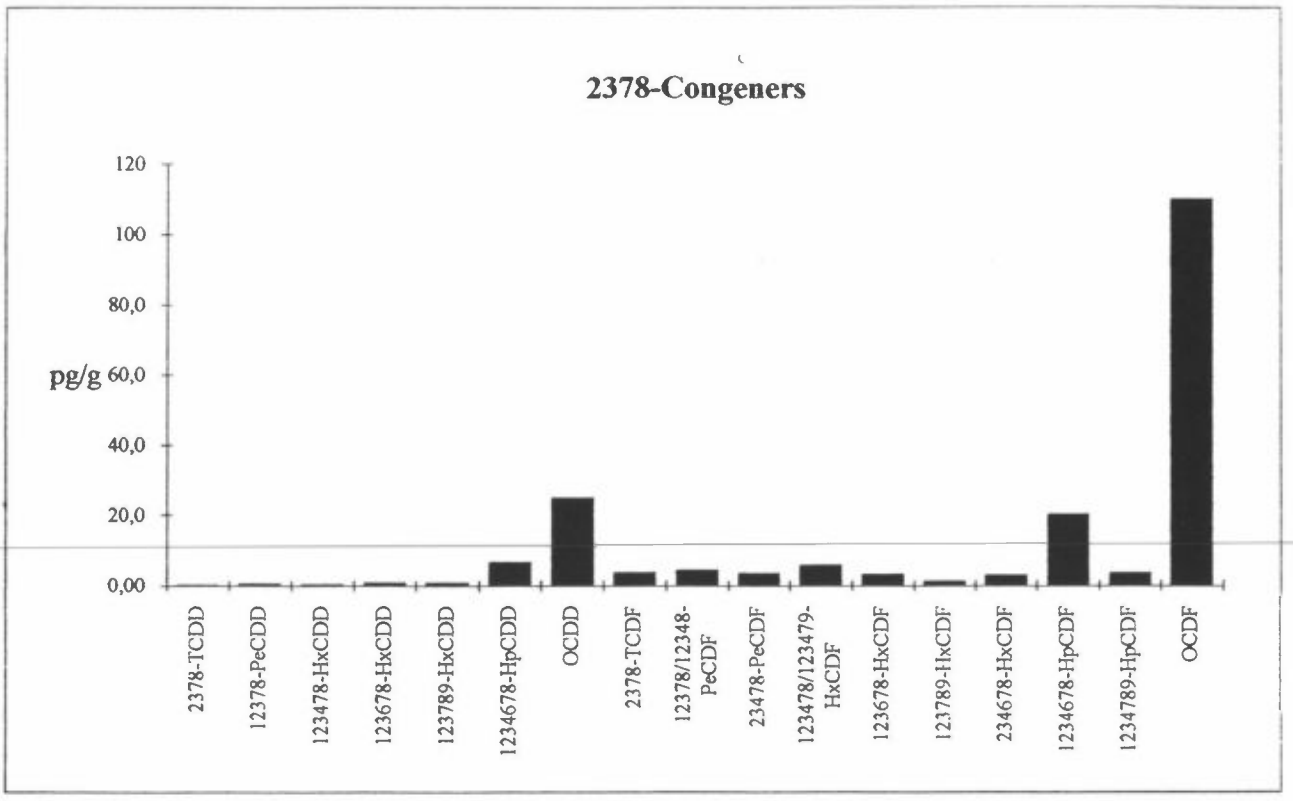
Compound	Concentration pg/g	Recovery %	TE(WHO) pg/g	TE (Safe) pg/g
33'44'-TeCB (PCB-77)	22,40	64	0,01	0,22
33'44'5-PeCB (PCB-126)	3,63	64	0,36	0,36
33'44'55'-HxCB (PCB-169)	1,45	44	0,01	0,07
SUM TE-PCB			**0,39**	**0,66**

