

Capacity Development
Programme on Air Quality
Management And
Emission Reduction Of
PM_{2.5} for ASEAN Countries



CBA2020-01MY-Verma

2022

Project Reference Number: CBA2020-01MY-Verma

Project Duration: 2 years

Funding Awarded: USD 79,800

Grant DOI: <https://doi.org/10.30852/p.13678>

Date of Publication:

Project Leader and Contact Details:

Dr. R. L. Verma, Regional Resource Centre for Asia and the Pacific, Asian Institute of Technology, Pathum Thani, Thailand (Email: ramlal.verma@rrcap.ait.ac.th)

Collaborators and Contact Details:

- Prof. Kim Oanh, Asian Institute of Technology, Pathum Thani, Thailand
(Email: kimoanh@ait.ac.th)
- Ekbordin Winijkul, Asian Institute of Technology, Pathum Thani, Thailand
(Email: ekbordinw@ait.asia)
- Dr. Ittipol Paw-Armart, Pollution Control Department, Bangkok, Thailand
(Email: ittipol.p@pcd.go.th)
- Dr. Hathairatana Garivait, Environmental Research and Training Center, Bangkok, Thailand
(Email: hathairatana@gmail.com)
- Dr. Didin Agustian Permadi, National Institute of Technology (ITENAS), Bandung, Indonesia
(Email: didin@itenas.ac.id)
- Dr. Md Firoz Khan, The University of Malaya, Kuala Lumpur, Malaysia (now at North South University, Dhaka, Bangladesh) (Email: firoz.khan@northsouth.edu)
- Ms. Maria Katherina Patdu, United Nations Environment Programme, Bangkok, Thailand
(Email: mariakatherina.patdu@un.org)

Recommended Citation: R. L. Verma, N. T. Kim Oanh, E. Winijkul, I. P. Armart, H. Garivait, D. A. Permadi, Md. F. Khan, and M. K. Patdu (2023); Capacity Development Programme on Air Quality Management and Emission Reduction of PM2.5 for ASEAN Countries; Regional Resource Centre for Asia and the Pacific, Asian Institute of Technology, Pathum Thani, Thailand



Asia-Pacific Network for Global Change Research (APN)

© 2022 The authors. Published by the Asia-Pacific Network for Global Change Research (APN) under the Creative Commons Attribution-NonCommercial 4.0 International (CC-BY-NC 4.0) licence.

All opinions, findings, conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of APN. While the information and advice in this publication are believed to be true and accurate at the date of publication, neither the editors nor APN accepts any legal responsibility for any errors or omissions that may be made. APN and its member countries make no warranty, expressed or implied, with respect to the material contained herein.

The use of geographic names, boundaries and related data on maps, and in lists and tables within this publication are not warranted to be error-free, nor do they imply any endorsement by APN.

