World Health Organization

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Monitoring the implementation of Parma conference commitments: methodological and organizational issues

Report of a meeting

Bonn, Germany

29-30 September 2011

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ABSTRACT

The WHO European Centre for Environment and Health (ECEH) is coordinating the development of tools for efficient monitoring of Parma Declaration commitments adopted at the 5th Ministerial Conference on Environment and Health (2010). At this meeting, representatives and technical experts from 36 Member States and four international organizations reviewed newly proposed indicators and agreed on data acquisition methods. Existing data will be used to the maximum extent possible. However, there is a need to coordinate new data collection efforts in order to close data gaps and ensure comparability of international data. Meeting participants have endorsed a new survey to characterize exposure to environmental hazards in schools, and supported pilot testing and implementation plans. Participants also supported plans for the further development of a standardized biomonitoring-based survey to assess early life exposure to environmental pollutants. Finally, the meeting produced recommendations for the consideration by the European Environment and Health Task Force.

Keywords

ENVIRONMENTAL HEALTH - CONGRESSES
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Background and preparation of the meeting

The Fifth Ministerial Conference on Environment and Health (Parma, Italy, 2010) adopted the Declaration and the Commitment to Act with specific targets to protect children's health from environmental hazards and to protect health and the environment from the effects of climate change. WHO's European Centre for Environment and Health (ECEH) has been developing indicators and data collection tools to enable efficient monitoring of the implementation of Parma commitments.

WHO European Centre for Environment and Health, Bonn office, organized and hosted a series of consultative meetings to evaluate the existing environment and health indicators in the European Environment and Health Information System (ENHIS), and develop new indicators that are necessary for the monitoring of Parma commitments. The WHO meeting "Tools for the Monitoring of Parma Conference Commitments" in Bonn, Germany on 25-26 November 2010 selected a set of 18 new indicators to ensure efficient monitoring of time-bound Parma commitments to protect children's health and agreed that new data collection will be necessary for some indicators. After the November 2010 meeting, WHO formed and coordinated working groups of experts that have developed indicators methodologies and prepared other technical documents that were presented at the current meeting.

Another technical meeting in Bonn on 4-5 April 2011 entitled "Methodologies of indicators reflecting exposure to indoor air pollutants" co-sponsored by WHO and the Joint Research Centre of the EC specified the design of a new survey of schools and agreed on methods of indoor air quality monitoring in classrooms. Working groups of experts further developed the proposed school survey to incorporate the assessment of access to adequately maintained sanitation facilities, smoking in schools and on the school grounds, and mode of transportation to schools.

Another set of indicators for the monitoring Parma commitments to protect children's health from the effects of climate change was developed under the Climate, Environment and Health Action Plan and Information System (CEHAPIS) co-sponsored by WHO and DG SANCO. This project involved the consultative meeting in Bonn in May 2009 "Defining health-relevant climate change indicators". A total of 17 new indicators were proposed under the CEHAPIS project, which also involved pilot testing of indicators in selected EU countries. In September 2011, WHO secretariat further evaluated the set of CEHAPIS indicators with inputs from external experts and recommended a subset of seven indicators for implementation in ENHIS.

Summary of meeting discussions

Meeting participation

The meeting was attended by representatives and technical experts from 36 Member States and four international organizations (a total of 62 participants). The List of Participants is available in Annex 1. Meeting participants were identified using several approaches as described below.

Representatives of Member States

Representatives were nominated by their national ministries of health or the environment. WHO sent standard requests of nomination to official WHO contacts at ministries of health in all 53 Member States. Nominees had to be experts in environmental health (EH) responsible for EH policy formulation and monitoring who would closely collaborate with national EH focal points and national EH policy-makers after the meeting and play an active role in the implementation of the proposed indicators in his/her country. WHO used the list of official WHO contacts at ministries of health that was available in June 2011 and a preliminary list of EH focal points for the Parma process. Many Member States had not yet nominated or changed/finalized EH focal points for the Parma process at that point. Thirty- one Member States nominated 34 meeting participants, while the remaining 22 Member States either declined to nominate a participant or failed to respond.

Representatives of international institutions

WHO identified the most relevant international institutions and organizations responsible for EH data collection, and sent invitations to participate in the meeting to appropriate managers who then identified meeting participants. Four individuals representing the European Commission (EC), the European Environment Agency (EEA) and an international nongovernmental organization (NGO) participated in the meeting.

Technical experts

Individual subject matter experts were identified by WHO based on their track record of research and publications on specific EH issues (e.g. indoor air pollution, water and sanitation, or chemical safety), as well as their prior involvement in the development of relevant WHO technical documents (e.g. guidelines on indoor air quality or ENHIS indicator methodologies). A total of 13 technical experts from 8 Member States (including five Member States that did not send their representatives to the meeting) and the United States participated in the meeting as WHO temporary advisers.

Observers

Two observers from the German Ministry of Health and the German Ministry for the Environment, Nature Conservation and Nuclear Safety participated in the meeting in addition to the nominated country representative.

WHO staff

Six technical officers and two interns from the Bonn Office, and one chemical safety expert from WHO headquarters, were assigned to participate in the meeting by their managers.

Meeting objectives and organization

The main objective of the meeting was to agree on specific methods for data collection and develop recommendations to be presented to the European Environmental and Health Task Force (EHTF). The meeting was supported using the Bonn Office funds generously provided by the German Government through its Federal Ministry for the Environment, Nature Conservation and Nuclear Safety.

The meeting reviewed recommendations from previous WHO meetings and technical documents prepared by working groups of experts. The meeting included plenary discussions as well as more in-depth discussions at three working groups focusing on subsets of the proposed indicators grouped by data acquisition method.

The meeting started with round table introductions of the participants and the election of plenary and working group session chairs and rapporteurs (see the list of assignments in Annex 2). This was followed by technical presentations at a plenary session to provide background information on a range of topics including the objectives and expected results of the indicator development process, the status of and development plans for the European Environment and Health Information System (ENHIS), approaches to assessing environmental health inequalities as well as technical presentations of methodologies of the proposed set of new ENHIS indicators.

Discussions in three working groups focused on three separate sets of indicators. Working group 1 discussed indicators that require new data collection in schools. Working group 2 focused on the use of biomonitoring to produce consistent data on early life exposure to mercury and other developmental toxicants. Working group 3 discussed indicators relying on existing data sources and policy action indicators, which will rely on data provided by designated contact points in Member States. Summaries of technical discussions and preliminary recommendations from working groups were presented at the concluding plenary session. Finally, the meeting participants agreed on a set of recommendations for the consideration of the EHTF and agreed with the WHO's plans for follow-up actions.

Status of the European Environment and Health Information System (ENHIS) and its strategic development plans

Background information

ENHIS (www.euro.who.int/enhis) includes indicators of exposure to environmental factors, environment-related health effects and policy actions. The system was launched in 2007 and updated indicators were released in 2009. The system served as the primary source of information for the WHO report, "Health and Environment in Europe: Progress Assessment", which was prepared for the Parma conference in 2010. ENHIS currently consists of 22 indicator factsheets in the form of pdf files. The preparation of the 3rd release of ENHIS

indicators is currently ongoing. Due to the lack of new data for some of the existing indicators, not all indicators will be updated during this round. Two new indicators (exposure to ground level ozone and exposure to noise in cities), will be included in the 3rd release.

The 5th Ministerial Conference on Environment and Health in Parma in 2010 re-affirmed the need to maintain ENHIS. The demand for information on the progress towards goals set in Parma started a new cycle of ENHIS development and expansion. In accordance with guiding decisions of the Regional Committee for Europe, WHO's efforts to develop new indicators focused on five Parma commitments with specific deadlines for implementation in 2015 or 2020.

New demands and challenges

Providing necessary information in a timely manner requires focused approaches, such as characterizing exposure to environmental hazards in children's facilities, and increased flexibility, responsiveness and specificity. This new situation requires ENHIS to play a more active role in facilitating and coordinating international efforts to synchronize national data collection systems, and to develop standardized methodologies and requirements for new data collection aimed at closing the existing data gaps and enabling information support for the Parma process.

The main objective of ENHIS development is to provide information on levels and trends in exposure and disease, as well as the effects of policy actions related to Parma commitments and other EH priorities. This should be accomplished by utilizing existing data sources to the maximum extent possible. At the same time, ENHIS will become a driving force in closing EH data gaps, facilitating the harmonization of surveillance systems and stimulating improvements in data quality and geographic coverage. Other objectives include facilitating the development of national EH surveillance programs and information systems compatible with ENHIS, and facilitating access to subnational data through collaboration with international and national surveillance programs.

ENHIS developments in responding to new demands

In order to better address new demands resulting from Parma commitments, ENHIS will be re-designed and re-launched on a new IT platform, which is currently under development. It will improve access to EH information related to the Parma process and enhance the dissemination of monitoring results. This new system will have an interactive, user-friendly interface and a dynamic graphical data presentation. It will enable users to download aggregated indicator data from a newly developed relational ENHIS database. The system will also be capable of serving as a depository for raw EH monitoring data, such as data collected for new WHO-sponsored surveys. It will also support data processing and basic data analysis. Incorporating a secure interface for authors, reviewers and publishers will facilitate a more open and participatory review process.

Use of existing data sources for ENHIS indicators will continue to be a default approach because of the low costs of abstracting data from existing sources. International databases, when available, offer highly standardized and comparable data. However, external surveillance programmes and data collection systems have limited incentives to respond to new WHO priorities, such as Parma commitments. Many existing international systems have

limited geographic coverage (e.g. European Union [EU] countries only). This makes timely and efficient monitoring of the implementation of some Parma commitments nearly impossible without supplementing existing data with new data collection efforts.

The use of inconsistent methodologies in national data collection programmes is another problem. An example is data on blood lead levels in children: different countries use inconsistent recruitment criteria, different analytical methods and different data presentation techniques in their national surveys. Data from many Member States are not readily available or are insufficient. This makes quantitative analysis of special patterns and temporal trends highly problematic and severely limits the usefulness of ENHIS data on children's exposure to lead in the European Region.

