

WHO-EM/CEH/156/E

Report on the

First Africa/Middle East expert meeting and workshop on the health impact of airborne dust

Amman, Jordan
2–5 November 2015



World Health
Organization

Regional Office for the Eastern Mediterranean

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1. INTRODUCTION

The World Health Organization (WHO) Regional Centre for Environmental Health Action (CEHA), the World Meteorological Organization (WMO), the United Nations Environment Programme/Regional Office for West Asia (UNEP/ROWA), the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT) and the State Meteorological Agency of Spain (AEMET) organized this workshop to review the scientific evidence on airborne dust and its health outcomes in the Region, and identify regional and national strengths and gaps in responding to the health impacts caused by natural and anthropogenic dust.

This workshop followed a technical meeting on combating sand and dust, 6–7 May 2013, Abu Dhabi, United Arab Emirates; WHO/CEHA regional consultation on air quality and health, 11–12 December 2014; World Health Assembly resolution WHA 68.8, May 2015; and WHO consultation on available evidence for the future update of the *WHO Global air quality guidelines*, 30 September–1 October 2015.

The meeting was inaugurated by H.E. Dr Taher Al Shakhshir, the Minister of Environment, Jordan. Dr Al Shakhshir's address focused on the huge impact of air pollution on health in the Region. He reviewed the air quality monitoring and management initiatives being implemented by the Government of Jordan. On behalf of WHO, Dr Basel Al-Yousfi thanked all the organizers and experts for joining WHO in reviewing the scientific evidence on airborne dust and its health outcomes in the Region, and in identifying strengths and gaps in responding to the health impacts caused by natural and anthropogenic air pollution. Representatives from all the co-organizers of the meeting namely WMO, UNEP/ROWA, EUMETSAT, and AEMET stressed the need for timeliness and the importance of joint efforts as a prerequisite for understanding sand and dust storms in the Region and minimizing their impact on the environment and health.

More than 60 experts from the Eastern Mediterranean Region, Africa, Europe and North America focused their four days of discussions on: strengthening the linkages and partnerships between meteorological, environmental and health sectors towards minimizing the impacts of airborne dust on health; reviewing the evidence on the toxicity of naturally caused air pollution; identifying research gaps and needs; contributing to the ongoing process of updating the WHO guidelines on air quality and health; and reviewing the meteorological, environmental and health interventions that help in minimizing the impacts of airborne dust on health and environment.

The programme, agenda and list of participants are included as Annex 1, 2 and 3, respectively.

2. TECHNICAL PRESENTATIONS

The workshop was divided into 10 sessions: six sessions focusing on different technical aspects of airborne dust, two sessions for country presentations by the meteorological, environmental and health sectors, and two group working sessions.

2.1 Airborne dust cycle and monitoring

Four presentations were made during this session. Dr Enric Terradellas started by focusing his presentation on the dust cycle and its impacts on health, climate and weather, transport, solar energy, and agriculture. Dr Alexander Baklanov presented the sand and dust storm warning advisory and assessment systems of the WMO. These systems are being designed and operated to enhance the ability of countries to deliver timely and quality sand and dust storm forecasts, observations, information and knowledge to users through an international partnership of research and operational communities. Mr Sergio Rodriguez presented ground observations of airborne dust. In his presentation he focused on definitions of dust, aerosols and pollutants; in-situ observations, including particle matter (PM)₁₀ and PM_{2.5} levels and composition and complementary observations; and observation networks. Mr Jose Prieto concluded this session by a presentation on satellite observations of airborne dust.

2.2 Airborne dust modelling and forecast

Ms Sara Basart started this session by addressing the dust modelling and prediction systems and tools of the Barcelona Supercomputing Centre. She reviewed the dust cycle and associated processes, types of dust storms, dust forecasting models, surface concentrations and visualizations, and multi-model products and comparisons with ground base and satellite observations. Mr Francesco Benincasa concluded this session by a presentation on dust forecasting services offered by the WMO Sand and Dust Warning Advisory and Assessment, Northern Africa/Middle East/Europe Regional Centre.