1. Summary

Air quality in many Asian countries is deteriorating due to increasing emissions of air pollutants. Most countries are lacking technical capabilities to manage the air quality. It is needed to build capacities of the Asian countries on air quality management (AQM). The Asia-Pacific Network for Global Change Research (APN) under its Capacity Development Programme (CAPaBLE) provided financial support for the project *“Capacity Development Programme on Air Quality Management and Emission Reduction of PM2.5 for ASEAN Countries”* for organizing 2 capacity building workshops on AQM for the ASEAN member countries. Due to the COVID-19, the first workshop *“Capacity Development Programme on Air Quality Management and Emission Reduction of PM2.5 for Asian Countries”* was organized online during 13-17 September 2021. Since the workshop was organized online participants from all countries were invited. A total of 310 participants, including policymakers, air quality managers, technical staff, air quality professionals, academicians, and young researchers from 30 countries registered for the workshop and about 150-200 participants from 29 countries have participated in the 5-day workshop. The proceedings of the workshop were divided into 5 Modules (Air Quality Monitoring, Emission Inventory Development, Air Quality Modeling, Impact Assessment, and Policy Measures for Air Pollution Mitigation). A total of 18 lectures were delivered by well-known resource persons. A “Certificate of Participation” was issued to participants. The majority of participants rated “5” (1-10 scale) regarding their knowledge and understanding on all aspects of AQM before the workshop. Their knowledge and understanding of was increased to “8” after the workshop. The second workshop *“Capacity Development Programme on Air Quality Management and Emission Reduction of PM2.5 for Member Countries of ASEAN Haze Agreement and Malé Declaration”* was organized during 19-23 September 2022 at AIT, Pathum Thani, Thailand. Participants from member countries of the 2 Intergovernmental Networks of Asia, namely, the ASEAN Agreement on Transboundary Haze Pollution (*10 Southeast Asian countries*) and the Malé Declaration on Control and Prevention of Air Pollution and its Likely Transboundary Effects for South Asia (*8 South Asian countries*) were invited to the workshop. A total of 55 participants, including 35 participants representing the member countries of the ASEAN Haze Agreement and the Malé Declaration, AIT and partner organizations participated in the 5-day workshop. Out of 55 participants, 24 were women and a healthy gender balance was achieved. The participants included policymakers, air quality managers, and scientific and technical staff working with the government institutions. The proceedings of the workshop covered 5 Modules (Air Quality Monitoring, Emission Inventory Development, Air Quality Modeling, Impact Assessment, and Policy Measures for Air Pollution Mitigation). A total of 11 lectures delivered, conducted 2 hands-on trainings, organized 2 visits to air quality monitoring labs of AIT and filed visits to air quality labs of ERTC and PCD. Most participants have rated “4” (1-10 scale) regarding their knowledge and understanding on all aspects of AQM before the workshop. Their knowledge and understanding was increased to “8” after the workshop. Participants informed that they had learned a lot from the workshop and satisfied with the workshop proceedings. Feedback from participants provided a way forward to organize separate workshop on emission

inventory developments and air quality modeling in the near future. A “Certificate of Participation” was awarded to each participant.

2. Objectives

- (1) to provide hands-on training on monitoring and analysis of PM2.5 and other air pollutants;
- (2) to develop expertise on retrieval and analysis of satellite data and their use in air quality management;
- (3) to develop expertise on emission inventory development including “bottom-up and top-down approaches” and practical training on emission data estimation using Excel-based ABC Emission Inventory Tool.
- (4) to familiarize with the concepts of air quality modeling, such as chemical transport models, source apportionment models, and secondary pollutants formation models, and provide training on how these models can be used for air quality management.
- (5) to familiarize with the concepts of the impact assessment of PM2.5 on human health and environment and provide practical training on how impact assessment models and tools can be useful for making effective emission reduction policies;
- (6) to enhance the capability of participants on the drafting of emission reduction policies, action plans incorporating the co-benefits approach, mitigation scenarios, strengthening emissions standards, etc. by using the knowledge and experience gained during Module 1 to 5 sessions.

3. Outputs, Outcomes and Impacts

Outputs	Outcomes	Impacts
<p>Workshop – 1 “Capacity Development Programme on Air Quality Management and Emission Reduction of PM2.5 for Asian Countries” was organized online during 13-17 September 2021.</p>	<p>- A total of 310 participants from 30 countries (mostly Asian) registered and about 150-200 participants from 29 countries have participated in the 5-day workshop which divided in to 5 modules, namely, Air Quality Monitoring, Emission Inventory Development, Air Quality Modeling, Impact Assessment, and Policy Measures for Air Pollution Mitigation to cover a wide score of air quality management.</p>	<p>- Based on the feedback received from the participants on whole of the workshop, majority of participants have rated 5 (on 1-10 scale) about their knowledge and understanding on all aspects of air quality management (i.e., monitoring, emission inventory, modeling, impact assessment, and mitigation policies) before the workshop and 8 after the workshop.</p> <p>- On an average, the</p>