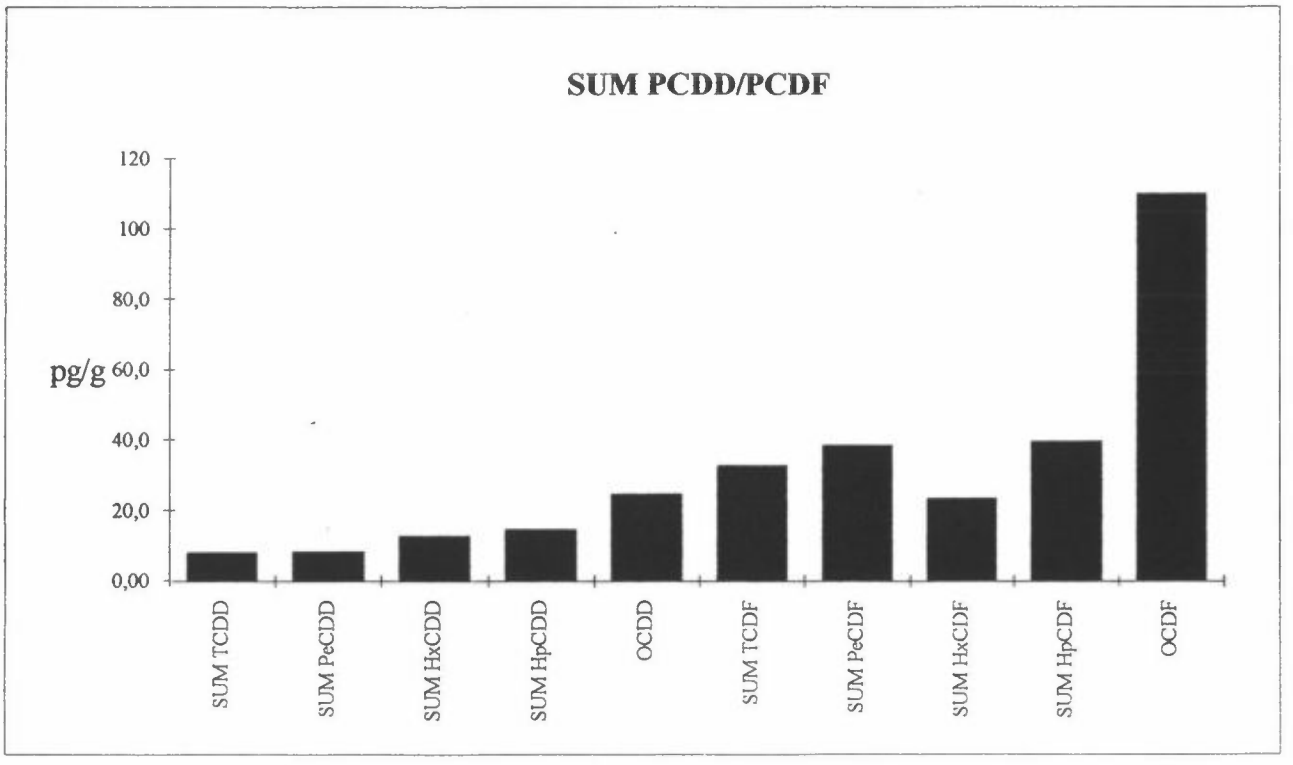
TE(WHO): 2378-TCDD toxicity equivalents according to Ahlborg et al. (1994).
TE(Safe): 2378-TCDD toxicity equivalents according to Safe (1994).
<: Lower than detection limits at S/N=3/1
(i): Isotope ratio deviates more than 20 % from theoretical value.
This may be due to instrumental noise or/and chemical interference