WHO meetings in November 2010 and April 2011 confirmed the need to develop standardized methodologies and protocols in support of new data collection efforts in Member States. Specific focus should be on monitoring exposure to environmental hazards in schools and other children's facilities and on assessing early life/pre-natal exposure to chemical pollutants using non-invasive exposure biomarkers. WHO has been coordinating the development of data collection methodologies utilizing experience from the existing national and international monitoring programmes. Member States are expected to review and pilot test the proposed methods, and provide feedback and comments. WHO will then publish standard methodologies in ENHIS and coordinate the implementation of new surveys. Enhanced international collaboration during the development and implementation of new surveys will provide added benefits of technology transfer to and capacity building in Member States with limited resources.

It is envisioned that the newly expanded ENHIS will be a product of the joint efforts of WHO and Member States. The role of WHO will be to provide standardized indicator methodologies, coordinate analysis and interpretation of international data, maintain ENHIS, and effectively communicate EH information. The role of Member States will be to produce EH data using their existing or new data collection systems based on standardized WHO methodologies, provide feedback to WHO in order to further improve data collection and presentation methods, and, most importantly, to use the EH data for policy development and assessments.

Establishing long-term collaborative agreements with institutions and organizations that can serve as sources of expertise will be necessary for the success of the proposed approach. Another challenging task is securing additional resources in order to provide effective coordination and technical support for new data collection programs.

Plans for incorporating environmental health inequality dimensions in ENHIS

The 5th Ministerial Conference on Environment and Health in Parma in 2010 identified socioeconomic and gender inequalities in environmental health as a top priority requiring urgent action. In response to this need, specific actions were taken shortly after the Parma conference. First, a set of inequality indicators was developed. Second, national EH inequality data profiles were created. Third, an international summary report was created on environmental inequality (e.g. inequalities in housing conditions, injuries and exposure to environment pollution). Stratification factors included place of living (urban/rural), age, sex,

income, education and household type. Examples of national EH inequality profiles were presented for Georgia and Hungary at the September 2011 meeting in Bonn.

Inequality dimensions (sex, income or place of living) are currently present in several ENHIS indicators: access to improved sanitation and wastewater treatment (rural vs. urban); public water supply and access to improved water sources (rural vs. urban); and population living in homes with problems of damp (people living in poverty vs. general population). Two new potential EH inequality indicators, both based on the Eurostat's Survey of Income and Living Conditions (SILC) data were proposed by WHO for further discussion and development: thermal comfort (ability to keep the home warm or cool) and lack of bath/shower/toilet in homes. A limitation of the proposed indicators is that the data are not available for most countries outside the EU. Although inequality dimensions can be incorporated in some of the proposed new ENHIS indicators that will require new data collection. Many data gaps will still need to be closed through national and international efforts in order to accurately characterize inequalities related to many top priority environmental risk factors or health outcomes.

Methodologies of new indicators for Parma monitoring

Indicators requiring new data collection in schools

Background information

Child care facilities, kindergartens, schools and public recreational settings are the places where children spend a substantial proportion of their time. Therefore, minimizing exposure to harmful factors in these environments is important for protecting children's health. The Parma Declaration described the following commitments related to children's facilities:

- Regional Priority Goal (RPG) 1, commitment (ii) "We will strive to provide each child with access to safe water and sanitation in… child care centres, kindergartens, schools… by 2020, and to revitalize hygiene practices".
- RPG 2 (iv) "We aim to provide each child by 2020 with access to healthy and safe environments and settings of daily life in which they can walk and cycle to kindergartens and schools…".
- RPG 3 (iii) "We aim to provide each child with a healthy indoor environment in child care facilities, kindergartens, schools…, implementing WHO's indoor air quality guidelines... and… ensuring that these environments are tobacco smoke-free by 2015".

Previous WHO meetings in Bonn in November 2010 and April 2011 selected indicators for monitoring progress towards these goals, reviewed the availability of data and determined that most Member States will need to organize new data collection systems to close data gaps related to the school environment. WHO has been coordinating the development of a standardized survey methodology based on the experience from several national programmes as well as international research and monitoring projects in the areas of indoor air quality, school sanitation and smoking in pupils. The proposed survey in schools is designed to produce critical data for the following seven indicators related to three RPGs:

RPG 1. Water and sanitation.
- Access to improved and properly maintained sanitation facilities in schools
- Hygiene practices in schools

RPG 2. Physical activity and injuries.
- Proportion of children going to and from school by different transportation modes

RPG 3. Air pollution.
- Dampness and mould in schools
- Insufficient ventilation in schools
- Exposure to selected indoor air pollutants in classrooms
- Smoking in schools and on school grounds

The proposed WHO survey will utilize methodologies and experience from existing national and international monitoring programmes. A critically important example of this approach of drawing upon existing experience is the collaboration between WHO and the European Commission's Directorate-General for Health and Consumers (DG SANCO)-funded School Indoor Pollution and Health: Observatory Network in Europe (SINPHONIE) project (www.sinphonie.eu). Partners from 38 environment and health institutions in 25 countries are involved in SINPHONIE. Monitoring and assessment activities are focused on indoor and outdoor air pollution. Health data include self-reported symptoms, spirometry tests, attention/concentration tests and school absenteeism data. Five schools were selected for the survey in each country. Data collection took place in October 2011 – March 2012. Air quality monitoring will be conducted in three classrooms per school to assess levels of multiple chemical pollutants, ventilation rate, specific fungal and bacterial groups, and allergens. Data collection will also include detailed school building inspections and interviews with school staff.

Important distinctions between SINPHONIE and the proposed WHO survey are related to their objectives. SINPHONIE is a research project that involves very detailed data collection and monitoring in a small number of schools in each country. In contrast, the WHO survey is designed to provide reliable characterization of exposure levels across the Region. Therefore, it includes a relatively small list of parameters and parsimonious data collection tools but requires a much larger sample size. Another important difference is that the WHO survey is not limited to air pollution. Data collection on sanitation and hygiene, for example, is based on the experience from western European countries where standardized survey methods are applied to evaluate the quality of sanitation facilities in schools.

School survey design

The meeting agreed that the objective of the proposed survey is to characterize exposure to known health hazards. The core survey protocol does not involve the collection of health data and the survey will not attempt to establish associations between exposure and health effects.

The proposed survey in schools will involve data collection for the seven new indicators of exposure listed above. Data collection activities will involve visits to schools by trained survey staff to do the following: administer questionnaires to pupils and teachers, interview school administrators, inspect all school premises for mould and dampness, check the conditions of sanitation facilities and install air quality monitoring equipment (e.g. automatic

CO2 loggers and passive samplers for NO2, formaldehyde and benzene). Monitoring of each school will be conducted during a single school week and all equipment will be retrieved by survey staff upon completion of monitoring.

Some meeting participants expressed an opinion that Member States should have the option to select specific elements of the proposed survey that are most relevant to local settings rather than be obligated to use the entire set of survey tools. The suggestion may be useful because it would help to reduce the cost of the survey.

The survey will have a randomized clustered design in order to reduce the costs by focusing on compact areas. First, in large countries, regions with similar weather conditions will be identified as the first step (note: this step can be omitted in small countries). Second, geographic clusters within each region will be selected using a randomized selection procedure with stratification (urban vs. rural clusters). Each cluster is to correspond to an administrative unit of appropriate size. The probability of selecting a specific cluster for the survey should be proportional to the number of school students (probability proportional to size [PPS]). Finally, schools will be selected within clusters. A constant number of schools should be randomly selected from each cluster.

Results of statistical simulations, which had been conducted prior to the development of this school survey design, were presented at the meeting. These results demonstrated the effects of different survey design options on the sample size, identifying the number of schools that is necessary to have adequate statistical power for demonstrating a change in exposure level between two consecutive cross-section surveys in a given country. Specifically, it was shown that conducting monitoring in three classrooms in each school is optimal. Using a greater number would only have a minor effect on the precision of estimates of population exposure. Thus, resources should be spent on sampling more schools. Using more clusters with a smaller number of schools per cluster is efficient from a statistical point of view. However, this has to be weighted with costs savings associated with clustered sampling. It is recommended that each cluster should contain at least five schools.

Sample size calculations were based on the available data on inter-school variability in the levels of specific chemical pollutants. The recommended sample size for national surveys is between 100 and 300 schools, depending on the country size. National sample sizes can be estimated more precisely when data from national pilot surveys become available. During the meeting it was also noted that some Member States are so small, that conducting monitoring in 100 schools may not be possible. Therefore, it was suggested that the samples size should not be greater than 20% of all schools in the country.

Monitoring ventilation rates in classrooms

Insufficient ventilation in schools has been associated with adverse health effects among students, including respiratory symptoms and infectious diseases, as well as absenteeism and poor learning outcomes. Improving ventilation reduces children's exposure to air pollutants from indoor sources, reduces dampness and mould, and prevents adverse health effects.

CO2, which is generated by building occupants, can be used as a trace gas to estimate ventilation rates in classrooms. There are different formulas for estimating ventilation rates

which are based on three different phases: (1) the build-up phase, which takes place after the space becomes occupied; (2) the steady state phase, when ventilation and CO2 generation are in balance; and (3) the decay phase, which takes places after occupants leave the room. To estimate ventilation rate, CO2 concentration should be measured regularly (e.g. each minute) during a school week. Room occupancy and activity data should be collected using diaries. CO2 emission rates are calculated using standard values for specific age groups and activity levels. Room volume needs to be measured during the initial inspection which should also involve collecting data on ventilation sources and practices, as well as potential sources of emission of chemical pollutants. Ventilation rates are estimated for class sessions (build-up or steady state method) and breaks (decay method) using specially developed Excel spread sheets. The intervals for using specific formulas are selected manually based on the occupancy/activity data and the shape of the CO2 concentration curve. The results are expressed in L/second per pupil units.

CO2 monitoring should be conducted in three classrooms per school during one school week. In addition, it is advisable to measure the background level of CO2 at an outdoor site, especially in urban areas. Ventilation rate estimates for specific classrooms and schools should be combined to produce a population-weighted, country-level indicator value that reflects the estimated proportion (and estimated total number) of students who are exposed to insufficient ventilation in classrooms. Although there are no international guidance values for the ventilation rate in schools, nationally recommended minimum values usually do not exceed seven (7) L/s per pupil, which can be considered as a cut-off point for estimating the indicator value.

