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REVIEW OF PROGRAMME PLANNING AND IMPLEMENTATION

(Item 5 (a) of the provisional agenda)

Transboundary Air Pollution in North-East Asia

Note by the Secretariat

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I. BACKGROUND

1. During 2014-2016, NEASPEC had implemented "Development of the Technical and Policy Frameworks for Transboundary Air Pollution Assessment and Abatement in North-East Asia" to develop a new subregional framework by conducting joint scientific assessments and consultations.

2. The project implementation mainly involved technical assessments and consultations on the overall direction and thematic area of a new subregional framework as summarized below. Outcomes and processes of the activities have been reported to Senior Officials Meetings (SOM-19 and SOM-20) for review and further guidance. Having noted the progress in formulating the concept for a new subregional framework, the SOM-20 in 2016 recommended the Secretariat to take account of programmes of existing mechanisms, notably, Long-range Transboundary Air Pollutants in Northeast Asia (LTP) and Acid Deposition Monitoring Network in East Asia (EANET), in such a way that the new framework complements these mechanisms.

- (a) **Expert Group Meeting on the Project** in May 2014: identified target pollutants and priorities of a potential framework, and prepared the implementation plan of the project, in particular, modeling of transboundary air pollution.

- (b) **Consultation Workshop on Modeling of Source-Receptor Relationship (SRR) of Transboundary Air Pollution** in March 2015, which developed a detailed modeling plan taking account of the methodology and emission inventory of LTP.

- (c) **Modeling of source-receptor relationship of transboundary air pollution** by Scientific Research Institute for Atmospheric Air Protection (SRI Atmosphere) with technical support from experts working on LTP for the installation of modeling programmes and the preparation of an input data set.

- (d) **Consultations with LTP experts** on the preliminary modeling results of SRI Atmosphere by presenting at the 18th and 19th Expert Meeting of LTP (Nov 2015 and Nov 2016, respectively).

- (e) **Preparation of technical papers to identify potential roles of NEASPEC and a new subregional framework** on selected areas including emission inventory, monitoring, modeling, integrated assessment, and science-policy linkages.

- (f) **Expert Consultation on integrated assessment modeling and a Roundtable on Transboundary Air Pollution in Northeast Asia** in December 2016, which discussed specific approaches and work on a new framework.

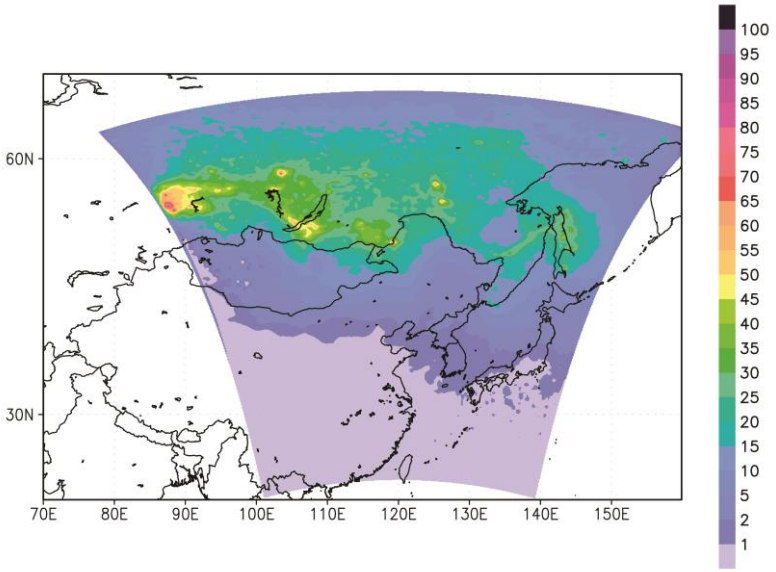
3. This preparatory process has helped identify potential approaches, thematic areas and cooperation modality of a new subregional framework, which are summarized in section II and presented as a proposal with a consolidated idea in section IV.