Results of PCDD/PCDF Analysis

Encl. to measuring report: O-36
NILU sample number: 93/785

Kjeller, 10.08.94

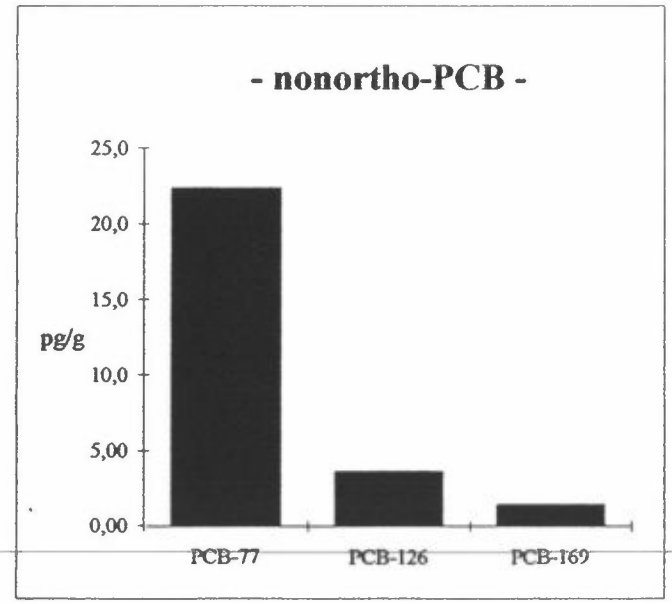


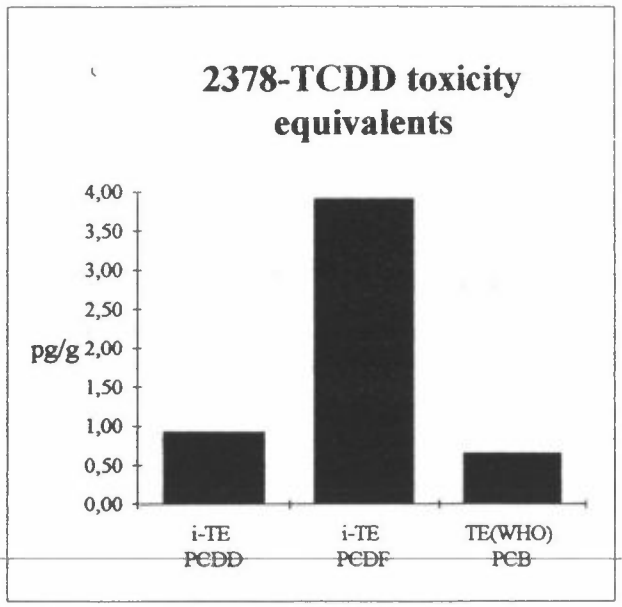


Results of PCDD/PCDF Analysis

Encl. to measuring report: O-36
NILU sample number: 93/785

Kjeller, 26.08.94





Results of PCDD/PCDF Analysis

Encl. to measuring report: O-36
NILU sample number: 93/786
Customer: O.A.B.
Customers sample ID: 3.Soil-Ostrava
:
Sample type: Soil
Sample amount: 8 g dry weight
Concentration units: pg/g
Data files: CD234091-CD234141-CD240091

Kjeller, 10.08.94

Compound	Concentration pg/g	Recovery %	TE (nordic) pg/g	i-TE pg/g
2378-TCDD	0,08	103	0,08	
SUM TCDD	**1,85**			
12378-PeCDD	< 0,07	120	0,04	
SUM PeCDD	**2,08**			
123478-HxCDD	< 0,07		0,01	
123678-HxCDD	0,19	120	0,02	
123789-HxCDD	0,10		0,01	
SUM HxCDD	**3,30**			
1234678-HpCDD	1,04	119	0,01	
SUM HpCDD	**1,89**			
OCDD	2,39	120	0,00	
SUM PCDD	**11,5**		**0,16**	
2378-TCDF	0,51	93	0,05	
SUM TCDF	**1,71**			
12378/12348-PeCDF	0,29 (i)		0,00	0,01
23478-PeCDF	0,18 (i)	117	0,09	
SUM PeCDF	**0,42**			
123478/123479-HxCDF	0,16	118	0,02	
123678-HxCDF	0,07		0,01	
123789-HxCDF	< 0,05		0,01	
234678-HxCDF	0,08		0,01	
SUM HxCDF	**0,41**			
1234678-HpCDF	0,43	119	0,00	
1234789-HpCDF	< 0,10		0,00	
SUM HpCDF	**0,62**			
OCDF	0,64	78	0,00	
SUM PCDF	**3,80**		**0,19**	**0,20**
SUM PCDD/PCDF	**15,3**		**0,35**	**0,36**

