PROJECT PLAN

I. General Information

<table>
<tr><td>Title of Project</td><td colspan="4">Proposal Number: 2023-04

Title: $PM_{2.5}$ source apportionment in major cities in EANET for recommendations on feasible reduction policy</td></tr>
<tr><td>Duration of Project</td><td colspan="4">January/2023 – December/2024</td></tr>
<tr><td>Project Lead (PL)</td><td colspan="4">Network Center for EANET, Asia Center for Air Pollution Research</td></tr>
<tr><td>Partner organizations (POs)</td><td colspan="4">• Pollution Control Department (PCD), the Ministry of Natural Resources and Environment (MONRE), Thailand
• Sub Institute of Hydro Meteorology and Climate Change (SIHYMECC), Institute of Meteorology, Hydrology and Climate Change (IMHEN), Vietnam</td></tr>
<tr><td></td><td colspan="4">• Japan International Cooperation Agency (JICA)</td></tr>
<tr><td>Implementation Agencies (IAs)</td><td colspan="4">• Network Center for EANET, Asia Center for Air Pollution Research (NC/ACAP) (Japan)</td></tr>
<tr><td>Beneficiaries of PCs</td><td colspan="4">• National and local/city government officers in charge of air quality monitoring
• Policy makers involved in air pollution mitigation</td></tr>
<tr><td>Total Required Resources and Requested amount of Project Fund</td><td colspan="4">• The total amount of required resources (USD): 20,000 (10,000 in 2023)
• The requested amount for EANET Project Fund (USD): 10,000 for two years (5,000 in 2023)</td></tr>
<tr><td rowspan="4">Resources other than EPF from Co-financers</td><td>Organization</td><td>Financial contribution (USD)</td><td>In-kind contribution (with estimated equivalent USD, if possible)</td><td>Status (Secured/under consultation etc.)</td></tr>
<tr><td>PCD</td><td>0</td><td>Providing PM samples, PM chemical component data, and other air quality data. Organizing a regional workshop for $PM_{2.5}$ pollution mitigation</td><td>Under consultation</td></tr>
<tr><td>SIHYMECC</td><td>0</td><td>Ditto</td><td>Under consideration</td></tr>
<tr><td>Total</td><td>0</td><td>-</td><td></td></tr>
<tr><td>Relevant Types of Activities</td><td colspan="4">• Activity 1 of Core Activities: Monitoring of acid deposition, improvement in monitoring methodologies and better instrument maintenance
• Activity 6 of Core Activities: Conduct an annual assessment of the state of acid deposition using trend analysis, numerical models
• Activity 10 of Core Activities: Promotion of public awareness on acid deposition, including other priority chemical species,</td></tr>
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	etc.	
Relevant Scope of EANET	• ITEM 6 of the Instrument: Studies on scientific issues related to acid deposition (PM components are listed in the attachment of)the scope of EANET.)	
Representative of the Project Lead /Contact Address	• Dr. Keiichi Sato, Head of Atmospheric Research Department, NC/ACAP / 1182 Sowa, Nishi-ku, Niigata-shi 950-2144, JAPAN, ksato@acap.asia	
Project Processing Information	Submission Date to the EANET Secretariat	
	1) Date of Register in the Project Cycle	
	2) Date of Latest Project Plan	
	3) Date of Approval	
	4) Date of Completion Report Submitted	

II. Description of the Project

Keywords of the project	$PM_{2.5}$, Source analysis, Biomass burning, Vehicle emission, Secondary aerosol
Summary of the Project	Many major cities in EANET participating countries suffer severe haze pollution due to rapid urbanization and motorization and biomass burning in forest and agricultural field. Our previous study of $PM_{2.5}$ characterization in Bangkok demonstrated Organic Carbon Mass (OCM) accounted for 40% of total $PM_{2.5}$. However, there are many unidentified sources of OCM, which becomes an obstacle for haze pollution mitigation. This study aims to assess $PM_{2.5}$ source contributions using the data of organic substances and other components in $PM_{2.5}$ collected in EANET participating countries. $PM_{2.5}$ samples are collected in major cities in EANET, and the chemical components of $PM_{2.5}$ such as ions, carbonaceous compounds, trace elements and organic markers will be analyzed. Regional and seasonal characteristics of the chemical components of $PM_{2.5}$ will be clarified. Finally, $PM_{2.5}$ source contributions is evaluated by the receptor models and the time profiles of the chemical components $PM_{2.5}$. These results will provide scientific knowledge for $PM_{2.5}$ pollution mitigation in Southeast Asian countries through outreach such as regional workshop.
Background and Rationale	Many large cities in East Asia, such as Bangkok and Ho Chi Minh City, suffer from severe air pollution caused by $PM_{2.5}$. Since the chemical composition of air pollutants emitted from each air pollution source varies greatly depending on the source, information on the chemical composition is necessary for quantitative estimation of the source of $PM_{2.5}$. Countries in Northeast Asia is industrialized and primary and secondary anthropogenic PM formation is dominant on regional air pollution. There are many researchers of characterization of PM component and source identifications in major cities in Northeast

