Environmental Protection Department
The Government of the Hong Kong Special Administrative Region

BRIEFING

UPDATED PATH MODELLING SYSTEM AND AIR QUALITY MODELLING GUIDELINES

Air Science and Modelling Group

PROGRAM

- Introduction on the updated PATH and streamlined arrangement in air modelling 01
- Technical sharing on Air Quality Modelling 02
  - Modelling open road emissions in AERMOD
  - Modelling options
- Hands-on training on setting up an AQIA modelling case using the Smart Air Modelling Platform 03
- Q&A 04

EIAO REVIEW

1. EIAO review commenced in 2022

2. The EIAO (Amendment of Schedules 2 and 3) Order 2023 and the revised EIAO-TM were passed by the Legislative Council on 29 June 2023 and came into effect on 30 June 2023.

Air Quality aspects:

(i) adoption of the mechanism of monitoring and auditing over the traditional quantitative assessment of construction dust; and

(ii) making available territory-wide background emission data and air quality modelling results derived from PATH through the **Centralised Environmental Database ("CED")** platform. To review the dataset yearly

WHAT DO YOU KNOW ABOUT RE-ENGINEERING?

① To understand requirements and expectation of the industry

② To identify the key problems and areas for improvement.

Innovation

Technologies

『提速』

『提效』

SMART AIR MODELLING SYSTEM (SAMS)

Major enhancement initiatives, leveraging innovation and technologies

….. Transforming air modelling work into **Transparent, Intelligent, Efficient and Consistent**

Challenges

Data Preparation
Manual process , Insufficient data

Adopting model assumptions
Difficult to under the science behind, lack of training

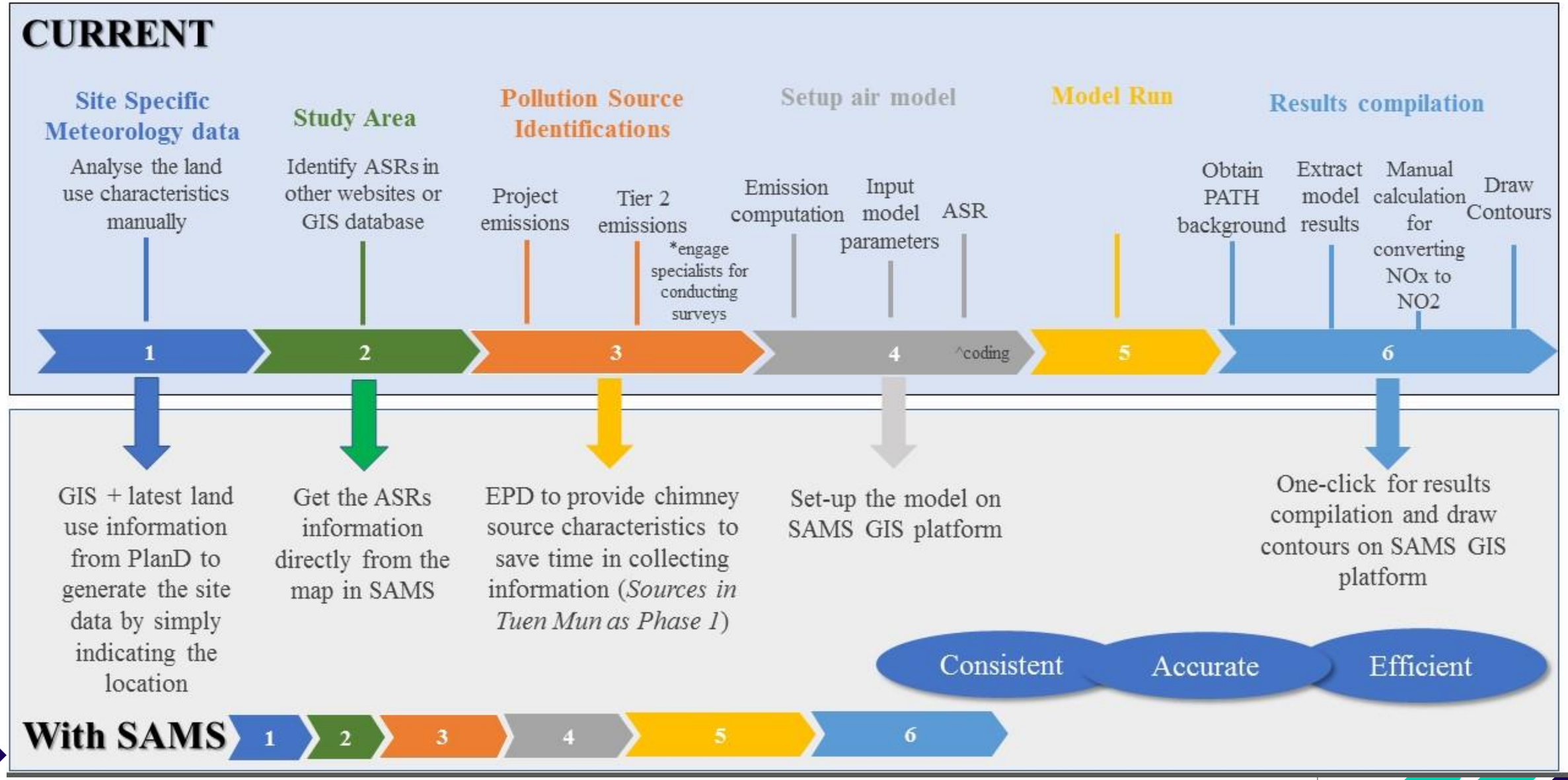
Complicate model update
Not user friendly, Project design may be revised during the EIA process