<: Lower than detection limit at signal-to-noise 3 to 1

TE (nordic): 2378-TCDD toxicity equivalents according to the nordic model

i-TE: 2378-TCDD toxicity equivalents according to the international model

(i): Isotope ratio deviates more than 20 % from theoretical value.
This may be due to instrumental noise or/and chemical interference

Results of PCDD/PCDF Analysis
- nonortho-PCB -

Kjeller, 10.08.94

Encl. to measuring report: O-36
NILU sample number: 93/786
Customer: O.A.B.
Customers sample number: 3.Soil-Ostrava
:
Sample type: Soil
Sample amount: 8 g dry weight
Concentration units: pg/g
Data files: CD234091-CD234141-CD240091

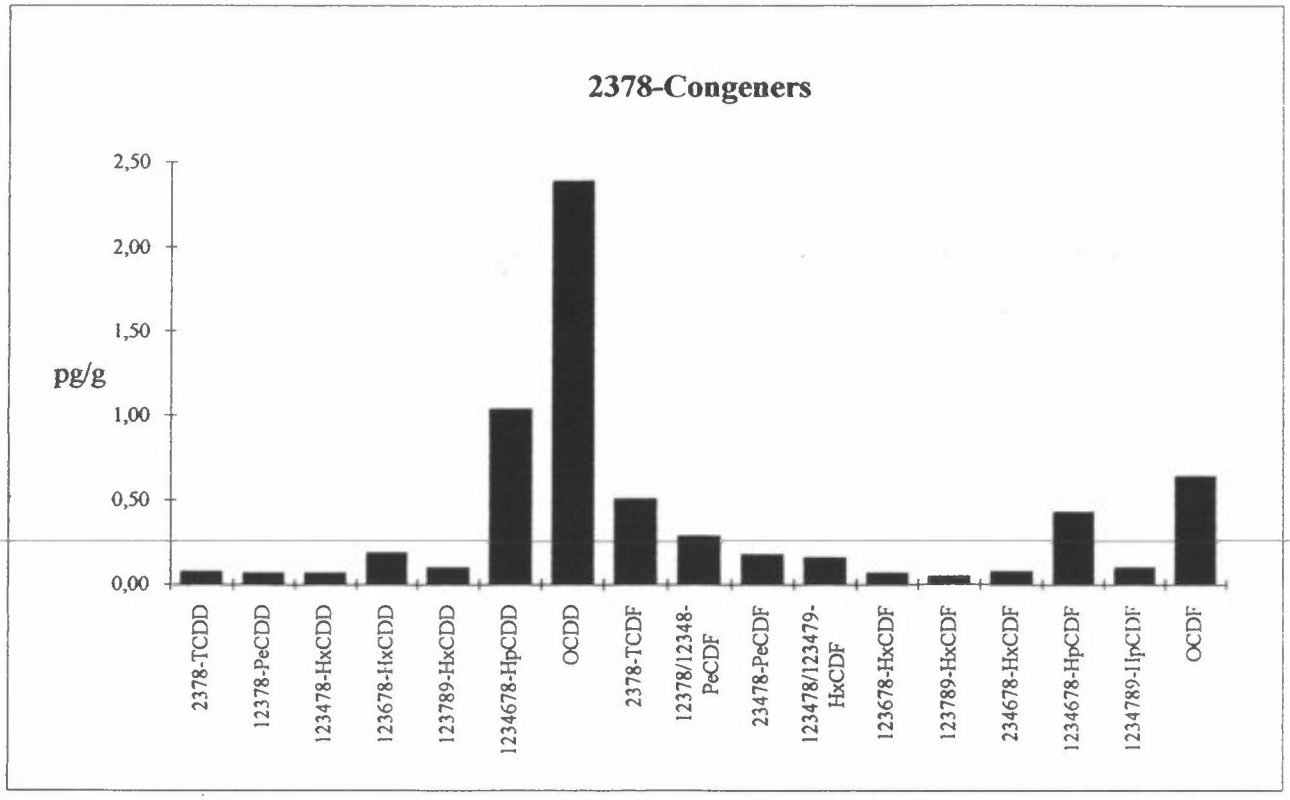
Compound	Concentration pg/g	Recovery %	TE(WHO) pg/g	TE (Safe) pg/g
33'44'-TeCB (PCB-77)	4,98	65	0,00	0,05
33'44'5-PeCB (PCB-126)	< 0,10	68	0,01	0,01
33'44'55'-HxCB (PCB-169)	< 0,10	53	0,00	0,01
SUM TE-PCB			**0,01**	**0,06**