	<ul style="list-style-type: none"> - A total of 18 lectures were delivered online by well-known resource persons for 5 modules. - A “Certificate of Participation” was issued to participants 	<p>knowledge and understanding of participants on all aspects of air quality management before the workshop were 5.4 ± 2.1 which increased to 7.9 ± 1.5 after the workshop, with a net increase of 2.5.</p> <ul style="list-style-type: none"> - Details evaluation of participants on their increased in knowledge and understanding on each topic lecture is given the workshop report published. - Post-workshop feedback received from participants they are using the workshop materials to enhanced their knowledge on air quality management and using their work and study.
<p>Workshop – 2 “Capacity Development Programme on Air Quality Management and Emission Reduction of PM2.5 for Member Countries of ASEAN Haze Agreement and Malé Declaration” was organized onsite during 19-23 September 2022 at AIT, Pathum Thani, Thailand</p>	<ul style="list-style-type: none"> - A total of 55 participants, including 35 participants representing the member countries of the ASEAN Haze Agreement (<i>9 Southeast Asian countries</i>) and the Malé Declaration (<i>8 South Asian countries</i>), AIT and partner organizations participated in the 5-day workshop which divided in to 5 modules, namely, Air Quality Monitoring, Emission Inventory Development, Air Quality Modeling, Impact Assessment, and Policy Measures for Air Pollution Mitigation to cover a wide score of air quality management. 	<ul style="list-style-type: none"> - Based on the feedback received from the participants on whole of the workshop, majority of participants have rated 4 (on 1-10 scale) about their knowledge and understanding on all aspects of air quality management (i.e., monitoring, emission inventory, modeling, impact assessment, and mitigation policies) before the workshop and 8 after the workshop. - On an average, the knowledge and understanding of participants on all aspects of air quality management before the

	<ul style="list-style-type: none"> - The participants included policymakers, air quality managers, and scientific and technical staff working with the government institutions of the countries. - A total of 11 lectures delivered, conducted 2 hands-on trainings, organized 2 visits to air quality monitoring labs of AIT and filed visits to air quality labs of ERTC and PCD - A “Certificate of Participation” was issued to participants 	<p>workshop were 4.4 ± 1.8 which increased to 7.7 ± 1.2 after the workshop, with a net increase of 3.3.</p> <ul style="list-style-type: none"> - Details evaluation of participants on their increased in knowledge and understanding on each topic lecture is given the workshop 2022 report (to be published). - Post-workshop feedback received from participants that they are using the workshop materials and knowledge gained during workshop in air quality management in their countries.
--	---	--

4. Key facts/figures

Workshop – 1: Capacity Development Programme on Air Quality Management and Emission Reduction of PM2.5 for Asian Countries organized online during 13-17 September 2021.

- A total of 310 participants from 30 countries of Asia and Europe registered for the workshop and about 150-200 participants from 29 countries have participated during the 5-day workshop.
- The participants included policymakers, air quality managers, technical staff, air quality professionals, academicians, young researchers, and students.
- The workshop was divided into five Modules, namely, (1) Air Quality Monitoring; (2) Emission Inventory Development; (3) Air Quality Modeling; (4) Impact Assessment; and (5) Policy Measures for Air Pollution Mitigation.
- To cover various aspects of air quality management of the 5 Modules, a total of 18 lectures were delivered online by 17 well-known resource persons from India, China, Japan, Hong Kong, Indonesia, Malaysia, Nepal, Philippines, Thailand, United Kingdom, and the United Nations Environment Programme during the 5-day workshop.
- A “Certificate of Participation” was issued online to participants.
- Evaluation of the participants was made by providing a set of questions for each topic of the lecture as well as for the whole workshop in order to measure the enhancement of knowledge and understanding of participants on the Modules and the topic of lectures.