2.3 Country presentations by the meteorological sector

Four presentations from Burkina Faso, Mauritania, Morocco and Palestine were made during this session. Mr Alfred Dango described the meteorological services for monitoring sand and dust and its relation to air pollution in Burkina Faso. Mr Sidi Ould Mohamed Lemine briefed the meeting about the frequency of dust and sand storms in Mauritania and the relation of these to climate change. He described challenges, opportunities and best practices to reduce sand and dust storms. Mr Rachid Abboubi presented air quality monitoring systems and networks in Morocco with a focus on the health impacts of PM₁₀. He talked about the air quality stations network; the pollutants measured and their impacts on health, air quality modelling, including high resolution modelling covering the Casablanca region. Dr Helmi Al Salem concluded this session by describing the air quality and health monitoring in Palestine.

2.4 Health impact of air pollution with focus on PM

Five presentations were made during this session. Mr Mazen Malkawi briefed participants on the health impact of outdoor air pollution in the Eastern Mediterranean Region. About 200 000 people are dying prematurely because of air pollution with PM caused by anthropogenic and natural resources in the Region. About 50% of this pollution is being caused by natural resources without a clear understanding of its impact on health. Lack of monitoring and reporting of air quality data is clearly observed in several countries of the Region. Ms Marie Eve Heroux presented the *WHO Air quality guidelines*. She focused on the existing WHO air quality guidelines; mandate and context for update of guidelines; and the WHO guideline development process and scope of the updated guidelines. Mr Michal Krzyzanowski updated the meeting on WHO's view on PM impact on health with focus on mineral dust. He focused on PM levels and trends; scientific evidence on health effects of PM – results of recent research; and the role of desert dust in causing health effects.

Two presentations were made remotely. Dr Michael Brauer reviewed the evidence on dust and health as used in the exposure assessment in the Global Burden of Disease 2013 (GBD 2013). The GBD estimates are made for PM_{2.5} and not for other size fractions as the evidence from dust storms generally does not identify effects of PM_{2.5} (versus PM_{10-2.5}, PM₁₀). Dr Aaron Cohen presented global and regional estimates of the burden due to ambient air pollution as estimated by the GBD 2013. He concluded that cardiovascular disease and other diseases affected by air pollution are among the top causes of mortality and lost years of healthy life in the Region; PM_{2.5} air pollution is an important source of disease burden in the Region and its importance has increased in the last two decades, driven by both increasing levels of exposure and cardiovascular disease, and populations of low-income Arab countries have almost twice the age-adjusted rate of mortality due to PM_{2.5} exposure than high-income Arab countries, and household air pollution contributes significantly to the burden in low-income Arab countries.

2.5 Environmental and other impacts of sand and dust

Five presentations were made during this session. Dr Abdul-Majeid Haddad reviewed the environmental dimensions of sand and dust storms, and the national and regional approaches for interventions. He described basic understandings and definitions; what we know so far about the sand and dust storms phenomenon in the Region; what were the gaps in knowledge; conceptual approaches for controlling sand and dust storms; national examples from Kuwait and Iraq; and regional approaches. Mr Sergio Rodriguez presented an overview of dust impact in urban areas. He compared the health effects of air pollution (respiratory and cardiovascular diseases) between Europe, North America and Asia and cities of the dust belt (North Africa, Middle East, West Asia to Asia) where dust is mixed with other pollutants. A recorded presentation on dust and meningitis in Africa by Mr Carlos Perez was presented to the meeting. Ms Delia Gutiérrez presented the HEALTHMET – a project on climate and health in West Africa – which succeeded in improving knowledge on climate–health relationships, access to remote sensing data and numerical models and preparation of studies

on climate and health. Dr Tareq Hussein concluded this session by a presentation on the need for an aerosol database to be utilized for health effect assessments in Jordan.