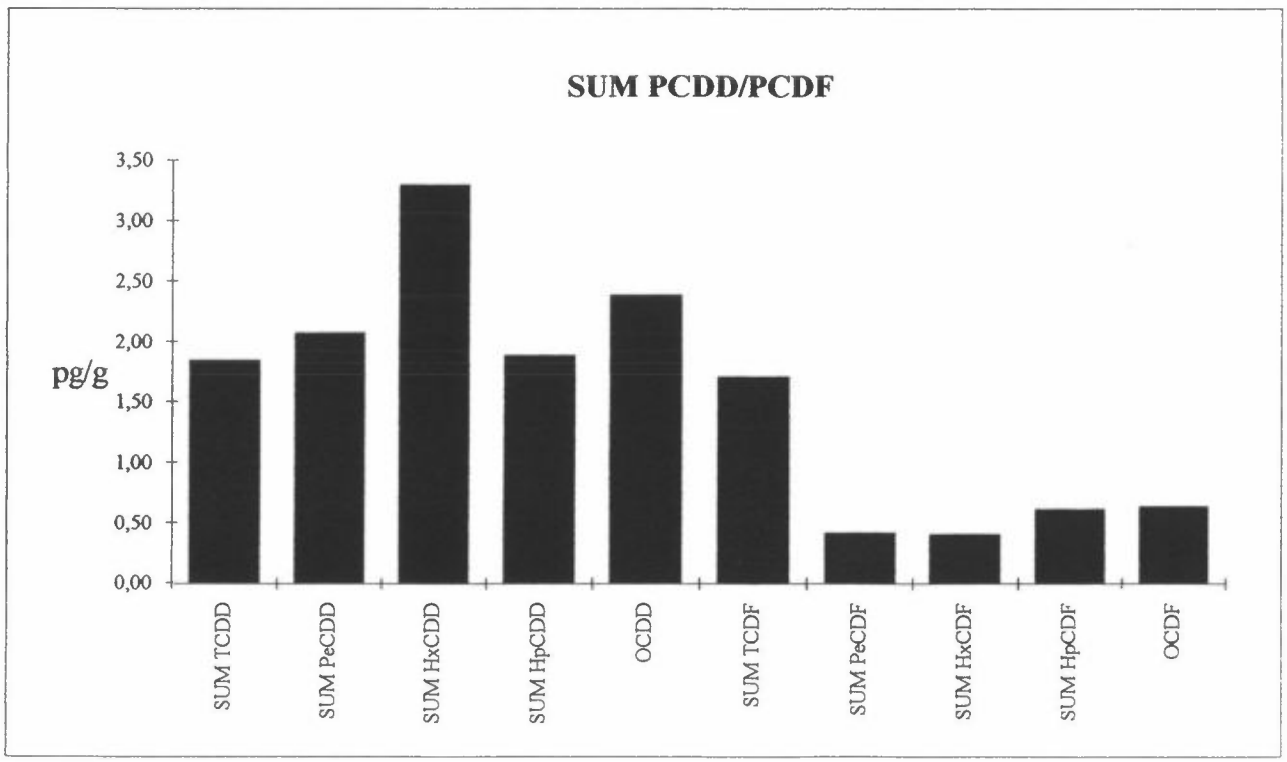
TE(WHO): 2378-TCDD toxicity equivalents according to Ahlborg et al. (1994).
TE(Safe): 2378-TCDD toxicity equivalents according to Safe (1994).
<: Lower than detection limits at S/N=3/1
(i): Isotope ratio deviates more than 20 % from theoretical value.
This may be due to instrumental noise or/and chemical interference