4. The modeling of source-receptor relationship (SRR) of transboundary air pollution by SRI Atmosphere was the first modeling that combines the geographic scope of the existing modeling under LTP with Siberia and the Russian Far East. It was also the first modeling work by a Russian institute to assess SRR in North-East Asia built on the existing work of LTP. Thus, the modeling involved aligning SRI Atmosphere's modeling programmes with LTP, installing new programmes at the SRI Atmosphere, and developing a new input dataset covering all target domains.

5. The specific tasks performed by SRI Atmosphere under the project included: 1) Improvement of SRI Atmosphere's computational capacity (acquiring, installing and configuring a new server); 2) Preparation of emission data from the Russian sources of key pollutants (SO_2, NO_x and PM) for 2010 and including such emission data in the emission related fields of EDGAR (Emission Database for Global Atmospheric Research) database for 2008; 3) Deployment, launching and testing of Weather Research Forecast Model (WRF)- Community Multiscale Air Quality Model (CMAQ) programmes in the new server at SRI Atmosphere to model air quality; and 4) Estimation of average annual ground level concentrations as well as average complete deposition of sulfur and nitrogen oxides by means of WRF-CMAQ system that is deployed on a multiprocessor server for meteorological conditions of 2010 based on the Russian emissions data as well as global emissions from the EDGAR database.

6. However, the technical complexity of the process delayed the modeling work. As of January 2017, calculation of impacts of air pollutants (SO_2, NO_x and $PM_{2.5)}$ from the Russian Federation on other NEASPEC member countries has been carried out. The results indicate that the impacts are not substantial (2-5%). The full calculation of the source-receptor relationship matrix for all countries will be carried out during the first half of 2017.

Figure 1 contribution of the Russian anthropogenic emissions in the annual surface concentrations of $PM_{2.5}$



7. Detailed information of modeling processes and preliminary results are contained in the Annex II of the present document.

II. TECHNICAL ASSESSMENT OF APPROACHES, THEMATIC AREAS AND COOPERATION MODALITIES

8. A series of assessments and consultations under NEASPEC spanning from 2012 demonstrated the need for strengthening science-based, policy-oriented cooperation that promotes a holistic approach covering all components of transboundary air pollution management, builds connections between science and policy, and provides channels for open and effective exchange of knowledge and information, etc.

9. In this connection, the first expert group meeting in May 2014 and the SOM-19 came to a general conclusion that the work of a new subregional framework could include source-receptor relationship of transboundary air pollution, policy scenarios, impact assessment, emission inventory, and abatement technology assessment. In terms of target pollutants, the framework could focus on key pollutants of national and subregional concerns, Particulate Matter ($PM_{2.5}$ and PM_{10}) and Ozone, while it would need to address their linkages with other pollutants including Sulfur Oxide (SO_x), Nitrogen Oxide (NO_x), Black Carbon, Ammonia (NH_3) and Volatile Organic Compounds (VOCs).

10. Subsequent assessments and consultations on **potential approaches, thematic areas and cooperation modalities** of a new subregional framework have suggested the following options.

11. **Potential Approaches**: Throughout the assessments and consultations, strengthening science-based, policy-oriented cooperation has been highlighted as a key approach for a new subregional framework. There have been a number of multilateral and academic programmes that contribute to science-based, policy oriented cooperation. Such programmes include Long-range Transboundary Air Pollutants in Northeast Asia (LTP), Acid Deposition Monitoring Network in East Asia (EANET), and Model Inter-Comparison Study for Asia (MICS Asia)[1]. Meanwhile, NEASPEC has contributed to improving technical and policy capacity for the mitigation of air pollution from coal-fired power plants through three projects during 1996-2012.[2] However, each mechanism has a narrowly defined scope as well as partners. Together with the narrow scope and their nature of intergovernmental setting, the existing mechanisms have a limited capacity for responding to the needs of science-based, policy-oriented cooperation as well as bridging science with policy. Having recognized such limitations, the following approaches have been put forwarded for a new subregional framework.

(a) Strengthening information sharing through exchanging available and relevant information on air pollution control technologies and national policies. NEASPEC Secretariat could compile the information and prepare (bi-) annual report to facilitate the information sharing and assess progress in policies and practices. Countries could voluntarily initiate a peer review of national policies.