2.6 Environmental and health interventions to mitigate airborne dust impacts

Dr James Schauer reviewed case studies from Iraq, Islamic Republic of Iran, Jordan and Pakistan. He concluded that dust was an important contributor to PM in the Middle East during dust events and non-dust events; sources and the chemistry of dust are diverse and need to be considered for health impacts (atmospheric ageing of dust, contaminated dust, anthropogenic dust); tools exist to quantify dust in routine monitoring networks and should be incorporated into PM monitoring networks in the MENA region. There is a great need for data in North Africa. Mr Mazen Malkawi reviewed interventions to minimize exposure to airborne dust health impacts. Interventions are needed through the whole life cycle of dust: environmental interventions and pollution control measures to reduce pollution at source; urban and rural interventions to reduce circulation of PM; interventions to minimize exposure to PM pollution (including natural and anthropogenic dust). Various studies to date have been conducted to summarize evidence to assess the effectiveness of air quality interventions to reduce ambient air pollution and their effects on health, but its relevance to airborne dust is very limited. There is an urgent need to evaluate several interventions before promoting them as solutions. For example, the efficiency of surgery mask for reducing exposure to dust needs to be evaluated before its use is promoted.

2.7 Country presentations by the health and environment sectors

Nine presentations from Egypt, Jordan, Kuwait, Morocco, Tunisia and the United Arab Emirates were made during this session. Dr Osama El Tawil reported on the air quality monitoring system of Egypt, and described a practical approach for assessing toxicity of environmental pollutants. Mr Jabur Daradkah described the air quality monitoring network in three Jordanian cities. Mr Michel Hindelah gave a live demonstration of the air quality monitoring network in Jordan. The near real time Jordanian air quality monitoring network was capable of capturing the heavy dust storm that hit Amman at the time of the meeting. Dr Marawn Dimashki presented a web-based GIS application for the management and dissemination of air quality data in Kuwait. This portal will be further developed to act as the gateway for environmental information on the countries of the Gulf Cooperation Council. Dr Mohammad Alolayan presented a case study on investigating the major sources of PM 2.5 in Kuwait, and using a health cost–benefit analysis to support the decision-making process. Dr Mohammed Yassin reviewed an assessment of dust storm sources in Kuwait. The dust storm source was from the Sahara and Arabian Deserts. Dr Rachid Wahabi reviewed correlation studies between air pollution and health in Morocco. These studies have alerted decision-makers and public opinion on the impact of air pollution on health in Mohamadia, Casablanca and other parts of Morocco. Dr Mabrouk El Nethif presented the Tunisia air quality monitoring system, and the outputs of several air quality health impact studies in Tunisia. Dr Nasser Hamadan concluded this session with a presentation describing the air quality monitoring system in the United Arab Emirates, and research and investigation of air pollution using non-destructive techniques.

2.8 Research on air quality and health in the Middle East and North Africa

This session was devoted to reviewing recent research and evidence on air quality and health in the Region. Dr Nour Abdo and Dr Mostafa Abdel Rahman presented the results of a systematic review of published literature on the effect of air pollution on human health in countries of the Region. The study reviewed 84 articles published during the period 2000–2014 and concluded that, at present, epidemiological literature in the Region is limited to a few studies in a few countries. More research is needed to elucidate the health outcomes of air pollution; standardized reliable assessments at the national level for various air pollutants on different regions should be implemented and publically available for researchers to utilize in research; and that advancing and utilizing epidemiological designs is of key importance.

Dr Hans Christen Hansson discussed the issue of necessity of atmospheric observations for air quality and climate mitigation. In view of the expertise of the developed world observation is needed to estimate the effects of air quality and to register the mitigation effects in the Region. Dr Turki Habeebullah reviewed several studies on analysis of the health effects of PM in Mecca, Saudi Arabia. The studies are the first attempts to apply the Air-Q 2.2.3 model and the approach proposed by WHO to provide quantitative results on the impact of PM exposure on the health of people living in Mecca city, during hajj seasons. All studies confirmed the contribution of vehicular traffic, industrial emissions and pollution transferred from abroad can impact on local atmospheric pollution. Dr Nasser Hamdan reviewed elemental analysis, chemical speciation and size distribution of atmospheric aerosols in the United Arab Emirates. Dr Mahmoud Abu-Allaban shared the output of studies on sources of dust air pollution in Egypt and Jordan. Dr Jihad Sawair presented the Aqaba air quality monitoring network and shared samples of monitoring data in 2014–2015. Dr Najat Saliba reviewed the recent research “Dust episodes and their effects on the physical and chemical transformations of coarse and fine particles in Beirut, Lebanon”. The overall redox activity of PM₁₀ (coarse + fine) in dust and non-dust does shows that PM₁₀ redox activity in Beirut mainly depends on sources with higher activities observed during non-dust episodes. Dr Tareq Hussein described measurements of particle number concentration and particle size distributions in Jordan. Dr James Schauer concluded this session by a presentation on the source apportionment and biological activity of PM_{2.5} in Baghdad.