- A total of 159 participants have provided their evaluation feedback. Among 159 participants, 32% were holding Bachelor's degree, while 42% and 26% are Master's and Ph.D. holders, respectively.
- The majority of participants have rated “5” regarding their knowledge and understanding on all aspects of air quality management (i.e., monitoring, emission inventory, modeling, impact assessment, and mitigation policies) before the workshop, on a given scale of 1-10. Their knowledge and understanding of air quality management were increased to “8” after the workshop.
- On average, the knowledge and understanding of participants on all aspects of air quality management before the workshop were 5.4 ± 2.1 which increased to 7.9 ± 1.5 after the workshop, with a net increase of 2.5.
- The feedback received from participants showed that they had learned a lot from the workshop and were quite satisfied with the contents of the modules and the topic of lectures delivered during the workshop.
- A dedicated website (www.rrcap.ait.ac.th/apn/) was developed for the project where all details of the workshop, including resource materials, were uploaded.
- The resource materials are uploaded on the Youtube, links of each video are given in [website](#)
- 102 comments were provided by participants of workshop (all quotes are given [workshop report](#), Annex 6)

Workshop -2: Capacity Development Programme on Air Quality Management and Emission Reduction of PM_{2.5} for Member Countries of ASEAN Haze Agreement and Malé Declaration organized onsite during 19-23 September 2022 at AIT, Pathum Thani, Thailand

- Participants, including policymakers, air quality managers, and scientific and technical staff from the member countries of the two Intergovernmental Networks of the Asian region, namely, the ASEAN Agreement on Transboundary Haze Pollution (*Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Vietnam*) and the Malé Declaration on Control and Prevention of Air Pollution and its Likely Transboundary Effects for South Asia (*Bangladesh, Bhutan, India, Iran, Maldives, Nepal, Pakistan, and Sri Lanka*) were invited to the workshop.
- A total of 55 participants, including 35 participants representing the member countries of the ASEAN Haze Agreement and the Malé Declaration, 1 ASEAN Secretariat, 9 Resource Persons, and the rest from AIT and partner organizations participated in the 5-day workshop on air quality management.
- Out of 55 participants, 24 participants were women and thus a healthy gender balance was achieved.
- The workshop proceedings was divided into five Modules, namely, (1) Air Quality Monitoring; (2) Emission Inventory Development; (3) Air Quality Modeling; (4) Impact Assessment; and (5) Policy Measures for Air Pollution Mitigation.

- To cover various aspects of air quality management of the 5 Modules, a total of 11 lectures were delivered, conducted 2 hands-on training, organized 2 visits to air quality monitoring labs of AIT and field visits to air quality labs of ERTC and PCD.
- 10 well-known resource persons from India, Indonesia, Bangladesh, Philippines, Thailand, and the United Kingdom delivered the lectures, and conducted hands-on trainings and assisted in the field visits.
- Evaluation of the participants was made by providing a set of questions for each topic of the lecture, hands-on training, and field visits as well as for the whole workshop in order to measure the enhancement of knowledge and understanding of participants on the workshop Modules.
- For the whole workshop, most participants have rated “4” (on 1-10 scale) regarding their knowledge and understanding on all aspects of air quality management (i.e., monitoring, emission inventory, modeling, impact assessment, and mitigation policies) before the workshop. Their knowledge and understanding of air quality management were increased to “8” after the workshop. On an average, the knowledge and understanding of participants on all aspects of air quality management before the workshop were 4.4 ± 1.8 which increased to 7.7 ± 1.2 after the workshop, with a net increase of 3.3.
- The feedback received from participants showed that they had learned a lot from the workshop and were quite satisfied with the proceedings of the workshop
- Participants expressed concern that enough time should have been provided to practice emission inventory tools and air quality models. It provided a way forward for organizing separate workshops on emission inventory developments and air quality modeling in the near future.
- A “Certificate of Participation” was awarded to each participant.
- A dedicated website (<http://www.rrcap.ait.ac.th/apn2022/>) was developed for the project where all details of the workshop, including resource materials, were uploaded.