(b) Building scientific foundation and a stronger epistemic community[3] through engaging in multidisciplinary research and policy-oriented assessment, covering subregional emission inventory development and maintenance, air pollution transport modeling including SRR modeling, integrated assessment modeling, etc.

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[1] The current phase of MICS-Asia is a part of EANET additional research activity and focuses on the following subjects and goals: (Topic 1) - Evaluate strengths and weaknesses of current multi-scale air quality models and provide techniques to reduce uncertainty in Asia; (Topic 2) - Develop a reliable anthropogenic emission inventories in Asia and understand uncertainty of bottom-up emission inventories in Asia; and (Topic 3)- Provide multi-model estimates of radiative forcing and sensitivity analysis of short-lived climate pollutants.

[2] For the detailed assessment of the existing mechanisms, please refer to the NEASPEC report, "Review of the main activities on transboundary air pollution in Northeast Asia", which was submitted to the 17th SOM in 2012. The report is available on the NEASPEC website (www.neaspec.org).

[3] Epistemic community is defined as a "transnational network of knowledge-based experts who help decision-makers to define the problems, identify various policy solutions and assess the policy outcomes".

(c) **Developing potential measures** to enhance cooperation and tackle transboundary air pollution through science-based, policy-oriented consultations, development of a common methodology for policy scenarios and integrated assessment modeling, cooperation on technologies and good practices, etc.

(d) **Promoting voluntary participation and contribution** to build a new subregional framework comprehensive but flexible. In terms of programme areas, the framework could be comprehensive in order to incorporate priority cooperation areas and bring all the key stakeholders into subregional cooperation. But it could also be flexible in terms of its legal and political nature, and member States' participation in specific activities.

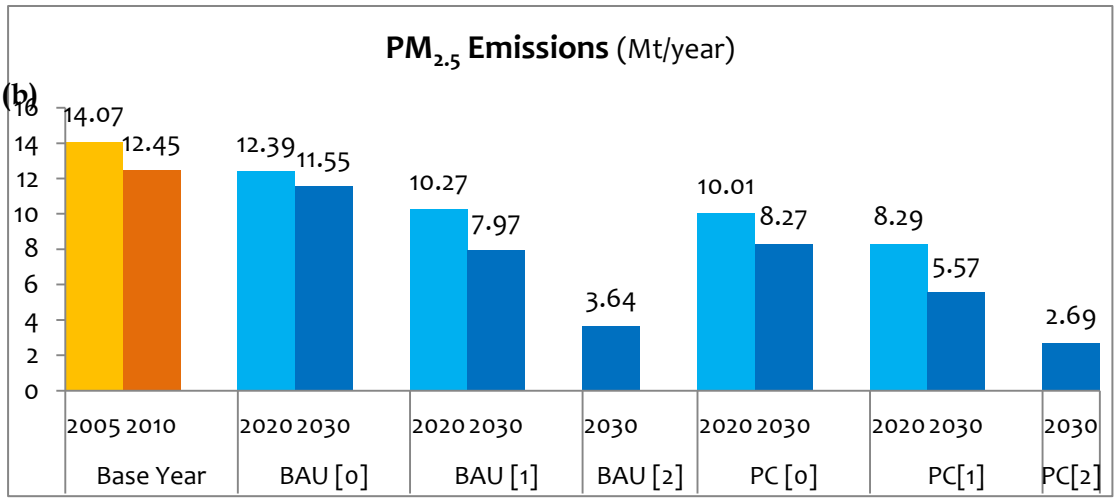
12. **Thematic areas:** Based on priority areas identified by the first expert group meeting and supported by the SOM-19 in 2014, the assessments and consultations further reviewed existing and potential activities and came to the following conclusion.