3. GROUP WORK

3.1 Interventions to minimize the health impacts of airborne dust

The participants of the meeting were grouped into three groups to address interventions that could be used to minimize the health impacts of airborne dust of health and environment. The first group (meteorological) was requested to: review the status of collaboration between meteorological, health and environment sectors at regional and national levels, identify gaps and research needs, and recommend mechanisms for collaboration. The second group (health) was requested to: review the existing health interventions at regional and national levels; identify gaps and research needs; and recommend evidence-based interventions. The third group (environment) was requested to: review the existing environmental interventions at

regional and national levels; identify gaps and research needs, and recommend interventions. The output of the group work is summarized in sections 3.1.1–3.1.3

3.1.1 Meteorological services and interventions

Coordination at national level (meteorology/air quality/health/emergency service)

Steering committees or working groups representing different but related agencies are needed to efficiently coordinate the flow of information between the three sectors. This requires consideration of internal structures which may differ from one country to another. It is essential to determine which institutions should be involved in these discussions in each country of the Region. There is a need to improve the density of observations in the Region to improve operational models and have access in near real time dust alerts for operational purposes.

The role of international organizations (WHO, WMO, UNEP)

- Needs assessment studies should be conducted in each country of the Region to identify which capacities are lacking. These capacities could be built through the establishment of a certified regional training centre in the Region.
- Meteorological protocols and products need to be harmonized.
- A data policy needs to be developed to centralize observational networks and access to near real time dust alerts for operational purposes.

Operational services and understanding user needs

- A threshold and actions should be defined for health authorities to manage risk. Thresholds have to be defined by each country for aviation, health and other different end-users.
- National forecast services need to be user-oriented.

Gaps in research

- Sand and dust storms and land surface characteristics through observation
- Data management
- Impact on meteorology through aerosol feedbacks
- Regional assessment of the impact of dust on health
- New end-user products.

3.1.2 Health interventions

Existing situation

- More work is needed to develop regulations (formulate evidence- and health-based policy), and on monitoring and surveillance to assess health studies.

- Integrated systems across countries of the Region are needed to address what is a transboundary problem of the health impacts of airborne dust on health and environment.
- Health systems lack preparedness.
- Egypt suffers from lead poisoning, a problem also common to some other countries of the Region. Urgent action is needed to remove lead sources (smelter, unleaded gasoline).
- While Morocco has no specific interventions to address health impacts of airborne dust on health and the environment it does place focus on PM in general. Efforts include: development of standards and regulations; establishment of an early warning system in two to three cities; provision of free treatment for some diseases, such as tuberculosis.
- In Bahrain, people who are vulnerable to health impacts of airborne dust on health and environment are given warnings but these warnings are often insufficient to protect health.
- In Jordan, schools are closed on days with dust storms, often at the last minute; air pollution and its impact on health should be included in curriculum in medical schools. Government officials and policy-makers in the ministry of health are now recognizing the problem and are considering ways to address the problem in future strategies and action plans.
- In Iraq, larger groups of communities need to work with relevant ministries that are responsible for environment and health.
- In Tunisia, agencies have been coordinating efforts to address air pollution since 1999, they coordinate between ministries and provide support, follow up and monitoring.