Meeting participants agreed that including CO2 monitoring in the proposed survey in schools is warranted as it would enable the estimation of ventilation exchange rates. It was noted that standardized protocols need to be provided in detail, prepared and pilot tested in volunteer countries with different school types and conditions in order to produce a standardized methodology for the Member States of the WHO European Region

Monitoring chemical indoor air pollutants in schools

The previous meeting of air pollution experts jointly sponsored by WHO and the EC Joint Research Centre (JRC) recommended using passive diffusion samplers for assessing the exposure to selected chemical air pollutants in classrooms. These samplers are small and easy to handle, do not require electric power, are silent (which is important in learning environments) and inexpensive. Draft protocols and standard operating procedures (SOPs) for the monitoring of formaldehyde, nitrogen dioxide (NO2), and benzene with related compounds (note: these are optional) have been developed by JRC based on the existing experience with international surveys in the EU.

Information which was included in the background materials for the meeting and discussed at the meeting, include: required technical specifications of samplers; recommended type of diffusion samplers; list of suppliers; storage conditions for samplers; sampling requirements; principles of chemical trapping reactions; laboratory analyses of samplers; calculation of results; assessing potential interferences and effects of temperature, relative humidity and wind speed; and data interpretation approaches.

Passive diffusion samplers will be placed in three classrooms and at one outdoor site at each school. Monitoring will be conducted during one school week. Samplers will be retrieved at the end of the week by survey technicians. Detailed information on potential sources of emission inside and outside the school building will be conducted using standardized inspection forms and interviews with school administration. Classrooms selected for monitoring will be described in more detail using special, standardized forms. The location of samplers will be marked on the floor plan. Ideally, samplers will be located at least 1.5 m from the walls or floor. Survey technicians will receive standardized training prior to data collection on sample placement and handling.

Laboratory analysis procedures for NO2, formaldehyde and benzene were also discussed. Training of laboratory personnel and laboratory proficiency testing were identified as important issues. It was recommended that each national laboratory would have to participate in inter-laboratory a quality assurance/quality control (QA/QC) programme with duplicate samples analysed at a designated reference laboratory. During the meeting it was discussed that WHO would organize a pilot survey in Albania and that the JRC laboratory in Ispra, Italy, would provide technical support to this first pilot survey. Formal agreements with reference laboratories will be needed for full scale national surveys.

The meeting participants agreed that the use of passive samplers is warranted and they noted that pilot testing of the proposed survey should involve the development of training materials as well as the identification of national laboratories based on the availability of equipment and expertise and results of proficiency testing.

While installing passive diffusion samplers is not time consuming, the procedure has to be pilot tested to decide on the best approach of characterizing average concentrations of pollutants. One approach is to leave samplers exposed for an entire school week, including nights. This approach is less time consuming but actual exposure levels in pupils will be characterized less precisely. An alternative approach is to cap the samplers at the end of each school day and uncap them in the morning. This approach would require more time and effort but may result in more precise exposure data.

Assessing exposure to dampness and mould

Based on a recent assessment, about 15% of all new cases of childhood asthma in the WHO European Region could be attributed to indoor dampness and mould in home environments. Dampness and mould in schools have also been associated with asthma and respiratory symptoms among children while remediation of dampness and mould problems seems to lead to a reduced prevalence of symptoms (e.g. blocked nose, sore throat, nocturnal cough) in children and decreased use of antibiotics.

Visual observations of dampness and mould are commonly used as markers of exposure. Two approaches have been used:
1) Questionnaire survey administered to the school principal to collect self-reported data on moisture damage/dampness/mould in the school building. Although this approach is easy to carry out and inexpensive, it is prone to reporting bias.
2) School building inspections by trained survey personnel using standardized checklists and special surface moisture monitors. This method is more accurate compared to the questionnaire but requires substantially more time and the use of trained personnel.

Within the Health Effects of Indoor Pollutants: Integrating microbial, toxicological and epidemiological approaches (HITEA) EU collaborative project, an internet questionnaire for school principals was developed in English and translated in Spanish, Catalan, Dutch and Finnish to collect self-reported data on the current and past presence of dampness, moisture and mould, as well as background information on school buildings. On-site investigations in selected schools were performed by trained investigators utilizing pre-designed checklists and recorders for moisture, temperature and relative humidity. Different types of dampness, moisture and mould problems were reported in 24% to 47% of school buildings. Several differences were observed among countries. For example, the Netherlands reported the most dampness; Spain reported the most moisture/water damage; Finland reported the most mould odor. The overall agreement between the questionnaire data and inspection data was moderate with inconsistent results in a substantial proportion of schools.

The proposed approach to assessing the prevalence of exposure to dampness and mould in schools is based on building inspections by trained survey technicians. While all school premises should be inspected, emphasis should be on classrooms and other spaces which are occupied by children. Inspections will cover all classrooms, other indoor spaces, attics, and crawlspaces. Inspection tools will include surface moisture monitors, digital cameras, distance measurement devices, and flashlights. Observations will be recorded in standardized forms which were included in the meeting's background technical materials. The forms will need to be translated in local languages.

The cut-off point for reporting mould contamination is 1 m^2 of mould growth on building materials. Additional questions on the building construction materials can help to evaluate sources of dampness and mould. For instance, if there is some kind of insulation consisting of organic material, hidden mould growth is possible.

Following on-site inspections, data will be entered into standardized data entry forms. Data analyses will involve dichotomizing exposure data at the classroom level, estimating the proportion of children exposed in each school and producing estimates of national- level, population-weighted prevalence of exposure in school pupils.

In addition, a detailed questionnaire form has been developed to collect data from school administrators on present and past mould/dampness problems along with relevant data on building type(s), materials, renovations, heating and ventilation systems and sources of indoor air pollution. The questionnaire data will be supplemental to the inspection data.

After data analysis using standardized procedures, the proportion of students exposed to dampness and mould will be estimated for each school. Then, country-level, weighted prevalence of exposure will be calculated taking into account the total number of students at each school surveyed.

An important aspect of survey implementation in the Region is the organization of centralized training for the field personnel. In order to ensure consistency and comparability of survey results in different countries, a core group of technicians from each participating country will have to be trained at a designated, specialized institution using standardized training materials. WHO will develop plans for collaboration with these institutions to facilitate and coordinate the training process (with the central training team). A train-the-

trainer model will be used. Each country will send a small group of technicians to a centralized training programme. Technicians who have completed centralized training will then provide training to other technicians at national or subnational training locations. Centralized online training has also been discussed. Final arrangements will have to be decided upon after the implementation of pilot surveys in selected countries.

After the completion of each national survey, feedback will be provided to the survey schools to inform administrators and representatives of school districts and city governments about the problems detected.

Conclusions:

- The proposed survey in schools shall include school building inspections in order to collect consistent and unbiased data on pupils' exposure to dampness and mould
- Standardized WHO protocols and data collection forms will be used for inspections
- Centralized training to field personnel is crucial for consistency, comparability and reproducibility of survey results
- Indicator data to be presented in ENHIS will involve country-level prevalence of exposure to dampness and mould in schools.

Assessing sanitary facilities and hygiene practices in schools

The Parma Declaration, issued in March 2010, included a commitment to provide each child with access to safe water and sanitation in homes, childcare centres, preschools, schools, health-care institutions and public recreational water settings by 2020, and to revitalize hygiene practices.

The French national survey on school sanitation and hygiene revealed that 7.2% of pupils never use school toilets. Nearly half of the pupils reported having stomach aches because they are reluctant to use school toilets unless they absolutely have to. Also, a majority of pupils complained about dirty toilet facilities and bad odour. Acute or chronic constipation and urinary tract infections in children may also be associated with their reluctance to use toilets.

Two indicators were proposed:

(1) Access to improved and adequately operated and maintained sanitation facilities in schools and kindergarten. The information will be collected on the proportion of school and kindergarten populations having access to safe and functional sanitation facilities with adequate operation and maintenance.

(2) Hygienic practices in kindergarten and schoolchildren. Information will be collected on the proportion of kindergarten and school populations a) having access to functional and adequately operated and maintained hand wash facilities; b) applying good hygiene practices.

The survey consists of three parts: 1) Questionnaire for the school director with core and optional questions; 2) Inspection of sanitation facilities by survey technicians; and 3) Questionnaire for the schoolchildren about hand wash facilities. Sanitation and hygienic practices will be evaluated, taking into account: functionality, adequate operation and maintenance (O&M), accessibility, safety, privacy, and acceptance/perception. Data will be

analysed in a data set stratified by the location of school (urban vs. rural area), gender and age category.

Assessing smoking behaviours in schools

Information about smoking prevalence in pupils can be collected through the proposed survey in schools or from the existing datasets when they are available. Since most Member States do not systematically collect data on smoking in schools, it is recommended that information on smoking be incorporated in the proposed school survey. A special smoking questionnaire for teachers will be used to collect data on the school's smoking policy and actual smoking behaviour by school staff, visitors and pupils, inside and outside schools. The form was developed using the Global School Personnel Survey (GSPS), with additional questions focusing on smoking in schools. A block of smoking-related questions was incorporated in the questionnaire for pupils to collect information about smoking inside the school and on the school grounds, and perceived disciplinary consequences. Each respondent would report his/her own smoking as well as observations of smoking by other pupils. Several questions were adopted from the Global Youth Tobacco Survey (GYTS) to collect general information on the smoking behaviours of pupils, their parents or legal guardians. Additional questions focusing on smoking in schools have been newly developed for the proposed survey. It was suggested that the smoking section of the questionnaire should be administered to pupils 14 years old and above. Questionnaire forms will not have individual identifiers. In order to maintain confidentiality and ensure truthful answers, questionnaires should be administered by trained survey technicians only. It was stressed that teachers or school staff should not be asked to administer questionnaires to pupils.