(a) **Integrated Assessment Modeling (IAM):** Priority areas identified by the first expert group meeting include policy scenarios, impact assessment, and abatement technology assessment. IAM integrates these multiple dimensions and serves as a cornerstone of interactive processes between science and policy. In particular, IAM incorporates the assessment of emission trends, health and environmental impacts, mitigation options, and costs and benefits of policy and technical measures so that it could support policy-makers to develop a more comprehensive view on mitigation policy as well as optimized technical solutions. The scientific community in North-East Asia has recently started IAM at a subregional scale.[4] For example, one study[5] has looked into the recent emission trends of SO_2, NO_x, PM, and non-methane volatile organic compounds (NMVOC) in North-East Asia, and projected their future emissions up to 2030 with six emission scenarios based on end-of-pipe control strategies and energy saving policies (*please refer to figure 1*). Such studies could be further expanded to incorporate other elements such as the assessment of emission control costs, abatement technologies, specific sectoral policies and measures, etc., and linked with policy dialogues at multilateral and subregional levels. This also entails the involvement of scientists and experts from diverse fields including atmospheric science, engineering and economics, and builds an epistemic community with wider stakeholders.

[4] EANET, 2015, Review on the State of Air Pollution in East Asia: please refer to chapter 7 Mitigation technologies of air pollutant emissions in East Asia

[5] Wang S. X. Wang, B. Zhao , S. Y. Cai , Z. Klimont , C. P. Nielsen , T. Morikawa , J. H. Woo, Y. Kim , X. Fu , J. Y. Xu , J. M. Hao, and K. B. He, 2014. Emission trends and mitigation options for air pollutants in East Asia, Atmos. Chem. Phys., 14, 6571–6603

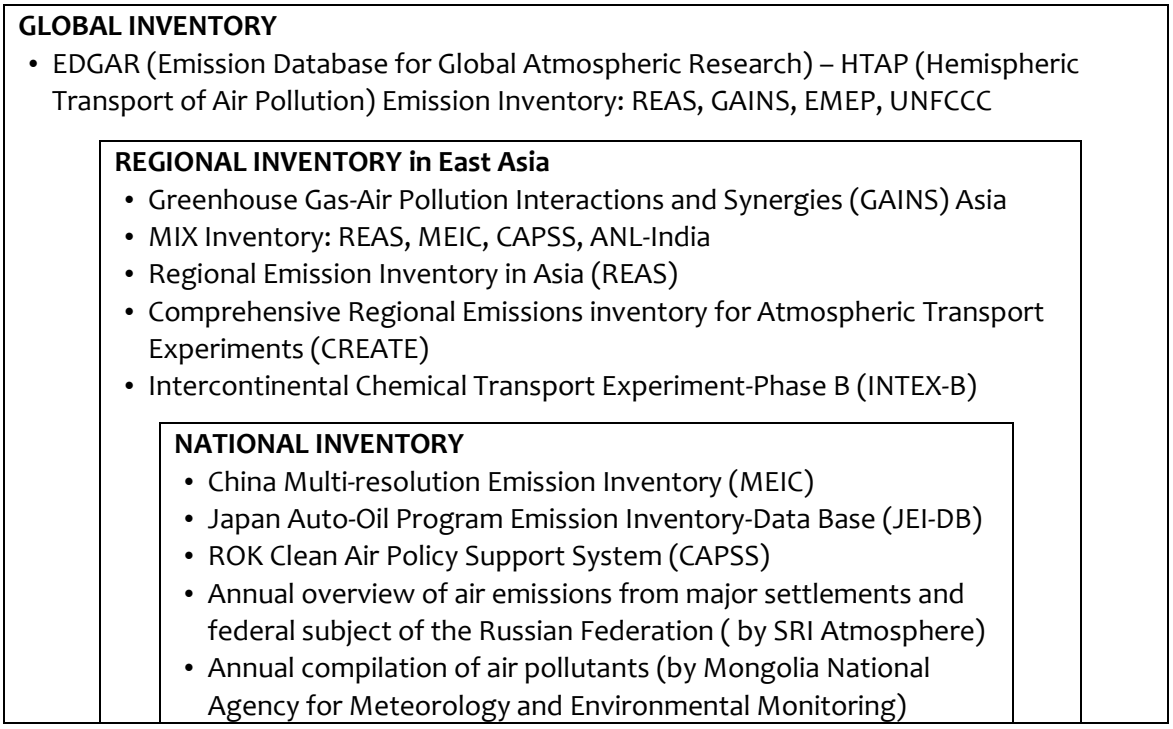
Figure 2 Emission scenarios of air pollutants in North-East Asia (excl. Russia)