Results of PCDD/PCDF Analysis

Encl. to measuring report: O-36
NILU sample number: 93/786

Kjeller, 10.08.94

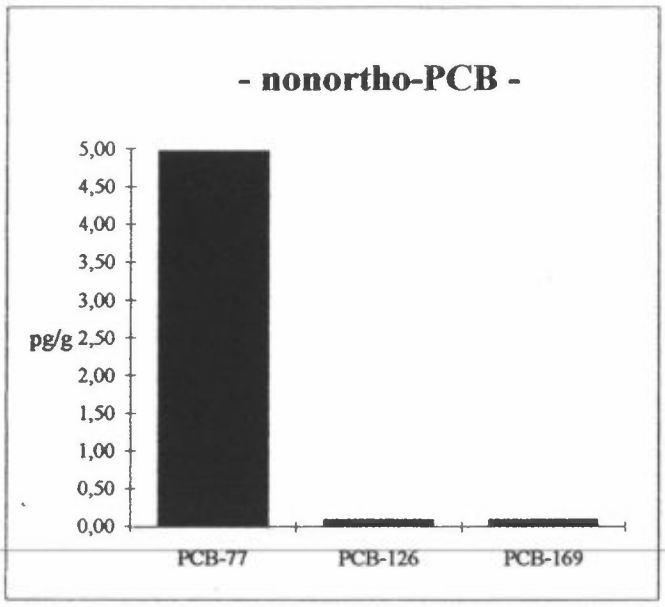


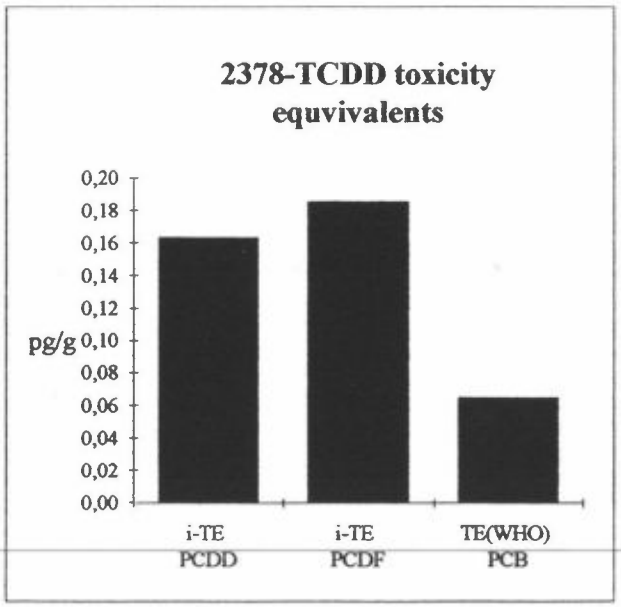


Results of PCDD/PCDF Analysis

Encl. to measuring report: O-36
NILU sample number: 93/786

Kjeller, 26.08.94





Vedlegg E

Kvalitetssikring, PAH

Norsk institutt for luftforskning
Norwegian Institute for Air Research
NILU

ELCOM
28. rijna 168
709 01 Ostrava - Marianske Hory
THE CHECH REPUBLIC

Att.: Ing. Jiri Svrcula

Deres ref./*Your ref.*:	Vår ref./*Our ref.*:	Kjeller,
	AM/MAa/O-92072	8 November 1996

PAH analysis results in air

Please find enclosed the analysis results of the above mentioned project. We also enclose our measuring report No. O-299. Our method NILU-O-3 ("Determination of polycyclic aromatic hydrocarbons"), which is accredited after EN-45001, is used.