Assessing the mode of transportation to school

The mode of transportation of children to schools influences the overall level of their physical activity. While walking or cycling should be encouraged, road safety problems may be a barrier in some countries. The proposed ENHIS indicator will reflect the proportion of children in a country going to and from school by specific modes of transportation. The data will be collected on school age children (5-19 years old), stratified by level of education: primary school and secondary school (subdivided into lower secondary and upper secondary, according to the International Standard Classification for Education, 1997). The modes of transport are walking, riding a bike, taking public transport (including school buses), and riding a private car. The questionnaire for the proposed school survey includes one question on the mode of transportation and questions on age and gender. Information on the type of school is collected from the school administrator. Another potential data source for this indicator is the optional module of the Health Behavior in Schoolchildren Survey (HBSC). However, these data are not available in many Member States.

Necessary resources for the survey

It was estimated that two person-days of work will be needed to conduct data collection in one school. Thus, a survey involving 100 schools will require 200 person-days for field data collection. This estimate does not include the labour needed for laboratory analysis of samples, data entry, processing, statistical analysis, and reporting of results. The cost is a major limiting factor which may restrict actual sample sizes in national surveys. Ensuring adequate representation of different types of schools in a stratified random sample is going to

be a challenge. Specifying the optimal level of precision and statistical power, as it was done in background materials for the meeting, is important for enabling national experts to determine an alternative minimum adequate sample size.

Preliminary cost estimates for monitoring equipment and laboratory analyses are as follows:

- Disposable passive samplers: 10 samplers per school at the average cost of 30 Euros each = 300 Euros per school;
- Laboratory analyses of formaldehyde samplers (the cost of NO2 analysis is included in the cost of NO2 samplers): 40 Euros per sample on average * 5 samples = 200 Euros per school;
- CO_2 monitors cost up to 1000 Euros each. They will be used for one week in three classrooms per school and re-used in multiple schools. However, a sufficient number of devices will be needed to complete the survey during a reasonably short interval, (e.g. 15 CO2 monitors for a survey of 100 schools);
- Surface moisture monitors (up to 500 Euros each) will be used for dampness/mould inspections (one monitor per school). The total number to be purchased for the survey will depend on the survey schedule and design;
- Other equipment, such as digital photo cameras (100 Euros per camera) and distance measurement devices (100 Euros per electronic device), would also be needed.

Pilot testing of survey methodology in volunteer countries

WHO presented a plan for pilot testing the proposed survey in Albania. The first pilot survey will have a clustered design with three to four clusters in urban and rural areas. Alternative approaches, such as continuous monitoring of indoor air pollutants during an entire school week vs. monitoring during the school sessions only, will be tested in order to decide on the most appropriate methodology. The cost of data collection and necessary resources will also be estimated more precisely after the pilot study. Meeting participants agreed that pilot testing the methodology is a crucial step in the development of the proposed survey and agreed on information about the first planned survey in Albania. More pilot surveys in different geographic and socioeconomic settings are desirable but concrete implementation plans depend on the availability of funds. Final versions of detailed survey protocols and data collection forms are expected to be ready by mid-summer 2012.

Human biomonitoring-based indicators of early life exposure to environmental pollutants

Background information and justification

At the 5th Ministerial Conference on Environment and Health, the Member States of the European Region made specific commitments to prevent diseases in children arising from the chemical pollution of the environment. Specifically, Regional Priority Goal (RPG) 4 of the Parma Declaration included the following commitments:

i. (…) We will contribute (…) to the development of the global legal instrument on mercury.

ii. We aim to protect each child from the risks posed by exposure to harmful substances and preparations, focusing on pregnant and breast-feeding women and

places where children live, learn and play. We will identify those risks and eliminate them as far as possible, by 2015.

iii. We will act on the identified risks of exposure to carcinogens, mutagens and reproductive toxicants, including radon, ultraviolet radiation, asbestos and endocrine disruptors (...).

During the WHO technical meeting on 25-26 November 2010 in Bonn, Germany, early life exposures to mercury and brominated flame retardants were identified as indicators for monitoring the implementation of RPG 4 Parma commitments related to environmental chemicals. The meeting participants agreed that these indicators should be based on human biomonitoring (HBM) data. Mercury levels in maternal hair samples collected at the time of childbirth and polybrominated diphenyl ethers (PBDE) in human breast milk were identified as two new indicators for monitoring RPG 4 Parma commitments. PBDEs are included as optional parameters in the existing WHO survey of persistent organic pollutants in human breast milk. Thus, the next step is to focus efforts on further developing a standardized methodology for the mercury exposure indicator.

HBM data reflect the body burden of pollutant resulting from cumulative exposure from all sources and via all exposure pathways. Information on personal body burdens of harmful chemicals is helpful for stimulating policy actions aimed at reducing overall emissions and exposures, as well as for evaluating their effectiveness. Since mercury has a global distribution, emissions from a specific source can have effects even in the remotest parts of the world. Therefore, coordinated actions at the international level are needed to prevent the adverse health effects of mercury, especially for the most vulnerable populations. The Minimata Convention, a legally-binding policy instrument to reduce mercury emissions worldwide, is expected to enter into force in 2013. HBM would be an appropriate tool for monitoring the effects of the proposed Minimata Convention on reducing early life exposure to mercury.

Two biomarkers of prenatal mercury exposure were considered: the mercury concentration in cord blood and the maternal hair mercury concentration. Both are subject to measurement error in the laboratory as well as to biological fluctuations. Whilst cord blood mercury is thought to be the best indicator of the biologically relevant concentration of mercury in the fetal circulation, maternal scalp hair samples are easier to collect and handle. Mercury in maternal hair is associated with the concentration of MeHg in blood, and with adverse health effects in children. As scalp hair grows at a rate of 1 cm per month, a 3 cm long strand of maternal hair collected near the scalp reflects foetal exposure during the third trimester of pregnancy. Most mercury in hair is in the form of methylmercury, which is commonly ingested with contaminated fish or other aquatic foods. However, methylmercury is relatively difficult to measure. Since most mercury in hair is in the form of methylmercury, total mercury in hair samples can serve as a biomarker of exposure to methylmercury. It can be measured accurately and inexpensively, using equipment that is available in most chemistry laboratories. Maternal dietary questionnaire allows obtaining information on the frequency of fish and seafood consumption and other possible exposure factors.

While some Member States have national biomonitoring programmes addressing exposure to mercury and other important pollutants, many others do not currently collect such data. Therefore, new data collection programmes using a standardized WHO methodology, are

suggested as a means to close critical data gaps and enable effective monitoring of Parma Declaration commitments across the Region.

Draft technical materials prepared for the meeting

In the follow-up to the November 2010 meeting, WHO has initiated the development of a standardized methodology for national surveys to provide comparable and consistent data collection on the distribution of pre-natal exposure to methylmercury and to assess temporal trends in exposure in the European Region's Member States.

In an effort to develop methodology based on the existing experience in the field, WHO has been closely collaborating with the European Commission-funded Consortium to Perform Human Biomonitoring on a European Scale (COPHES). The COPHES project involves the development of common guidelines and harmonized methods for the determination of cotinine, cadmium, and phthalate metabolites in urine and mercury in scalp hair. The current feasibility study DEMOCOPHES implements the guidelines in a cross-sectional survey in 16 EU countries. It involves randomly selected 6 to 11 year-old children and their mothers (120 child-mother pairs per country).

The draft WHO survey protocol was developed by COPHES experts with contributions from the WHO secretariat. The list of technical documents developed by COPHES experts for the WHO survey include: standard operating procedures (SOP) for recruitment, field work, hair sampling and laboratory analysis of samples; questionnaire for survey participants; and templates for informed consent, withdrawal forms, notification to the privacy authorities and submission for ethics review committees.

The proposed survey follows a randomized clustered design. Randomly selected maternity hospitals would form recruitment clusters for survey participants who would be mothers between 20 and 35 to 40 years old. The survey would have two arms: (1) general population arm to characterize an overall distribution of exposure in a specific country and determine "reference values"; and (2) high exposure arm to characterize exposure "hot spots."

The general population arm would consist of a statistically meaningful population-based sample from all geographic or administrative regions of a country. A geographically stratified random selection approach may be recommended for larger countries in order to ensure representation of all major subnational regions.

The minimum number of survey participants (sample size) for a national survey was based on findings from an analysis of the survey's precision and statistical power. Using data on the inter-personal variability in hair mercury levels in Flanders, it was determined that a sample size of 240 participants would provide an adequate probability of demonstrating meaningful temporal changes between sequential cross-sectional surveys in the general population. The minimum recommended number of maternities for the general population arm is 10 per country.

The general population arm would be open to including measurements for additional biomarkers to characterize exposure to selected high priority pollutants that affect children.

The high exposure arm would involve mothers living in areas with high fish and seafood consumption, and/or higher meat consumption (e.g., muscle and organs from marine

mammals, such as seals and whales) or with other known sources of elevated mercury exposure.

Mercury in maternal hair as a core biomarker

The proposed indicator (mercury in maternal hair) is appropriate for assessing pre-natal exposure to mercury. It reflects cumulative exposure of the mother via all food sources during the last trimester of pregnancy. Total mercury level in scalp hair is a biomarker of exposure that is recommended by the United Nations Environmental Programme (UNEP). Meeting participants agreed that mercury should be the core indicator in light of the Minimata Convention and that maternal hair is the most appropriate matrix for monitoring pre-natal exposure to mercury.

Meeting participants noted that contaminated fish is a major source of exposure to methylmercury in pregnant women, consumption of fish also has well-known health benefits. National regulatory agencies should develop well-balanced risk communication strategies encouraging consumption of fish species with low levels of methylmercury and high levels of omega-3 fatty acids.

General population and high exposure arms of the proposed survey

The survey should include two arms to characterize the distribution of exposure both in the general population and in high exposure groups.

A general population-based survey is ideal for international comparisons and for providing information on the distribution of exposure level. National averages will be compared with the WHO European Region average values and with benchmark values when they are available. It is recommended to incorporate biomarkers of exposure for additional pollutants in the general population arm of the proposed survey.