(c) Emission Inventory: As shown in the figure 2, various global and regional inventories available for such modeling. In particular, inventory experts from China (Tsinghua University and Peking University), Japan (Asia Center for Air Pollution Research) and the ROK (Konkuk University) as well as experts outside North-East Asia have jointly developed a regional emission inventory, MIX, a mosaic of regional and national emission inventories including Regional Emission Inventory in Asia (REAS), the Multi-resolution Emission Inventory for China (MEIC), a NH_3 emission inventory, the Clean Air Policy Support System for the ROK (CAPSS), and an Indian emission inventory (ANL-India). The inventory has been developed to support the Model Inter-Comparison Study for Asia (MICS-Asia III) and the Task Force on Hemispheric Transport of Air Pollution (TF HTAP) projects.[6]

[6] For further information, please refer to MIX Asian Emission Inventory (http://www.meicmodel.org/dataset-mix)

Figure 3 Overview of emission inventories



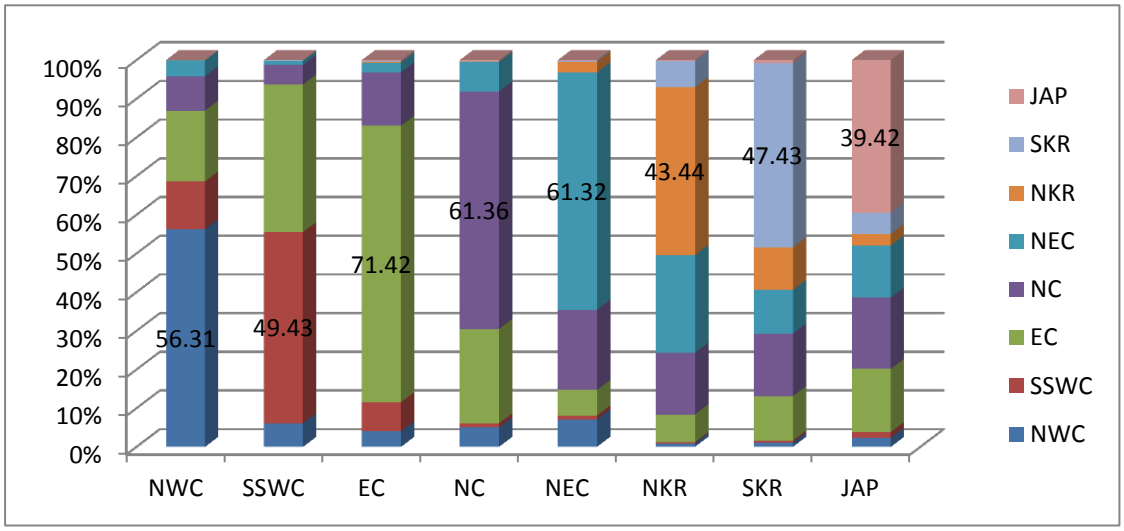
However, the modeling work under this NEASPEC project faced a difficulty in preparing an input data as it was not possible to ensure the full comparability among national data. Also there are large discrepancies among inventories both in magnitude and spatial distributions.[7] Furthermore, conducting a policy-oriented modeling work requires a more comprehensive set of data that includes not only the emission data of each pollutant, but also data on socio-economic activities including economic indicators, energy consumption sectors, etc. In this regard, the assessments and consultations indicated the need for developing and improving a subregional inventory that provides accurate, complete and up-to-date data with a common methodology for comparability between national data. As elaborated in the Annex II, developing such inventory requires defining a technical framework shared by all the stakeholders, and agreed by the policy-makers. Thus, the work on a subregional inventory would involve close consultations among experts working on national and regional inventories, and intergovernmental supports including through NEASPEC.