Yours sincerely

Ole-Anders Braathen

Ole-Anders Braathen
Head, Chemical analysis

Adler Mikalsen

Adler Mikalsen
Engineer

Enclosures: Measuring report No. O-299 and analysis results

Vennligst adresser post til NILU, ikke til enkeltpersoner/Please reply to the institute.

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Foretaksnr./Enterprise No. 941705561

NORSK AKKREDITERING P 008

Accreditation according to EN 45001

Norwegian Institute for Air Research
P.O. Box 100, N-2007 Kjeller

NILU

Measuring report No. O-299

Customer: ELCOM
28. rijna 168
709 01 Ostrava - Marianske Hory
The Czech Republic
Att.: Ing. Jiri Svrcula

Project No.: O-92072

Sampling:
Location: Oslo
Responsibility: NILU
Comments: "Background" station in Oslo

Sample information:

NILU Sample ID	Customer's Sample ID	Sample type	Sample received	Sample analysed
96/551	-	Air	21.06.96	24.10.96
96/557	-	"	24.06.96	25.10.96
96/601	-	"	26.06.96	30.10.96
96/602	-	"	28.06.96	"
96/606	-	"	01.07.96	"

Analyses:
Performed by: Norwegian Institute for Air Research
P.O. Box 100
N-2007 KJELLER

Method: NILU-O-3 ("Determination of polycyclic aromatic hydrocarbons")
Uncertainty: ±%15
Comments:

Accepted: Kjeller, 7 November 1996

Ole-Anders Braathen

Ole-Anders Braathen
Head, Chemical Analysis

Enclosures: Results of 5 analyses: 2 pages
Measuring report and enclosures cover 4 pages totally

Measuring results represent only the samples analysed. This report shall not be reproduced except in full, without the written approval of the measuring laboratory

PAH - Measuring results

Enclosure to measuring report:	O-299	Sample type:	Air
NILUs sample ID:	96/551, 96/557, 96/601	Sample quantity:	402 m^3, 607 m^3, 396 m^3
Customer:	NILU	Measuring unit:	ng/m^3
Customers sample ID:	Nordahl Brunsgt., Oslo	Data files:	A10-A03, 13, 33 A.I

Sample No./sample description	96/551, 19.-21.6.96	96/557, 21.-24.6.96	96/601, 24.-26.6.96
PAH	ng/m^3	ng/m^3	ng/m^3
Naphthalene	1,6	1,0	1,3
2-Methylnaphthalene	1,1	0,91	1,6
1-Methylnaphthalene	0,66	0,50	0,94
Biphenyl	0,41	0,29	0,66
Acenaphthylene	0,80	0,28	0,67
Acenaphthene	0,26	0,23	0,61
Dibenzofuran	1,7	2,0	3,2
Fluorene	2,3	2,6	4,1
Dibenzothiophene	0,39	1,0	1,2
Phenanthrene	7,4	15,5	6,2
Anthracene	0,62	0,91	-
2-Methylphenanthrene	1,2	2,0	2,0
2-Methylanthracene	0,14	0,17	0,19
1-Methylphenanthrene	0,58	1,0	1,1
Fluoranthene	1,9	3,0	2,7
Pyrene	1,5	2,0	1,6
Benzo(a)fluorene	0,16	0,24	0,27
Retene	0,04	0,10	0,42
Benzo(b)fluorene	0,08	0,13	0,23
Benzo(ghi)fluoranhten	0,12	0,17	0,16
Cyklopenta(cd)pyrene	0,02	0,02	0,01
Benz(a)anthracene	0,04	0,08	0,07
Chrysene/Thriphenylene	0,10	0,18	0,18
Benzo(b/j/k)fluoranthenes	0,11	0,23	0,13
Benzo(a)fluoranthene	0,01	0,02	0,02
Benzo(e)pyrene	0,06	0,11	0,08
Benzo(a)pyrene	0,03	0,05	0,05
Perylene	0,01	0,01	<0,01
Inden-(1,2,3-cd)pyren	0,05	0,10	0,05
Dibenzo(ac/ah)anthracenes	<0,01	<0,01	<0,01
Benzo(ghi)perylene	0,15	0,17	0,10
Anthanthren	0,01	0,01	<0,01
Coronene	0,20	0,13	0,10
Total:	23,8	35,1	29,9