Identified gaps and research needs

There is a need for:

- health system strengthening, capacity-building;
- greater funding and support for air quality monitoring and researchers;
- more interdisciplinary research;
- improved quality and quantity of research;
- longer term health studies (cohort studies);
- health impact assessment and CEHA can provide support to countries to establish standard protocols for health impact assessment for air quality;
- greater transparency, open access and dissemination of information on air pollution levels from the owners of the data, for example meteorological information and hospital/health care registration);
- increased awareness of medical professionals about the health effects of air pollution.

Recommended health interventions

- Define categories for dust storms (severe to mild) with related alerts and advice for the public; identify vulnerable populations.
- Administer anti-oxidants (fish oil) and other natural supplements to protect health.

- Provide early warnings to vulnerable people.
- Address the problem of transport-related pollutants; impose restrictions on traffic.
- Disseminate information on air pollution levels through public health messages and billboards.
- Adopt an integrated approach addressing the problem at community, individual, general and vulnerable population levels.
- Identify the magnitude of the problem, conduct health risk assessment and estimate forecasts.
- Improve multisectoral collaboration and translate knowledge for policy-makers.
- Make meteorological data available for free.
- Improve communication between agencies.
- Establish national committees for air quality to coordinate between ministries.

3.1.3 Environmental interventions

Pollution and control measures

Pollution and control measures include:

- updating regulations.
- ensuring greater regulation on stationary sources of pollution.
- exerting more effort to control mobile sources (fuel quality, emission control equipment, etc.).
- addressing all sectors in controlling the problem, particularly energy, quarrying and mining, etc.
- improving efforts to control natural sources (dunes fixation in Saudi Arabia and United Arab Emirates, forestation and reforestation, land reclamation, compacting).

4. CONCLUSIONS

Participants were put into three groups to draft conclusions and action points for countries and regional and international organizations to minimize the health impacts of airborne dust of health and environment.

4.1 Health impact assessment of airborne dust

The meeting concluded that plenty of evidence on the health impacts of PM (including airborne dust) exists globally and can be utilized in the Region in the absence of local evidence but greater resources are needed to address the shortage of a local evidence base of information and research. The efficiency of existing interventions to minimize exposure to airborne dust (masks, staying indoors) is not fully known. Countries lack preparedness and response for episodes of air pollution in the Region and should adopt more proactive approaches.

4.2 Air quality monitoring and source apportionment

Generally speaking, there are reasonable capabilities for air quality monitoring in some countries of the Region, however, few initiatives on chemical and physical speciation and source apportionment exist so far. Regulatory agencies are not specialized or fully capable of conducting chemical speciation, and thus support to research institutions is essential in this regard.

Reliability of data is an issue, as cross-calibration is not available at regional level and many times at national levels.

Research activities face several challenges, including fragmentation among countries of the Region; limited availability of national emission inventories; the need to develop national emission factors; limited studies on air pollution and health linkages from both anthropogenic and natural sources in the Region. Data sharing is weak among countries of the Region; with no framework for consolidation of data; and a lack of early warning systems available at the national and/or regional levels.

4.3 Airborne dust cycle, monitoring, modelling and forecast

Global sand and dust monitoring, modelling and forecasting capacities exist, however, the present capabilities for capturing local and regional sand and dust episodes could be further improved by tracking local ground-based monitoring data. National capacity for local monitoring, modelling and forecasting is still limited. Data sharing and research need strengthening at country and inter-country levels.

5. ACTION POINTS

To countries

1. Identify and engage group of experts working in air pollution and health to address the health impacts of airborne dust on health and environment.
2. Reinforce existing laws and initiate development of new national legislation. Update national regulations and legal texts, in line with international literature and guidance.
3. Use available global evidence in the absence of regional evidence but encourage the development of local/regional evidence for improved advocacy at local level.
4. Raise awareness of air pollution and make air quality and meteorological data publicly available.
5. Develop early warning systems and provide linkages on the ground between the public, hospitals, pharmacies and other stakeholders.
6. Conduct health impact assessment to provide basic estimates by utilizing internationally available data (satellite estimates if no local/national monitoring available), focusing on both short- and long-term exposure to keep policy-makers and the health sector (hospitals, etc.) informed.