The general population arm would help countries to evaluate health risks due to certain pollutants and draw attention to their problems in the entire Region. The first round of the survey in the general population will characterize the distributions of early life exposure levels while follow-up surveys will enable characterization of temporal trends in exposure. National-level results should be published in ENHIS. A summary of findings from the baseline survey round should be presented at the 6th Ministerial Conference in 2016.

In addition to a comparison with other countries, it will be important for some countries to characterize exposure levels in “hot spots,” or in highly exposed subpopulations. The high exposure arm would be conducted in specific geographic areas with known high levels of exposure to pre-defined priority pollutant(s). The high exposure arm is recommended as optional. It can be postponed until the second round of the general population survey (to be conducted in approximately 5 years after the baseline round).

The methodology for the high exposure arm needs to be further developed. One approach is to conduct separate surveys in exposure hot spots. Another possible approach is to oversample known or suspected high-exposure areas in the general population survey.

Clustered design and sample size

The meeting agreed that the survey should have a clustered design with randomly selected maternities forming recruitment clusters. This design will reduce the cost of the survey and make it much easier to organize. In order to have a representative sample for the general population arm in large countries with diverse geographic or socioeconomic conditions, maternities may need to be selected from distinct regions using a stratified random sampling approach. The meeting also agreed that 240 women per country is an adequate sample size for the general population arm. In order to obtain a representative sample, the number of participants in each region should be proportional to the number of deliveries in that region. Member States can increase the sample size in order to have sufficient statistical power to compare findings from different regions of the country.

There will be a trade-off between the number of maternities and number of participants per maternity: using a smaller number of maternities with more women recruited in each maternity would make the survey easier to organize but would result in a loss of statistical power and precision. On the other hand, a national survey design shall assure a good representation of different subnational regions using a geographically stratified random sampling approach. The selection of appropriate regions for the random sampling of maternities should be the responsibility of countries. It is recommended to include at least one coastal region in countries that have a sea coast. The minimum number of maternities per country should be ten.

A larger sample size than the one recommended above will be needed in order to characterize the spatial distribution of exposure within a specific country, which can be valuable additional information for national policy-makers. For example, in Spain, mercury biomonitoring data are evaluated at the regional level. The results show clear differences in exposure levels between coastal and inland regions. Recommendations for pregnant women to avoid potentially contaminated food products should be based on the results of this proposed method of mercury biomonitoring.

Recruitment of survey participants

The working group on biomonitoring discussed whether instead of pregnant women in maternities, other target populations, such as all women of child-bearing age, would be more appropriate for the proposed survey. It was noted that the Parma Declaration clearly identified pregnant women as a priority group. Furthermore, the neurotoxic effects of mercury exposure are also the strongest during the pre-natal period.

Combining the proposed survey with the WHO breast milk survey was also discussed. It was noted that the WHO breast milk survey has a very different design and different objectives. For example, its sample size is much smaller (only 50 women per country), while the participation rate in the latest round of the survey was very low (only 4 countries of the WHO European Region participated). The next round of the WHO breast milk survey will only take place in 3-4 years. On the other hand, countries participating in the newly proposed WHO survey should have an option to include the collection of breast milk samples for analysing exposure to bioaccumulating lipophilic compounds.

Combining a biomonitoring survey with the proposed indoor air pollution survey in schools was another alternative approach discussed at the meeting. It was noted, however,

overloading the school survey with unrelated activities would be undesirable. This approach might ultimately jeopardize both surveys. The current meeting supported the recommendation of the November 2010 WHO meeting, which identified the recruitment of study participants through maternities as the most appropriate approach.

Timing of sampling

The goal is to recruit mothers who have just given birth. While such women can be recruited through different mechanisms, such as during pregnancy consultations or during appointments with physicians and stays in maternity wards/maternity hospitals, recruitment through maternities is clearly the preferred method in some countries, such as the Russian Federation.

The meeting agreed that hair samples can be collected from one week before until two weeks after delivery. It is recommended that recruitment of participants and sampling should take place in maternity hospitals. Sampling can also be conducted after the women are discharged from the maternity, if preferred. However, hair samples have to be collected during the specified time period in order to characterize exposure to mercury during the 3rd trimester of pregnancy.

Mercury levels in hair samples can vary by season. For example, a statistically significant seasonal effect has been demonstrated in Flanders. Collecting samples during or immediately after a peak exposure season is one option. However, some national surveys (for example, in Spain) are conducted throughout the year. The biomonitoring working group recommended spreading sampling across all seasons rather than sampling in one season only.

Implementation schedule and follow-up surveys

The participation in the proposed survey will be completely voluntary. The meeting participants agreed that participating countries should also have sufficient flexibility for defining the details of national surveys. It is important, however, to make sure that the baseline monitoring data becomes available before the 6th Ministerial Conference on Environment and Health in 2016. Therefore, preparations for national surveys, including proficiency testing of national laboratories and pilot testing of survey tools, should start in early 2013 and full scale data collection should start in 2014. The meeting participants discussed an optimal time interval between consecutive surveys and recommended that follow-up national surveys should be conducted five years after the baseline survey round. It was noted that Member States should have flexibility in regards to survey frequency.

Technical support, quality assurance and quality control

Internal and external quality control systems for participating laboratories are essential. Otherwise, the laboratory effect (difference between results produced by different laboratories) can outweigh or confound findings of regional differences. A reference laboratory will have to be identified in advance to coordinate quality control (QC) and quality assurance (QA) programmes. In each country, the evaluation of laboratory capabilities and proficiency tests will need to start one year before the beginning of monitoring. Thus, decisions about QA/QC support and reference laboratories will need to be made relatively soon. A target date has been set for the fall 2012.

In order to ensure the comparability of results from different countries, recruitment, sample collection and sample analysis procedures will need to adhere to standardized WHO protocols. It is important to have QA schemes developed for all participating laboratories. Meeting participants agreed that it is not necessary for participating laboratories to have an accreditation. However, national QC plans have to meet clearly defined criteria. It is also necessary to provide methodological support and training based on protocols from a centralized reference laboratory for the Region.

Selecting additional biomarkers

The meeting participants agreed to focus on discussing the proposed methodology for total mercury in hair samples as the core biomarker. Discussion of additional biomarkers for the proposed survey was only initiated at this meeting. More consultations will be needed to define a set of recommended biomarkers and agree on methodological approaches. A summary of preliminary discussions at the current meeting is presented below.

The meeting participants agreed that the proposed biomonitoring survey needs to address a range of important environmental issues. While organizing a survey requires substantial efforts and resources, marginal costs of including additional biomarkers would be rather low. Therefore, including multiple biomarkers in the same survey would be a cost-effective approach. Future efforts should involve identifying optional biomarkers and developing standardized methodologies for these biomarkers. This would enable individual countries to incorporate selected biomarkers in their national surveys based on country-specific conditions (e.g. national environmental health [EH] situation and policy priorities).

It is necessary to specify a clear set of criteria for selecting additional pollutants, such as the prevalence of exposure, public health impact, interpretation of biomonitoring data, feasibility and costs, and relevance to national and international policy priorities. The list of substances selected for the existing national biomonitoring programmes can serve as a starting point for biomarker selection. The survey needs to be relatively simple as it would not be feasible to initiate a complex survey within the tight time frame for monitoring of Parma commitments. It is advisable to start with formulating a short list of pollutants and biomarkers, which can be expanded later if necessary.

Additional biomarkers should characterize exposure to common and biologically persistent chemicals that are known to play a significant role in the aetiology of diseases. It is important to focus on pollutants with a global distribution or widespread exposure in the Region and which are known to have a small margin of safety. It is equally important to take into account the concerns of the public and the potential for preventing exposure, whether at the individual or societal level. Additional criteria for selecting biomarkers should include: feasibility and practicality aspects, such as the ease of specimen collection, transport and storage; the availability of a well-validated analytical method with a sufficiently low limit of detection; the availability of reference materials; and the cost of laboratory analysis. Data interpretation aspects–such as well-understood pharmacokinetics and the availability of broadly accepted health–based reference values or biomonitoring equivalents–should also be considered.

Incorporating additional biomarkers in the general population arm of the proposed survey should not affect the overall survey design and sample size. Additional efforts would be focused on collecting relevant specimens (for example, urine or cord blood), analysing specimens, and collecting additional questionnaire data on relevant exposure factors.

Plans for pilot testing and implementation of the proposed survey

Experts from several countries expressed interest in pilot testing the proposed methodology. However, the cost of the proposed survey may be a deciding factor for the participation of many countries. Therefore, it will be helpful to provide, upfront, an approximate estimate of the resources required to conduct the survey. It was noted that laboratory analysis of hair samples for total mercury is rather inexpensive. Since labour costs vary in different countries, required resources for fieldwork should be estimated in person-days. The advantage is that Member States will be able to estimate the monetary costs of data collection using their prevailing wages. Specimens can then be analysed in national laboratories or, alternatively, arrangements can be made for specimen analysis in a pre-selected reference laboratory.

Each Member State will have to identify a national institution responsible for the survey and establish a national survey office which will coordinate data collection and ensure compliance with the standardized WHO protocol. A national survey coordinator will have to prepare a field manual in the national language based on the WHO protocol, coordinate the selection of maternities and recruitment of participants, design and implement an internal QA/QC programme, maintain the survey database and liaise with the WHO secretariat.

WHO shall identify reference laboratories to provide assistance with quality assurance and quality control, as well as to analyse samples from countries that do not yet have sufficient national laboratory capabilities. An additional benefit of the proposed survey is national capacity building. For example, laboratories in the eastern part of the Region would participate in the survey and contribute to the analysis of some biomarkers after receiving training and assistance with quality control procedures from reference laboratories.

The participation of Member States in the proposed survey will be completely voluntary. WHO will provide a standardized survey methodology specifying a minimum set of survey design requirements, and provide standard operating procedures for proposed biomarkers. Member States will be able to choose a subset of biomarkers matching national priorities. WHO will coordinate technical assistance to countries with limited internal resources.