(d) Modeling of Source-Receptor Relationship (SRR) of transboundary air pollution: As explained in the previous section, the SRR modeling under the NEASPEC project was the first attempt to have a complete view of transboundary air pollution among all NEASPEC member countries. Thus, it could supplement the

[7] Eri Saikawa, 2015. Comparison of Asian Emission Inventories, https://www.epa.gov/sites/production/files/2015-09/documents/saikawa_pres.pdf

existing SRR modeling work by experts in China, Japan and the ROK under the LTP. LTP has been conducting the SRR modeling, which initially started with SO_2 and NO_x, and recently expanded to PM, based on eight source and receptor subregions, i.e. North-East China (NEC), North-West China (NWC), North China (NC), Southern South-West China (SSWC), East China (EC), North Korea (NK), South Korea (SK) and Japan (JP). The figure below shows the SRR result conducted by the RO Korean team, which presents the level of $PM_{2.5}$ contributions from its own and other subregions. The numbers on the column indicate the rate of self-contribution of $PM_{2.5}$.

Figure 4 SRR Modeling of $PM_{2.5}$ by RO Korean experts under the LTP



(*Note: The figures on the columns indicate the share of $PM_{2.5}$ originated from its own sources in 2013.)*

This LTP process has supported the national experts to build a common modeling methodology, have a shared view on transboundary air pollution as well as gain a substantial experience in carrying out joint research. Thus, subregional collaboration on SRR modeling needs be closely connected with LTP in such a way to further scale up the existing geographical scope of LTP, and utilize findings from LTP for IAM and policy dialogues.

13. To sum up the assessment and consultations, the Integrated Assessment Modeling is proposed as the centerpiece of a new subregional framework to incorporate identified priority areas, i.e. policy scenarios, impact assessment, and abatement technology assessment and SRR, and enhance science-based, policy-oriented cooperation. This would require creating a multidisciplinary group of experts and designating academic institution(s) with solid experiences as a technical centre.

14. **Cooperation modalities:** In support of science-based, policy-oriented cooperation, the assessments and consultations have put forwarded the following ideas.

(a) **Operating standing bodies for strengthening scientific cooperation and building science-policy linkage:** For planning and coordinating the overall work, carrying out scientific studies, holding policy dialogues, liaising with other relevant mechanisms, etc., it is proposed to operate the Science and Policy Committee and its Science Working Group and Policy Working Group.

(b) **Operating technical centers for carrying out tangible cooperation and enhancing roles of academic and research institutions in member States:** In particular, carrying out IAM and operating an emission inventory would require dedicated support from academic and research institutions. Thus, a new subregional framework could invite member Governments to designate their institutions as a technical center for a specific programme and to provide supports for the center.

(c) **Operating an open platform for policy-makers and stakeholders:** An open forum, e.g., *North-East Asia Clean Air Forum*, could be held (bi) annually to widely share the latest findings from scientific assessment, discuss policy and technical measures and build multidisciplinary expert network.

(d) **Coordinating with other relevant mechanisms for technical inputs:** As mentioned above, the work of the new framework would require close coordination with the LTP and MICS Asia as well as their individual experts to mutually support the work on IAM and emission inventory. The new framework could also seek mutual supports with the Asia Pacific Clean Air Partnership (APCAP) which operates the APCAP Science Panel and plans to regularly publish a regional assessment report on air pollution. Furthermore, the LTP could be relocated under the new subregional framework. The 19th LTP Expert Meeting held in November 2016 discussed the relocation of the LTP secretariat from the ROK National Institute for Environmental Research to ESCAP East and North-East Asia Office (or NEASPEC Secretariat) and requested its member Governments to inform the position by end of February 2017. If agreed to relocate, the LTP work could become a key element of the framework which needs to reflect this arrangement into its standing bodies and programmes.

III. NORTH-EAST ASIA CLEAN AIR PARTNERSHIP

15. Based on the various ideas and recommendations summarized as above, SOM-21 could launch the "*North-East Asia Clean Air Partnership*" as a voluntary programme under NEASPEC. The Terms of Reference (TOR) is attached as Annex I for the review and decision by member Governments.