7. Reinforce/establish adequate health information systems to document and provide information on number of death incidents, hospital admissions and emergency room visits.
8. Develop regional mechanisms for forecasting and controlling trans-boundary pollution (perhaps negotiating the feasibility of a regional convention for long range transport).
9. Mobilize resources and strengthen regional collaboration on air quality monitoring and research, and conduct networking among researchers in the Region to address common problems.
10. Establish an expert regional working group and professional networks for air quality monitoring and research, and align research agendas with national and regional priorities.
11. Establish an integrated monitoring network of air quality for source apportionment analysis over the whole Region, and improve monitoring and analysis capacities on chemical and physical speciation of aerosols and PM.
12. Generate comprehensive emissions inventory data for the Region to control emissions, and agree on resolution of the inventory.
13. Develop emission and fingerprinting profiles for the major sources of pollution in the Region.
14. Conduct intercountry comparison exercises to validate automatic sampling results, and improve quality assurance and quality control of the data for comparability across countries of the Region.
15. Improve reporting and sharing with regional and international databases, and exchange expertise between countries through the WHO global air quality platform, UNEP LIVE, AREIN and the Gulf Cooperation Council Environmental Portal.
16. Improve awareness and stimulate a public response by publishing air quality indices on national, regional and international portals.

To regional and international organizations

17. Evaluate existing air pollution prevention and control interventions for their impact on health and propose the most efficient (technically merited and economically favourable) by developing guidance on good practices for the public.
18. Compile and present evidence and explain the burden of disease concept and process to policy-makers, ministries and decision-makers.
19. Design a collaborative multi-central study to investigate the health effects of air pollution, including airborne dust through retrospective cohort and time-series, or panel studies.
20. Create a mechanism for coordination between national meteorological, health and air quality agencies (i.e. steering committee, working group).
21. Establish/maintain a national air quality monitoring network. It should include both air quality and meteorological agencies at country levels.
22. Encourage stakeholders and relevant agencies to exchange available data, as the trans-boundary nature of sand and dust storms require information availability and exchange at national/regional/international levels through international organizations.

23. Support countries in developing and updating their national ambient and indoor air quality standards.
24. Support countries in developing and ratifying regional binding agreements for air quality monitoring and management.
25. Organize practical and technical workshops for capacity-building on air quality, monitoring, source profiling, chemical speciation and emission inventories.
26. Provide support to countries in securing financing for research activities and capacity-building.
27. Improve awareness of air pollution issues by: 1) valuating impacts (loss of opportunities, health costs, ecosystem and cultural heritage impacts costs); 2) conducting awareness campaigns.
28. Encourage countries to exchange environmental data. Due to the trans-boundary nature of sand and dust storms the information should be available at national/regional/international levels through international organizations.
29. Continue joint efforts to establish the West Asian node of the Sand and Dust Storm Warning Advisory and Assessment System project.
30. Promote certified regional centres on airborne dust to conduct training, research and development.
31. Mobilize resources and synergize efforts for research projects and technical infrastructures at national/regional level.

Annex 1

AGENDA

1. Objectives and mechanisms of the consultation
2. Impact of air pollution on health in the Eastern Mediterranean Region
3. Dust and air quality measurement, monitoring,
4. Forecasting and early warning systems
5. Air quality guidelines
6. Dust causes and transportation paths
7. Health hazards and impacts studies
8. Health services and preparedness
9. Response and mitigation measures on dust and health
10. Conclusions and recommendations
11. Closing session