Summary of discussions

- Participation in the proposed survey will be completely voluntary;
- The objective of the proposed survey in to assess early life exposures to environmental pollutants with known adverse health effects;
- The target population is new mothers in the age interval from 20 to 40 years;
- Total mercury in maternal hair is recommended for characterizing pre-natal exposure to mercury;
- Maternity hospitals are ideal places for recruiting survey participants;
- The survey should have two optional arms to characterize exposure in the general population and in high exposure areas/population groups;
- Randomized clustered design is recommended for the general population survey; the minimum national sample size is 240 women and the minimum number of maternities is 10;

- Design of the high exposure arm needs to be further elaborated;
- More consultations are necessary to select additional biomarkers.

Indicators relying on existing data sources and policy action surveys

Two groups of proposed indicators were presented and discussed at the meeting: (i) indicators for monitoring commitments to protect children's health from harmful environmental factors listed in Section A of the Parma Declaration; and (ii) indicators pertaining to Section B, "Protecting health and the environment form climate change". Both groups of indicators included indicators of exposure and health effects relying on existing data sources. Policy action indicators, requiring designated national experts to fill out standard WHO data collection forms, were also included. Specific indicators are described below.

A. Protecting children's health

Urban population exposure to ozone

This indicator reflects the population-weighted annual mean of city-level accumulated maximum daily 8-hour average ozone concentration in excess of 70 $\mu g/m^3$ of ground level ozone. Ozone concentrations need to be measured throughout the year at urban background and suburban monitoring sites. The data should cover a minimum of 273 days (75% of a year). The source of ozone data is the air quality database of the European Environment Agency (EEA). The data is available for all EU countries and several other Member States. City-level demographic data are also required. The data for this indicator have already been abstracted and analysed for presentation in ENHIS. The indicator factsheet is currently being developed. Meeting participants unanimously accepted this indicator.

Population exposure to noise and its health effects

Noise in one of the most important environmental issues in Europe: half of the population live in noisy surroundings and one third of the population experience sleep disturbance due to traffic noise. WHO published night noise guidelines in 2009 specifying the Nigh Noise Guideline of 40 dB based on the observed association with cardiovascular diseases as well as the Interim Target at 55 dB L_{nigh}.

The proposed indicator includes two subindicators:

- Exposure subindicator: Proportion of urban population exposed to environmental noise from major sources.
- Health effect subindicator: Proportion of general population annoyed by environmental noise in the neighbourhood.

The exposure subindicator is defined as the proportion of people exposed to specific ranges of noise measured or modelled 4 m above the ground on the most exposed façade in urban agglomerations with >250 000 inhabitants at night and during entire day. Data are presented

separately for road, rail and air traffic, and industrial sources. The main data source is the noise monitoring database of the EEA (http://noise.eionet.europa.eu). The health effect subindicator is defined as the proportion of the population reporting annoyance due to noise exposure. The main data source is the Eurostat Survey of Income and Living Conditions (SILC).

Meeting participants agreed to accept this indicator. It was suggested that methods need to be further clarified. Specifically, clearer distinction needs to be made between exposure and effect subindicators. Pilot testing of the standard indicator methodology is necessary. It was also suggested that non-EU countries should follow the requirements of the EU Environmental Noise Directive 2002/49/EC. A representative of Slovakia and WHO temporary advisers from The Netherlands and the former Yugoslav Republic of Macedonia suggested that pilot testing can be conducted in their countries.

Access to public green/open spaces in cities

Accessibility of green/open spaces can be evaluated using two alternative approaches: (1) a questionnaire survey of the urban population; and (2) analysis of geographic information system (GIS) data on land use and population distribution. The proposed indicator is based on GIS data. While the standard indicator methodology is still under development, a case study presented at the meeting demonstrated the application of the GIS methods to estimate access to green spaces in Utrecht, The Netherlands. Two alternative methods can be used to calculate the proportion of the urban population living within a certain distance (300 m) from the boundary of green space using GIS data. One method requires GIS data on each residential house, while another method relies on population data aggregated in certain territorial units, such as census blocks.

After plenary and working group discussions, meeting participants approved the GIS-based approach. However, there were some concerns about the cost of data acquisition and analysis. Further development and pilot testing of this indicator in several cities will be necessary in order to finalize the standardized method. A WHO temporary adviser from the Netherlands and representatives of Lithuania and Hungary suggested pilot testing to be conducted in their countries (the latter two countries agreed to provide data on one city each).

Policy to prevent injuries in children

The indicator reflects the development and enforcement of legislation and regulations that establish mandatory requirements aiming at reducing transport injuries and other unintentional injuries in children. The indicator consists of 22 components which are grouped in two categories: (1) policies to promote safe mobility and transport; and (2) policies to prevent other unintentional injuries. The first group includes legislation on traffic rules and safety measures for passenger cars, motorcycles and bicycles. The second group includes components related to preventing drowning, burns, suffocation, and poisoning. The results of indicator's pilot testing in Romania were presented at the meeting. Comments from meeting participants included concerns about the lack of weighting in the scoring system, somewhat unclear scoring procedures and the large number of components (22 in total). There is a need to clarify what it means to systematically collect data on unintentional injuries. It is also necessary to ensure common understanding of the scoring system in order to collect consistent and comparable data from different countries. The indicator should be harmonized

with other pertinent initiatives of international agencies. Representatives of Lithuania, Hungary and the former Yugoslav Republic of Macedonia expressed interest in pilot testing this indicator.

Policy to improve hygiene in schools and kindergartens

The proposed policy indicator reflects the existence and enforcement of policies that ensure access to safe water and sanitation in schools and kindergartens, and encourage health promotion and hygiene practices in pupils. The indicator consists of seven components reflecting policies and regulations related to: the provision of sanitation facilities in schools/kindergartens, minimum gender-specific numbers of sanitation and hygiene facilities, inspection and enforcement practices, education programmes, and investment programmes to ensure safe water and sanitation. At the meeting, a concern was expressed about the lack of information on the availability of "safe drinking-water" in schools in some Member States. Also, the existence of different standards for different types of children's facilities (such as kindergartens vs. private child care centres) may complicate efforts to characterize country-level policies. Therefore, there is a need for clear definitions of kindergartens and private day care centres. Representatives of several countries expressed interest in pilot testing of this indicator including Lithuania, Hungary, Cyprus, Latvia, Bulgaria and the Republic of Moldova.

Policy to improve indoor air quality in schools

Meeting participants discussed the importance of integrating appropriate measures into school regulations to ensure proper indoor air quality. Examples of policies include: specifications for building and furnishing materials and ventilation systems, and operation and maintenance procedures for preventing exposure to indoor air pollution. The proposed indicator involves 15 components, such as indoor temperature and humidity, maximum allowed concentrations of specific pollutants, enforcement activities and education/training programmes, reflecting the existence of specific policies and regulations. For each component, the possible scores are zero (non-existing), one (existing but poorly implemented/enforced) and two (effectively enforced policies or regulations). The total score can vary from 0 to 30. Meeting participants discussed the draft indicator methodology which was included in the background technical materials and presented at the meeting, and recommended to extend the indicator's coverage to include kindergartens, include a component on the control of biological pollutants and possibly infectious agents (in addition to chemical pollutants), and to clarify who is responsible for managing the monitoring of indoor air quality in schools. Representatives of Lithuania, Slovakia, Bulgaria and Hungary expressed interest in pilot testing this indicator. More changes are expected based on the results of pilot testing.

Policy to prevent smoking in schools

The proposed policy action indicator consists of seven components. Data on the existing regulations on the sale of tobacco products to children can be abstracted from the WHO Framework Convention on Tobacco Control (FCTC) implementation database. Additional information on regulations as well as data on education programmes in schools can be obtained from the Global Youth Tobacco Survey (GYTS). Information on smoking-related education will also be collected from pupils via the proposed survey in schools. Information

on regulations for smoke-free educational facilities and data on the cost of tobacco products can be obtained from the WHO Report on the Global Tobacco Epidemic, which is updated on a yearly basis. Data on the enforcement of no smoking policies in schools can be collected through the proposed survey in schools via the interview with school administrators and the questionnaire for teachers. Meeting participants expressed a concern about the lack of a policy to ban advertising of tobacco products to children in many Member States. It was also suggested to add specific information about the approaches to scoring of smoking prevention measures. Other suggestions were to evaluate local- and national-level smoking-prevention campaigns separately and to add information on the impact of specific tobacco taxes on the cost of tobacco products. It was noted that volunteer countries will be needed to pilot test this indicator in different settings.

Policy to prevent asbestos-related diseases

The asbestos policy indicator was recommended for further development by the WHO technical meeting in November 2010. Its methodology involves 12 components reflecting national policies and the capacity to eliminate asbestos exposure and its health effects following the recommendations of WHO and the International Labour Organization (ILO). The indicator was supported by the meeting participants and recommended for implementation. Representatives of Slovakia, Cyprus, Latvia and Lithuania suggested pilot testing of this indicator in their countries.

Mortality and morbidity due to asbestos-related diseases

At the November 2010 WHO meeting, the mortality/morbidity indicator was recommended for further discussions to determine its suitability. A draft methodology of this indicator, included in the background technical materials, was presented. The mortality/morbidity indicator would reflect the incidence of diagnosed and reported asbestos-related diseases: mesothelioma, lung cancer and asbestosis. Meeting participants made a number of comments on the lack of specific mortality/morbidity data on mesothelioma and asbestosis in a majority of Member States. The indicator was not recommended for implementation.

B. Protecting health and the environment from climate change

Background information

The Climate, Environment and Health Action Plan and Information System (CEHAPIS) project, co-funded by the WHO Regional Office for Europe and DG SANCO, aims to provide an evaluation of policy options for successful health adaptation to climate change and to monitor trends. These aims are coherent with the objectives outlined in the "Protecting health in an environment challenged by climate change: European Regional Framework for Action" document developed by the European Climate Change and Health taskforce (http://www.euro.who.int/__data/assets/pdf_file/0005/95882/Parma_EH_Conf_edoc06rev1.pdf). This project used a structured process involving preparation of background materials by technical experts, review and evaluation of indicator proposals and WHO technical meetings to develop a set of 17 indicators reflecting the effects of global climate change on exposure to and health effects of specific environmental hazards, as well as policy actions to prevent or mitigate these impacts.. Standardized methodological documents were developed for all

proposed indicators. The project also involved pilot testing of seven indicators in selected EU countries. While the final CEHAPIS report is still being evaluated by the European Commission, WHO has initiated efforts to utilize some of the CEHAPIS indicators for monitoring the implementation of Parma Declaration commitments.