Comments: i = interference

PAH - Measuring results

Enclosure to measuring report:	O-299	Sample type:	Air
NILUs sample ID:	96/551, 96/557, 96/601	Sample quantity:	406 m^3, 579 m^3
Customer:	NILU	Measuring unit:	ng/m^3
Customers sample ID:	Nordahl Brunsgt., Oslo	Data files:	A10-A34, 35 A.I

Sample No./sample description	96/602, 26.-28.6.96	96/606, 28.6.-1.7.96	
PAH	ng/m^3	ng/m^3	
Naphthalene	1,9	1,2	
2-Methylnaphthalene	2,4	1,5	
1-Methylnaphthalene	1,5	0,92	
Biphenyl	0,79	0,56	
Acenaphthylene	1,7	0,89	
Acenaphthene	0,53	0,45	
Dibenzofuran	2,3	2,1	
Fluorene	3,4	3,0	
Dibenzothiophene	0,94	0,87	
Phenanthrene	12,8	5,1	
Anthracene	0,90	-	
2-Methylphenanthrene	1,8	1,8	
2-Methylanthracene	0,31	0,23	
1-Methylphenanthrene	0,96	0,90	
Fluoranthene	2,5	2,2	
Pyrene	1,8	1,6	
Benzo(a)fluorene	0,31	0,31	
Retene	0,49	-	
Benzo(b)fluorene	0,15	-	
Benzo(ghi)fluoranhten	0,22	0,17	
Cyklopenta(cd)pyrene	0,03	0,02	
Benz(a)anthracene	0,10	0,07	
Chrysene/Thriphenylene	0,20	0,17	
Benzo(b/j/k)fluoranthenes	0,21	0,14	
Benzo(a)fluoranthene	<0,01	<0,01	
Benzo(e)pyrene	0,12	0,07	
Benzo(a)pyrene	0,07	0,04	
Perylene	<0,01	<0,01	
Inden-(1,2,3-cd)pyren	0,09	0,04	
Dibenzo(ac/ah)anthracenes	<0,01	<0,01	
Benzo(ghi)perylene	0,17	0,09	
Anthanthren	<0,01	<0,01	
Coronene	0,14	0,07	
Total:	38,8	24,5	

Comments: i = interference

Norsk institutt for luftforskning (NILU)
Postboks 100, N-2007 Kjeller

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TITTEL	PROSJEKTLEDER
Measurement as basis for emission reductions: VOC, PAH, PCB and dioxins in air in Ostrava Sluttrapport	Ole-Anders Braathen NILU PROSJEKT NR. O-92072
FORFATTER(E) Ole-Anders Braathen	TILGJENGELIGHET * A
	OPPDRAGSGIVERS REF.

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0030 OSLO 0032 OSLO

STIKKORD		
Ostrava	Luft	Oragniske forurensninger

REFERAT
Som et ledd i miljøvernsamarbeidet Norge-Tsjekkoslovakia har NILU gjennomført et prosjekt i Ostrava, Tsjekkia. Formålet med prosjektet har vært å overføre kompetanse til Ostrava slik at det kan gjennomføres målinger av luftkonsentrasjoner av utvalgte organiske forurensninger. NILUs samarbeidspartner i Ostrava har vært firmaet ELCOM. Arbeidet har bestått i kompetanseoverføring og anskaffelse og etablering av utstyr og analyse-metodikk i Ostrava.

TITLE
Measurement as basis for emission reductions: VOC, PAH, PCB and dioxins in air in Ostrava - Final report.

ABSTRACT

* *Kategorier:*
- *A Åpen - kan bestilles fra NILU*
- *B Begrenset distribusjon*
- *C Kan ikke utleveres*