Annex 2**PROGRAMME****Monday, 2 November 2015**

08:30–09:00	Registration and networking	
	Opening session and remarks	
09:00–09:10	Message from World Health Organization /Regional Centre for Environmental Health Activities	<i>Dr Ahmad Basel Al-Yousfi, Director, WHO/CEHA</i>
09:10–09:20	Message from United Nations Environment Programme/Regional Office for West Asia	<i>Dr Abdul-Majeid Haddad, Regional Climate Change Coordinator, UNEP/ROWA</i>
09:20–09:30	Message from State Metrological Agency of Spain (AEMET)	<i>Dr Enric Terradellas, Technical Director, WMOSDS-WAS Regional Center for Northern Africa, Middle East and Europe</i>
09:30–09:40	Message from European Organization for the Exploitation of Meteorological Satellites (EUMETSAT)	<i>Mr Jose Prieto</i>
09:40–09:50	Message from World Meteorological Organization (WMO)	<i>Prof. Alexander Baklanov, World Meteorological Organization (WMO)</i>
09:50–10:00	Message from H.E. Minister of Environment	<i>H.E. Dr Taher Shakhshir</i>
10:00–10:10	Objectives and expected outcome of the consultation	<i>Mr Mazen Malkawi, Environmental Health Exposure, WHO/CEHA</i>
10:10–10:45	Introduction of participants, adoption of the programme, and election of consultation officers Group photo	
	Airborne dust cycle and monitoring	
10:45–11:30	The dust cycle and impacts	<i>Dr Enric Terradellas</i>
11:30–11:45	Sand and dust storm warning advisory and assessment system	<i>Prof. Alexander Baklanov</i>
11:45–12:30	Ground observation of airborne dust	<i>Mr Sergio Roriguez</i>
12:30–14:15	Satellite observation of airborne dust	<i>Mr Jose Prieto</i>

Airborne dust modelling and forecast

14:15–15:00	Dust modelling and prediction	<i>Ms Sara Basart</i>
15:00–15:45	Dust forecast services	<i>Mr Francesco Benincasa</i>
15:45–17:15	Country presentations: meteorological	

Tuesday, 3 November 2015**Health impact of air pollution with focus on PM**

09:00–09:30	Health impact of outdoor air pollution in the Eastern Mediterranean Region	<i>Mr Mazen Malkawi</i>
09:30–10:00	WHO air quality guidelines	<i>Ms Marie-Eve Heroux</i>
10:00–10:45	Particulate matter and health: update on WHO's view on its impact on health with focus on mineral dust	<i>Mr Michal Krzyzanowski</i>

Environmental and other impacts of sand and dust

10:45–11:15	The environmental dimension of sand and dust	<i>Dr Abdul Majeid Haddad</i>
11:15–12:00	Dust impact in urban areas: an overview	<i>Mr Sergio Rodriguez</i>
12:00–12:30	Dust and meningitis in Africa	<i>Mr Carlos Perez</i>
12:30–12:45	HEALTHMET, A project on climate and health in West Africa	<i>Ms Delia Gutiérrez</i>
12:45–14:00	The need for an aerosol database to be utilized for the health effects assessment in Jordan	<i>Dr Tareq Hussein</i>

Environmental and health interventions to mitigate airborne dust impacts

14:00–14:30	Source apportionment: experience from the Region	<i>Dr James Schauer</i>
14:30–14:45	Environmental interventions – national and regional approaches	<i>Dr Abdul Majeid Haddad</i>
14:45–15:15	Health interventions	<i>Mr Mazen Malkawi</i>
15:15–17:00	Country presentations: health and environment	
17:00–17:30	IHME Global Burden of Disease 2013	<i>Mr Aaron Cohen</i>
17:30–18:00	Review of evidence on dust and health and dust coverage in the GBD 2013	<i>Mr Michael Brauer</i>

Wednesday, 4 November 2015

09:00–09:45	Literature review: air quality and health in the Eastern Mediterranean Region	<i>Nour Abdo and Mustafa Abdul Rahman</i>
09:45–14:00	Research on air quality and health in the Middle East and North Africa	<i>Moderated by Dr Najat Saliba and Dr Tareq Hussein</i>
14:00–16:00	Group work on interventions	
16:00–17:00	Presentation of group work	

Thursday, 5 November 2015

09:00–12:00	Group work for identifying gaps and needed action in the three sectors: meteorological, environment and health	
12:00–12:45	Presentation of group work	
12:45–14:00	Closing remarks	

Annex 3

LIST OF PARTICIPANTS

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