The WHO secretariat evaluated the proposed indicators based on their relevance to global climate change, public health significance, addressability through policy actions (if applicable) and data availability, and selected a subset of seven indicators for further evaluation at the current meeting (see below). Methodologies of the proposed indicators and results of pilot testing (if available) were included in the background technical materials and presented at this meeting.

Overall, meeting participants provided positive feedback on the proposed indicator methodologies. It was noted that performing the proposed assessments would require certain resources. However, the knowledge to be gained is valuable and important, so, it could be argued that the costs are outweighed by the benefits. Some country representatives expressed the desire to learn more about data collection methods before volunteering to conduct pilot testing of indicators. Only one proposed indicator, cardiovascular mortality, was not approved for further development and implementation due to its questionable connection to climate change.

Population exposure to heat waves and excess mortality from heat waves

The proposed indicator includes the exposure and health effect components. Analysis has to be conducted at the city level and the results should be summarized at the country level. In the proposed draft methodology, heat wave is defined as at least three consecutive days with maximum temperatures exceeding the 95th percentile for summer temperatures in the previous 10 years. Excess deaths are defined as the difference between observed and expected deaths (excluding deaths due to external causes) in the general population and in the elderly. For each category, expected deaths are calculated using mortality data for the previous five summers after adjusting for changes in the population size. The indicator was pilot tested in Budapest, Hungary, using data from the National Environmental Health Institute, Hungary. The results show that in 2003-2007 almost 400 excess deaths were associated with heat waves. A high intensity heat wave in 2007 had the strongest impact on deaths in the elderly. The definition of heat waves needs to be further clarified. Specific approaches to using city-specific thresholds were also discussed. The implementation of this indicator relies on the availability of daily mortality data from many cities. Meeting participants expressed concerns about having limited access to daily mortality data. Potential for pilot testing may exist in the former Yugoslav Republic of Macedonia, Cyprus, Ireland, The Netherlands, Slovakia and France.

Population exposure to actual flooding and population vulnerability to flooding

The proposed indicator reflects the proportion of the population that has been affected by flooding in a specific country or area during one calendar year. The required data include GIS data on areas affected by floods and population size data for an appropriate grid size. The vulnerability (e.g. potential exposure) indicator requires data on the areas which can be affected by catastrophic floods as well as population data for the vulnerable areas including data on the elderly and population groups living in poverty. Meeting participants suggested

that more feasibility testing of these twin indicators is needed prior to implementation. Representatives of Slovakia and Hungary expressed interest in pilot testing the methodology.

Lyme borelliosis incidence

This indicator reflects monthly incidence of Lyme borreliosis in the general population of a country of subnational region. The indicator will rely on existing national databases on infectious diseases. The data from Hungary demonstrate a more than three-fold increase in the incidence of Lyme borelliosis from 1998 to 2010. Meeting participants supported this indicator. Representatives of Slovakia and Hungary expressed interest in pilot testing this indicator.

Population exposure to allergenic pollen

This is a complex indicator reflecting exposure to allergenic pollen of grasses, alder, birch and ragweed. It includes the following subindicators:

- Population-weighted average pollen levels in a specific year for each type of pollen
- Population-weighted exposure to allergenic levels of the ragweed pollen
- Population-weighted duration of the ragweed pollen season

The indicator requires daily pollen monitoring stations located in densely populated areas. The size of the population living within 17.5 km from a specific monitoring station has to be estimated, and then used for calculating national or regional population-weighted exposure measures. The indicator was pilot tested in Hungary using daily ragweed pollen concentration data from eight monitoring stations. Findings showed that population exposure levels varied considerably over time, with lower levels associated with dry summer weather conditions which are unfavourable for ragweed growth.

Meeting participants suggested that more consultations are needed to ensure access to pollen data and facilitate further pilot testing of this indicator. Representatives of Germany and Hungary expressed interest in additional pilot-testing of this indicator.

Cardio-respiratory mortality

The proposed indicator reflects age-standardized death rates for cardio-respiratory mortality (ICD-10 codes I00-I99; J00-99) in a specific population or geographical region during “hot” and “cold” months. Meeting participants discussed the lack of data on demonstrating a relationship between ozone and summer mortality. The proposed indicator was not recommended for implementation.

Policy actions to prevent heat-related health effects

This indicator is a composite index involving a set of components reflecting the existence of alert and early warning systems, heat-related information plans, detailed guidelines for preventing health effects, specification of vulnerable subpopulations, real-time surveillance efforts, strategies to reduce indoor exposure to heat, and action plans for extreme weather events. The indicator was pilot tested in France, Hungary and Spain. Meeting participants supported this indicator. Representatives of Lithuania and Slovakia expressed interest in further pilot testing of the indicator methodology.

Policy to secure water supplies

The proposed indicator consists of a set of components reflecting the implementation of water safety plans, protection of drinking-water treatment plants, plans for water supplies during droughts and floods, safety requirements for water distribution systems, measures to reduce vulnerability of waste water treatment plants to extreme weather events, flood preparedness plans, planning for drought conditions and measures to ensure equal access to water. The meeting supported the proposed indicator. A representative of Bulgaria expressed interest in pilot testing this indicator.

Policies to prevent infectious diseases

This indicators includes nine components that are grouped in four categories: (1) implementation of the 2005 International Health Regulations; (2) measures to prevent vector-, food- and water-borne diseases, such as disease surveillance, early warning and outbreak detection systems, and infrastructure for disease prevention and emergency responses; (3) measures to inform, educate and empower members of the public, such as the existence of education and awareness campaigns, and vector control measures; and (4) measures to foster the development of healthy public policy through climate-resilient land use planning (e.g. quality and quantity of green spaces) and building codes to minimize the exposure to heat. The proposed indicator was accepted by meeting participants. Representatives of Latvia and Slovakia expressed interest in pilot testing this indicator.

Recommendations and conclusions

The meeting participants reviewed the lists of proposed indicators for the monitoring of Parma Commitments to protect children's health from environmental factors and to protect public health from the effects of climate change. It was acknowledged that the data for some of the proposed indicators are available in most Member States. However, the meeting participants agreed that there is a need to coordinate new data collection programmes for a subset of proposed indicators in order to close data gaps in many Member States and ensure comparability of data from different countries. Meeting participants discussed the way forward and developed a set of recommendations for the consideration by the European Environment and Health Task Force (EHTF), which are listed below.

1. Indicators based on existing data sources

Meeting participants reviewed newly proposed exposure and health effect indicators that will use existing data sources, as well as policy action indicators that will rely on country-level policy surveys. The meeting participants recommended specific changes to indicator methods and identified countries that will pilot test these indicators. WHO should coordinate the pilot testing of indicators and finalize indicator methodologies. The proposed indicators should be implemented in ENHIS in 2012; a follow-up round of data collection should take place in 2014. The following indicators are recommended for pilot testing and implementation:

a. Indicators for monitoring Parma commitments to protect children's health:
    - exposure to ground level ozone;

- exposure to noise and its health effects;
- access to public green/open spaces in cities;
- policy to prevent injuries in children;
- policy to improve hygiene in schools and kindergartens;
- policy to improve air quality in schools;
- policy to prevent smoking in schools;
- policy to prevent asbestos-related diseases.

b. Indicators for monitoring Parma commitments to protect health from the effects of climate change:
   - exposure to heat waves and mortality due to heat waves in cities;
   - population exposure to actual flooding;
   - population vulnerability to flooding;
   - Lyme borelliosis incidence;
   - exposure to allergenic pollen;
   - policy to secure water supplies;
   - policy to prevent infectious diseases.

2. Survey of exposure to environmental factors in schools

Meeting participants recommended implementing a comprehensive school-based survey to collect data on environmental exposures, hygiene practices, physical activities and injuries to monitor progress towards the corresponding Parma commitments.

a. The proposed survey will generate data for the following indicators:
   - exposure to NO_2, formaldehyde and benzene (optional) in classrooms;
   - exposure to dampness and mould in schools;
   - ventilation rate in classrooms;
   - access to properly maintained and operated sanitation facilities;
   - hygienic practices of pupils;
   - smoking in schools and on school grounds;
   - mode of transportation to schools.

b. Member States can choose to limit the survey to specific indicators or subsets of indicators that are selected based on the local context.

c. The proposed survey in schools should have a randomized clustered design. The recommended range of sample sizes is from 100 schools (but no more than 20% of all schools in the country) to 300 schools, depending on the variability in exposure levels within the country. The estimated required amount of labour for field data collection is two person-days per school. The estimated cost of materials and laboratory analyses is approximately 50,000 Euros per 100 schools.

c. The methodology of the proposed survey will be finalized through pilot projects in selected countries in late 2011 – early 2012.

d. WHO will provide the survey methodology and coordinate training and inter-laboratory QA/QC activities through collaborative agreements with reference institutions (formal agreements are yet to be prepared). Pilot surveys will involve

collaborations with the EC JRC in Ispra, Italy, the National Public Health Institute in Kuopio, Finland, and other institutions.

3. Human bio-monitoring to assess early life exposure to mercury and other pollutants

Meeting participants recommend further development and testing of the proposed methodology of a human biomonitoring survey to assess the distribution of pre-natal exposure to mercury and other pollutants pertinent to RPG 4.

a. The proposed approach involves recruiting mothers in a random sample of maternity hospitals and using mercury levels in their hair samples as a non-invasive biomarker which characterizes foetal exposure.

b. The survey should have two optional arms: (1) general population arm to characterize exposure distribution in the general population (the total sample size should be at least 240 women recruited from at least ten maternities); and (2) high exposure arm to characterize exposure in geographic areas or subpopulations with high fish consumption (the main route of exposure to methylmercury) or living near industrial sources of emission. Sample size for the high exposure arm is expected to be comparable with the general population arm.

c. A list of additional biomarkers should be developed for characterizing early life exposure to environmental pollutants that constitute a public health concern.

d. The methodology of the proposed survey should be finalized in 2012-2013. WHO would identify reference laboratories for technical and QA/AC support of national laboratories.

e. Pilot surveys would be conducted in 2013. It is recommended that participation in QA/QC exercises be required in order to assess the proficiency of involved laboratories and ensure comparable results.

f. National surveys would start in 2014.