16. The TOR consists of (1) introduction, (2) Aims and Objectives, (3) Geographic scope and target pollutants, (4) Core Activities, (5) Organizational structures, (6) Budget, (7) Role of member States. With the aim to ensure the protection of the environment and human health from air pollution in North-East Asia, the TOR proposes the following objectives of NEACAP: promote environmental cooperation, including its science, policy and technical aspects, enhance and further develop information and experience exchange, act as the key voluntary framework addressing transboundary air pollution issues in North-East Asia, contribute to the development of relevant national and subregional policies, and promote knowledge on environmental and human health aspects of air pollution

17. In terms of target pollutants, as identified during expert consultations, TOR proposes that NEACAP could focus on pollutants of national and subregional concern, namely Particulate Matter ($PM_{2.5}$ and PM_{10}) and Ozone, and other relevant pollutants, including Sulfur Oxides (SO_x), Nitrogen Oxides (NO_x), Black Carbon, Ammonia (NH_3) and Volatile Organic Compounds (VOCs). Core activities on addressing the pollutants could include exchanging available and relevant information to extent possible; engaging in common research activity development; and proposing potential technical and policy measures through regular meetings, regular review reports, technical projects, open forums, and outreach.

18. In support of these activities, the TOR proposes to set up a number of standing bodies including Science and Policy Committee, Science Working Group, and Policy Working Group, the Secretariat, and Technical Centers, which will be operated under the broad guidance of the Senior Officials Meetings of NEASPEC. NEACAP could begin with a pilot stage of 2-3 years, review its outcomes and develop its full structure and programmes at a later stage.

19. Developing and implementing collaborative activities with the technical support from the proposed bodies will require substantial increases in financial and in-kind contributions of member States to NEASPEC Core Fund as well as Project-based Fund.

IV. ISSUES FOR CONSIDERATION

20. The Meeting may wish to request member States to provide guidance on the proposed NEACAP and launch it by adopting the terms of references.

21. The Meeting may wish to invite member States to express their plan for the nomination of national experts for the Committee and Working Groups, and technical centers.

22. The Meeting may wish to request member States to provide guidance on the proper arrangement and collaboration with relevant mechanisms, including LTP, EANET, MICS Asia and APCAP.

23. The Meeting may wish to request member States to announce their intended contributions to the framework.

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Annex I. (DRAFT) Terms of Reference of the NORTH-EAST ASIA CLEAN AIR PARTNERSHIP (NEACAP)

1. Introduction

The pressing problem of air pollution, its adverse effects on human health and the environment in North-East Asia are well known to countries in the subregion. The transboundary nature of pollution requires effective cooperation to ensure comprehensive assessment and monitoring in the subregion, as well as to promote the dialogue on potential multilateral measures to tackle the problem. With support from NEASPEC member States, the partnership shall provide the basis for strategic cooperation, through exchange of information, scientific, technical and policy collaboration, taking into account various technical and scientific initiatives and instruments that exist in the subregion.

2. Aims and Objectives

The *aim* of the partnership is to ensure the protection of the environment and human health from air pollution in North-East Asia.

Objectives of the partnership include:

a. To promote environmental cooperation, including its science, policy and technical aspects, on atmospheric air protection in the transboundary context in the subregion;
b. To enhance and further develop information and experience exchange in national and transboundary air pollution matters;
c. To act as the key voluntary framework addressing transboundary air pollution issues in North-East Asia, covering China, the Democratic People's Republic of Korea, Japan, Mongolia, the Republic of Korea, and the Russian Federation;
d. To contribute to the development of relevant national and subregional policies addressing air pollution based on regional and national scientific research;
e. To promote knowledge on environmental and human health aspects of air pollution in the North-East Asian subregion.

3. Geographic scope and target pollutants

The geographic scope of NEACAP includes the territories of China, the Democratic People's Republic of Korea, Japan, Mongolia, the Republic of Korea, and the Russian Federation. The domain for technical modelling and assessment is to be consulted with NEACAP member States.

Target pollutants of NEACAP include, but not limited to, pollutants of national and subregional concern, namely Particulate Matter ($PM_{2.5}$ and PM_{10}), Ozone, and other relevant pollutants, including Sulfur Oxides (SO_x), Nitrogen Oxides (NO_x), Black Carbon, Ammonia (NH_3) and Volatile Organic Compounds (VOCs). Step-wise approach is applied when addressing the listed pollutants as the completeness of relevant emission inventories and modeling capacities in member States may vary.