	Asia. On the other hand, many major cities in Southeast Asian countries suffer severe haze pollution due to rapid urbanization and motorization and biomass burning in forest and agricultural field. The proponent and collaborators previously studied $PM_{2.5}$ characterization in Bangkok. As a result, Organic Carbon Mass (OCM) accounted for 40% of total $PM_{2.5}$. However, there are many unidentified sources of OCM, which becomes an obstacle for haze pollution mitigation
Objectives	The objectives of this project consist of three parts. Specifically, ➢ Elucidate regional and seasonal characteristics of $PM_{2.5}$ component ➢ Identification of major sources of $PM_{2.5}$ in major cities in EANET ➢ Transfer research outcomes to policy actions
Activities to achieve Objectives	➢ Observation and chemical analysis of $PM_{2.5}$ components in Thailand, Japan, Vietnam and other major East Asian cities ➢ Quantitative evaluation of $PM_{2.5}$ sources by using PM chemical composition data and receptor models. Analysis of PM pollution structure in major East Asian cities by integrating the results of this source analysis with air quality models ➢ Organizing a regional workshop for $PM_{2.5}$ pollution mitigation in East Asia to conclude recommendations on feasible reduction of primary and secondary particulate matter.
Links and relevance to existing policy process of the target areas and regional activities	National or local governments in Asian region have adopted a range of air quality standards, most of which are based on the prevailing international guidelines, such as Air Quality Guidelines (AQG) of WHO and National Ambient Air Quality Standards (NAAQS) of United States Environmental Protection Agency (USEPA), at the time of development. It is desirable that national or local governments should develop standards after considering prevailing exposure levels, meteorological and topographical conditions, socio-economic levels, natural background concentration, and population susceptibility in their communities. Some countries in East Asia such as Cambodia and Myanmar still has not established air quality standards of PM_{10} or $PM_{2.5}$. Japan has an air quality standard of Suspended Particulate Matter (SPM) and $PM_{2.5}$. China has air quality standards for several levels classified by industrial, residential and natural conservation area. Compared with AQG of WHO and NAAQS of USEPA, all current PM_{10} standards in Asia are equivalence or lower than the NAAQS (150 $\mu g/m^3$ for 24-hour value), whereas those are higher than the AQG (50 $\mu g/m^3$ for 24-hour value and 25 $\mu g/m^3$ for annual mean). Establishment of $PM_{2.5}$ standard in Asian countries are slowly moving towards compared to PM_{10}. There are only 12 countries which establish $PM_{2.5}$ standard. Many countries set $PM_{2.5}$ standards equivalent or more than NAAQS (35 $\mu g/m^3$ for 24-hour value and 12 $\mu g/m^3$ for annual mean primary standard) and AQG (20 $\mu g/m^3$ for 24-hour value and 10 $\mu g/m^3$ for annual mean). The main reason of this situation is lack of epidemiological data on $PM_{2.5}$ and insufficient nationwide monitoring data. It is important to set sufficient number of monitoring stations for assessing compliance to the air quality standards and effectiveness of air quality policies. Since 2018, Japan-Thailand Clean Air Partnership (JTCAP) has