5. Publications

1. R. L. Verma, N. T. Kim Oanh, E. Winijkul, I. P. Armart, H. Garivait, D. A. Permadi, Md. F. Khan, and M. K. Patdu (2022); [Capacity Development Programme on Air Quality Management and Emission Reduction of PM2.5 for Asian Countries](#); Regional Resource Centre for Asia and the Pacific, Asian Institute of Technology, Pathum Thani, Thailand (ISBN (e-Book): 978-616-8230-13-8) (Workshop Report)
2. R. L. Verma et al. (2023); Capacity Development Programme on Air Quality Management and Emission Reduction of PM2.5 for Member Countries of ASEAN Haze Agreement and Malé Declaration, Regional Resource Centre for Asia and the Pacific, Asian Institute of Technology, Pathum Thani, Thailand (*to be published*) (workshop report)

6. Media reports, videos and other digital content

1. R. L. Verma (2021); [Regional Capacity Building on Air Quality Management and Emission Reduction of PM2.5 Enhanced Through RRC.AP Workshop](#)
2. R. L. Verma (2022); [RRC.AP and Partners Built Capacities of Member Countries of ASEAN Haze Agreement and Malé Declaration on Air Quality Management](#)

7. Pull quotes

102 comments were provided by participants of [workshop 1](#) (organized online), all quotes are given [workshop report](#), Annex 6, few are given below:

- It's a great workshop and well-organized. Thank you for sharing such great useful information. I am looking forward to attending the next workshop.
- In general, the majority of the talks are really informative and at the same time pose challenging questions, but also provided clear guidelines on the many possible steps to take and concepts and methods to consider. To be honest, I may not be able to attend this workshop if this was held in a face-to-face setting (funding issues, etc). That is why I feel fortunate to be able to attend.
- I have improved my knowledge a lot on Air Quality Management from fundamental to advanced through the workshop. Moreover, the materials of the workshop were available on the website and the workshop was recorded and uploaded on YouTube which help me be able to easily review all of the lectures.

29 Comments on overall impressions, recommendations, suggestions on the proceedings of the workshop 2 (organized physically), all comments are given in Table 2 in workshop report, few are given below:

- The training is well organized and the organizers are very helpful and friendly, Some lecturers should slow down their lecture and simplify their lessons, I hope this kind of training will be happened annually with expansion of further knowledge regarding the AQ management., Should has separate session on training for modelling session due to it require more time to understand, To sum up all lectures are really useful and I gain a lot of knowledge regarding AQ which I can bring home to share with my colleagues to improve AQ management in my country.
- This platform is very much beneficial to us as implementors of air quality regulation. Glad for your effort taken to empower us with knowledge within a very short period of time. Though some aspect are not properly understood looking forward to contact with resource persons while we start practicing in modelling aspect. If you can share the recording of Dr Didin ppt on modelling that will be helpful.
- Well organized and very important to improve our knowledge on air quality related policies, action and mitigation measure. We hope to participate further program also about develop emission inventory and air quality modelling.

8. Acknowledgments

We would like to thank Dr. Guilberto Borongan, Director, Regional Resource Centre for Asia and Pacific (RRC.AP) for his support and encouragement in the implementation of project activities which include organizing the capacity development workshop. Acknowledgment is also to RRC.AP colleagues who had contributed to the success of the workshop, namely, Mr. Bayasgalan Sanduijav, and Ms. Sengja Jangmaw for providing IT services and support in the development of the project website; Ms. Charina May Lepiten and Ms. Lakshani Gunawardhana for overall support in the organization of the workshop; Mr. Ric Dennis Canullas for the layout design of the report; and Ms. Nawaphorn Supakarn and Natanat Sittichaiyakarn (Ping) for providing administrative and logistic support to the project.

We also appreciate and acknowledge the strong support and valuable contributions from colleagues of the partner organizations, namely, AIT, PCD, ERTC, ITENAS, University of Malaya, and UNEP.

9. Appendices

1. Workshop 2 report: Capacity Development Programme on Air Quality Management and Emission Reduction of PM2.5 for Member Countries of ASEAN Haze Agreement and Malé Declaration (organized during 19-23 September 2022 at AIT, Pathum Thani, Thailand).