4. Core Programmes

Core programmes of NEACAP include:

i. Exchange relevant information and data, covering

a. Emission data of the above-listed target pollutants, at periods of time and formats to be agreed upon,
b. Information on transboundary transport of target pollutants along with relevant meteorological and physico-chemical data, where applicable,
c. Information on emission control technologies and national policies in use and/or under-development;

ii. Engage in development of research activity covering

a. Subregional emissions inventory development and maintenance according to agreed formats and templates;
b. Air pollution monitoring through existing programmes and frameworks, including national networks and multilateral initiatives, including the Acid Deposition Monitoring Network in East Asia (EANET), and others;
c. National and regional air pollution transport and deposition modeling, including source-receptor relationship (SRR) modeling, based on existing capacities to apply mutually agreed and recognized instruments; and reference from established initiatives, namely the Long-range Transboundary Air Pollutants in Northeast Asia (LTP) and the Model Inter-Comparison Study for Asia (MICS Asia);
d. Integrated assessment modeling, where possible, based on current experiences in the application of the Greenhouse Gas - Air Pollution Interactions and Synergies (GAINS) model and other relevant approaches.

iii. Propose potential technical and policy measures to tackle air pollution through

a. Science-based, policy-oriented consultations among national scientists, experts, policy- and decision-makers of the member States,

b. Development of common technical and policy scenarios based on integrated assessment modeling and projections,
c. Exchange of information on emerging technologies and potential for technological cooperation on mitigating pollution,
d. Sharing of information and lessons learnt on relevant good environmental practices applied nationally.

The core programmes of NEACAP supported through the following activities:

a. Regular meetings of working groups, publication and dissemination of relevant information through up-to-date channels, including a dedicated website;
b. Annual or biennial subregional review reports based on agreed templates;
c. Projects on emission inventories, integrated assessment modeling, policy scenario development, air pollution monitoring, and other relevant topics;
d. Seminars, workshops and trainings for strengthening capacity of subregional experts on source-receptor relationship modeling, integrated assessment, emissions inventory development and verification, as well as promoting science-policy dialogue. In particular, an *open forum*, e.g. the North-East Asia Clean Air Forum, could be organized and held annually or biennially to share scientific results, and promote dialogue among multidisciplinary experts on policy and technical measures to address air pollution issues.
e. Liaising and exploring opportunities to collaborate with relevant initiatives and frameworks including Long-range Transboundary Air Pollutants in Northeast Asia (LTP), Acid Deposition Monitoring Network in East Asia (EANET), Asia Pacific Clean Air Partnership (APCAP), the UNECE Convention on Long-Range Transboundary Air Pollution (CLRTAP) and others.

5. Organizational structure

The organizational structure of NEACAP includes the following: the Science and Policy Committee, the Science Working Group, the Policy Working Group, the Secretariat, and technical centers. The Science and Policy Committee shall report to the Senior Officials Meetings of NEASPEC.

i. ***Science and Policy Committee*** (SPC) – a steering body which coordinates the overall work of NEACAP, guiding the scientific and policy-oriented activities. Committee members are nominated by member States (at least one per country); the Committee may meet on annual or biennial basis to plan, monitor and review activities under NEACAP;

ii. ***Science Working Group (****SWG)* – a group of nominated national experts on air pollution to carry out scientific study, review information, data and outcomes of relevant domestic and international research, and provide technical advice to the SPC and PWG;

iii. ***Policy Working Group*** *(PWG)* – a group of nominated national experts to review outputs from the SWG, develop related policy options for transboundary air pollution, hold science-policy dialogs and provide policy advice to the SPC.

iv. ***Secretariat*** *(NEASPEC Secretariat)* - be responsible of the overall coordination and administration of NEACAP, including the meetings of the SPC, PWG and SWG.

v. ***Technical centers*** - designated research institutions in member States to support the technical work of NEACAP including the operation of the subregional emission inventory, conducting integrated assessment modelling, reviewing monitoring results and providing required technical support.

6. Budget

NEACAP will be supported by the Core Fund of NEASPEC. Other funding sources, including the voluntary contributions from the member States, and multilateral financial mechanisms should be explored and utilized.

7. Roles of Member States

NEACAP is a voluntary, needs-driven partnership. Member States may actively participate in and develop NEACAP, as they explore potential for financial or in-kind contributions necessary for the effective functioning of the partnership.