	been established based on the policy dialogue between the Ministry of the Environment of Japan (MOEJ) and the Ministry of Natural Resources and Environment of the Kingdom of Thailand (MONRE) as the joint project of countermeasure for severe air pollution caused by $PM_{2.5}$ and other air pollutants in Thailand. JTCAP is implementing the following activities to mitigate the effects of air pollution caused by $PM_{2.5}$ and other pollutants. (1) Identification of major source sectors and areas of $PM_{2.5}$ by chemical transport model (2) Long-term observations and identification of major $PM_{2.5}$ sources using receptor models (3) Formulate policies and appropriate measures by building relationships with stakeholders
Expected Outputs	Atmospheric observation in major cities in EANET will provide seasonal and regional characteristics of $PM_{2.5}$ component variations. There is lack of data for $PM_{2.5}$ component seasonal variations especially in Southeast Asian countries. The outputs in this study will clarify $PM_{2.5}$ composition in specific season, which is important for source analysis in EANET region. Receptor model analysis will show important source factors of biomass open burning, diesel vehicles, secondary inorganic particulate and industry. Source identification by Positive Matrix Factorization (PMF) could be done by combination of marker components. Potential Source. Contribution Function (PSCF) analysis will show the distribution of source intensity in Southeast Asian region for each sources identified by PMF. Clarification of major $PM_{2.5}$ source in major cities in EANET will lead to recommendations on feasible reduction policy of $PM_{2.5}$.
Expected Outcome	The most distinctive outcome of this project is to share the obtained scientific knowledge among policy makers, researchers, and people from industries and general public. A regional workshop is planned in the 2nd year (2024). Through the discussions at the workshop, the stakeholders are expected to recognize the benefit of new regulation and measures for $PM_{2.5}$ and eventually accept them. As a consequence of the proposed research, the following output regarding policy measure will be expected. (1) Finalizing the target of PM compositions for setting up reduction strategy and measures (2) Setting up proposed numerical targets of PM compositions for setting up reduction strategy and measures
Risks and Countermeasures	• Local surveys of $PM_{2.5}$ monitoring may be difficult due to restrictions imposed by COVID-19. In such a case, we will contact partner organizations and discuss the possibility of shipping samples to Japan by international mail.
Plan to deliver outcomes to beneficiaries	• The results of $PM_{2.5}$ characterization and source analysis will be report at relevant Task Force and SAC. • Disseminate information through conference presentations and submissions to international journals such as EANET Research Portal.

Comments from PC to be considered in the implementation	
Responses from the Project Lead to above	
Comments from SEC, NC, PCs	

III. IMPLEMENTATION PLAN

Activities and Milestones

Name of Activities	Brief Summary of Each Activity with milestones and name of responsible IA	Implementation Period
Selection of PM2.5 samples in target cities	The NC will contact to the Partner Organizations to discuss target period and cities.	JAN-FEB 2023
Analysis of PM2.5 samples and data compilation	The NC will conduct chemical analysis of PM2.5 and the data are compiled.	MAR-SEP 2023
Source apportionment of PM2.5 in target cities	By using PM2.5 chemical component dataset and a receptor model, PM2.5 source contribution will be evaluated.	AUG-SEP 2023
Report on the progress of PM2.5 characterization and source analysis	The interim results of PM2.5 characterization and source analysis will be report at relevant Task Force (e.g. Task Force on Monitoring for Dry Deposition) and SAC.	SEP-OCT 2023
Comparing the PM2.5 source analysis results with those evaluate by an air quality model	The results of PM2.5 characterization and source analysis will be share with the Partner Organizations to compare with the PM2.5 source evaluate by an air quality model.,	NOV-DEC 2023
Preparing the activity report	The activity report will be prepared and submitted to the Secretariat	DEC 2023

IV. BUDGET PLAN

In USD

Name of Activities	Required Resources (financial and in-kind)	Secured Sources for Required Resources	In-balance
Collecting of PM2.5 samples in target cities.	(4,000 (8,000 for 2 years) Expected in-kind from POs)	Under consideration	
Chemical analysis of PM2.5 samples and data compilation and evaluation.	7,000 (14,000 for 2 years)	Under consultation	
Comparing the PM2.5 source analysis results with those evaluate by an air quality model	3,000 (1st year only)	Under consultation	
Organizing a regional workshop for PM2.5 pollution mitigation	3,000 (2nd year only) (7,000 by in-kind from POs)	Under consideration	

Note: For multiple-year projects, specify the total amount for entire projects and subtotal for each year