Conclusions

Efficient monitoring of Parma commitments will require the implementation of a new set of indicators. Existing data sources need to be utilized to the maximum extent possible. At the same time, many Member States do not currently collect data for a number of the proposed indicators related to the school environment and early life exposure to chemicals. New surveillance programmes are necessary to close these critical data gaps and provide information support for policy actions. WHO should play an active role in facilitating and coordinating international efforts to conduct these new surveys harmoniously in order to ensure that data is comparable across the Region. The development of standardized methodologies and training programmes would reduce the barrier to entry, facilitate the participation of Member States with limited internal resources, and promote capacity building. Besides generating data of crucial relevance to the Parma Conference commitments, the proposed monitoring programs would provide a unique opportunity for the development of human and institutional capacities for more effective environmental health assessments in the Member States.

Annex 1. List of participants

Albania

Gazmend Bejtja	Directorate of Public Health, Ministry of Health, Tirana

Armenia

Nune Bakunts	State Hygiene & Anti-Epidemic Inspectorate, Ministry of Health, Yerevan

Azerbaijan

Nuraddin Abdullayev	Sanitary-epidemiological surveillance unit Ministry of Health of Azerbaijan, Baku

Belarus

Irina Zastenskaya	Republican Scientific Practical Centre of Hygiene, Minsk

Belgium

Martine Delhaye	National Cell on Environment-Health FPS Health, Food Chain Safety and Environment, Brussels
Fabrice Thielen	National Cell on Environment-Health FPS Health, Food Chain Safety and Environment, Brussels

Bosnia and Herzegovina

Andreja Subotic Popovic	Health Department, Ministry of Health and Social Welfare of the Republic of Srpska, Banja Luka
Aida Vilić-Švraka	Public Health Institute of Federation of Bosnia and Herzegovina, Sarajevo

Bulgaria

Veska Kambourova	National Centre of Public Health and Analyses (NCPHA), Sofia

Croatia

Goranka Petrović	Department of Physiology Monitoring and Improvement of Nutrition Croatian National Institute of Public Health Zagreb

Czech Republic

Růžena Kubínová	Environmental Health Monitoring, National Institute of Public Health, Prague

Cyprus

Pavlos Pavlou	Health Monitoring Unit, Ministry of Health Nicosia

France

Charles Saout	Subdirectorate of Prevention of Risks Linked to Environment and Food, French ministry of labour and health Paris

Georgia

Nana Gabriadze	Department of Noncommunicable Diseases National Centre for Disease Control & Public Health of Georgia, Tbilisi

Germany

Dagmar Kallweit	Section II 1.1 General Aspects of Environment and Health, Federal Environment Agency, Berlin

Hungary

Anna Paldy	National Institute of Environmental Health, Budapest

Ireland

Patrick Goodman	Dublin Institute of Technology, Dublin

Kazakhstan

Albert Askarov	State Sanitary Epidemiological Surveillance Committee, Ministry of Health, Astana

Kyrgyzstan

Meerim Azhimatova	Hygiene of Environment and Toxicology laboratory Scientific and Production Centre for Preventive Medicine, Bishkek

Latvia

Jana Feldmane	Division of Environmental Health, Department of Public Health Ministry of Health, Riga

Lithuania

Ingrida Zurlyté	Centre for Health Promotion and Disease Prevention, Vilnius

Malta

John Attard Kingswell	Environmental Health Directorate, Msida

Montenegro

Borko Bajić	Institute of Public Health, Podgorica

Poland

Wojciech Hanke	Nofer Institute of Occupational Medicine, Lodz

Republic of Moldova

Ion Salaru	National Centre of Public Health, Chisinau

Romania

Adriana Galan	Health Programmes & Health Promotion Institute of Public Health Bucharest, Bucharest

Russian Federation

Irina Ilchenko	I.M.Sechenov 1-st Moscow State Medical University, Moscow

Serbia

Marija Jevtić	Sector for Public health and Sanitary Inspection Ministry of Health, Belgrade

Slovakia

Katarina Halzlova	Department of Environmental Health Public Health Authority of the Slovak Republic Bratislava

Slovenia

Pia Vracko	Communicable Diseases and Environmental Health National Institute of Public Health, Ljubljana

Spain

Mario Cárdaba Arranz	Environmental and Occupational Health Directorate of Public Health and International Health Ministry of Health, Social Policy and Equality Madrid
Argelia Castaño	Environmental Toxicology Department I.S. Carlos III, Madrid

Tajikistan

Said Davlatov	Sanitary and Epidemiological Surveillance Department, Ministry of Health, Dushanbe

Ukraine

Iryna Rudenko	Section of Prevention of Noncommunicable Diseases, Safety of Life Environment Factors and Formation of Healthy Life Styles, Division of Public Health and Sanitary and Epidemiological Welfare of Population, Department of Medical Services Control, Regulatory Policy and Sanitary and Epidemiological Welfare, Ministry of Health of Ukraine, Kyiv

Temporary Advisers

Kerstin Becker	Federal Environment Agency, Berlin, Germany
Ludwine Casteleyn	Leuven Catholic University, Leuven, Belgium
Barry Castleman	Environmental Consultant, Garrett Park, MD United States of America
Eva Csobod	Regional Environmental Centre, Country office Hungary Budapest, Hungary
Guido Fischer	WHO Collaborating Centre for Housing and Health, State Health Office Baden-Württemberg Stuttgart, Germany

Dragan Gjorgjev	Institute of Public Health Skopje, The former Yugoslav Republic of Macedonia
Otto Hänninen	National Institute for Health and Welfare (THL) Kuopio, Finland
Ulla Haverinen-Shaughnessy	National Institute for Health and Welfare (THL), Kuopio, Finland
Anke Joas	Environment and Health, BiPRO GmbH Munich, Germany
Greta Schoeters	Environment at Risk and Health, VITO (Vision on Technology), Mol, Belgium
Ovnair Sepai	Health Protection Agency, CRCE, HPA Chilton, United Kingdom of Great Britain and Northern Ireland
Brigit Staatsen	National Institute for Public Health and the Environment Bilthoven, The Netherlands
Songul Vaizoglu	Department of Public Health, Faculty of Medicine Hacettepe University Ankara, Turkey

Observers

Clemens Schreiner	Federal Ministry of Health, Berlin, Germany
Birgit Wolz	Section IG II 2 “Environment and Health” Federal Ministry for the Environment, Nature Conservation and Nuclear Safety Bonn, Germany

Representatives of other organizations

Otmar Geiss	European Commission Joint Research Centre Institute for Health and Consumer Protection Ispra, Italy
Fabienne Lefebvre	European Commission, SANCO C.2 – Health Information, Luxembourg

Dorota Jarosinska	European Environment Agency Copenhagen, Denmark
Claudia Wendland	Sanitation Products, Water and Sanitation Women in Europe for a Common Future (WECF) Munich, Germany

World Health Organization

Regional Office for Europe

Matthias Braubach
Technical Officer

James Creswick
Technical Officer

Andrey Egorov
Technical Officer

Stefanie Fleischmann
Intern

Christian Gapp
Technical Officer

Rokho Kim
Technical Officer

Michal Krzyzanowski
Head of Bonn Office

Stephanie Sangalang
Intern

Wendy Williams
Programme Assistant

Headquarters

Ruth Etzel
Medical Officer

Annex 2. Working group assignments

Working group 1. Indicators of exposure to environmental health factors in schools *(Russian interpreting)*	**Working group 2. Biomarker-based indicators of early life exposure to harmful chemicals**	**Working group 3. Exposure and health effect indicators using existing data sources, and policy action surveys** *(Russian interpreting)*
1. Adriana Galan 2. Aida Vilic-Svraka 3. Borko Bajić 4. Claudia Wendland 5. Dagmar Kallweit 6. Eva Csobod 7. Fabienne Lefebvre 8. Gazmend Bejtja 9. Goranka Petrovic 10. Guido Fischer 11. Iryna Rudenko 12. John Attard Kingswell 13. Meerim Azhimatova 14. Nana Gabriadze 15. Nune Bakunts 16. Nuraddin Abdullayev 17. Otmar Geiss 18. Otto Hanninen 19. Patrick Goodman 20. Songul Vaizoglu 21. Ulla Haverinen	1. Anke Joas 2. Argelia Castaño 3. Birgit Wolz 4. Charles Saout 5. Fabrice Thielen 6. Greta Schoeters 7. Irina Ilchenko 8. Irina Zastenskaya 9. Kerstin Becker 10. Ludwine Casteleyn 11. Marija Jevtic 12. Ovnair Sepai 13. Pia Vracko 14. Ruth Etzel 15. Ruzena Kubinova 16. Wojciech Hanke	1. Albert Askarov 2. Andreja Subotic Popovic 3. Anna Paldy 4. Barry Castleman 5. Brigit Staatsen 6. Christian Gapp 7. Clemens Schreiner 8. Dorota Jarosinska 9. Dragan Gjorgjev 10. Ingrida Zurlyte 11. Ion Salaru 12. James Creswick 13. Jana Feldmane 14. Katarina Halzlova 15. Mario Cardaba Arranz 16. Martine Delhaye 17. Pavlos Pavlou 18. Rokho Kim 19. Said Davlatov 20. Stefanie Fleischmann 21. Stephanie Sangalang 22. Veska Kambourova

Note: Michal Krzyzanowski and Andrey Egorov moved from one working group to another during the meeting.

The WHO Regional Office for Europe

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World Health Organization
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Scherfigsvej 8, DK-2100 Copenhagen Ø, Denmark
Tel.: +45 39 17 17 17. Fax: +45 39 17 18 18. E-mail: contact@euro.who.int
Web site: www.euro.who.int