Solutions

Data Transparency:
- Background AQ yr 30,35 and 40 in CED
- Non-project induced emission (by phase)

Systematic Assessment:
- Training provided by modelling team
- Update modelling guidelines
- Release Technical notes

Technological Reform:
- “MAP” based application
- CALINE4 to AERMOD


CURRENT
Site Specific Meteorology data
Analyse the land use characteristics manually
Study Area
Identify ASRs in other websites or GIS database
Pollution Source Identifications
Project emissions
Tier 2 emissions
*engage specialists for conducting surveys
Setup air model
Emission computation
Input model parameters
ASR
^coding
Model Run
Results compilation
Obtain PATH background
Extract model results
Manual calculation for converting NOx to NO2
Draw Contours
1
2
3
4
5
6
GIS + latest land use information from PlanD to generate the site data by simply indicating the location
Get the ASRs information directly from the map in SAMS
EPD to provide chimney source characteristics to save time in collecting information (Sources in Tuen Mun as Phase 1)
Set-up the model on SAMS GIS platform
One-click for results compilation and draw contours on SAMS GIS platform
Consistent
Accurate
Efficient
With SAMS
1
2
3
4
5
6

Using AERMOD for vehicular emission

CALINE

CL4_KT.inp

```
1   LT_Long_Existing - NO@21_44
2   4no
3      100.0000   1.0000    0.0000    0.0000    920  186   1.0000  0  0 0
4   816984.4  831146.6  5.3
5   816935.7  831153.8  4.8
6   816905.4  831146.9  3.7
7   816832.1  831175.9  4
8   816870.5  831288.2  5.2
9   816807.2  831357.0  3.4
10  816659.0  831411.0  1.9
11  816649.1  831458.0  2.8
12  816610.4  831474.1  2
13  817004.7  831434.7  4.3
14  816856.7  831516.4  3.8
15  816559.3  831401.0  1.2
16  816536.1  831369.9  0.6
```

```
595472   28
595473   34
595474   141
595475   62
595476   62
595477   3
595478   62
595479   141
595480   3
595481   3
595482   3
```

```
1740955   0.4021
1740956   0.0967
1740957   168.1    2.5      5      196.7     11.0      0        28.9      20
1740958   11111noHR4652
1740959   330
1740960   330
1740961   330
1740962   23
```

Over a million rows in the input file!

Hard to read and trace when there are many road links. Large file size

Before

After

AERMOD

Clear and Concise syntax for setup and vetting

```
SO LOCATION 198_06 LINE 816191 827233.06 816228.18 827338.47 18
SO LOCATION 199_03 LINE 816206 827517.58 816224.54 827543.19 16
SO LOCATION 236_05 LINE 814644 827584.31 814602.22 827540.45 6
SO LOCATION 236_06 LINE 814602 827540.45 814563.68 827444.29 6
SO LOCATION 236_07 LINE 814564 827444.29 814532.82 827385.19 6
SO LOCATION 238_01 LINE 815885 827553.35 815901.5 827489.42 6

SO SRCPARAM 001_01 0.001 6.3 14 3.16
SO SRCPARAM 002_01 0.001 6.2 14 3.16
SO SRCPARAM 002_02 0.001 6.2 14 3.16
SO SRCPARAM 003_01 0.001 12.1 14 3.16
SO SRCPARAM 003_02 0.001 12.1 14 3.16
SO SRCPARAM 004_01 0.001 11.9 12 3.16

SO EMISFACT 001_01 MHRDOW 6.71908e-03 6.41518e-03 5.94013e-03 5.75893e-03 7.36735e-03 7.06444e-03 7.28196e-03 7.73516e-03
SO EMISFACT 001_01 MHRDOW 8.08116e-03 8.85515e-03 9.29971e-03 8.74039e-03 7.09135e-03 5.96478e-03 5.65737e-03 4.86564e-03
SO EMISFACT 001_01 MHRDOW 1.63041e-03 1.10612e-03 7.50853e-04 6.05241e-04 4.92471e-04 1.21752e-03 2.82699e-03 5.21567e-03
SO EMISFACT 001_01 MHRDOW 6.28878e-03 5.93905e-03 5.53636e-03 5.36940e-03 6.89857e-03 6.65768e-03 6.90836e-03 7.28455e-03
SO EMISFACT 001_01 MHRDOW 7.60050e-03 8.35840e-03 8.77123e-03 8.29401e-03 6.72671e-03 5.66575e-03 5.32509e-03 4.58054e-03
SO EMISFACT 001_01 MHRDOW 1.55411e-03 1.05691e-03 7.18396e-04 5.72231e-04 4.66040e-04 1.14823e-03 2.67187e-03 4.94407e-03
SO EMISFACT 001_01 MHRDOW 5.98092e-03 5.69784e-03 5.26046e-03 5.16043e-03 6.64580e-03 6.33549e-03 6.57422e-03 6.99885e-03
```

Technology Reform

Traditional Modelling

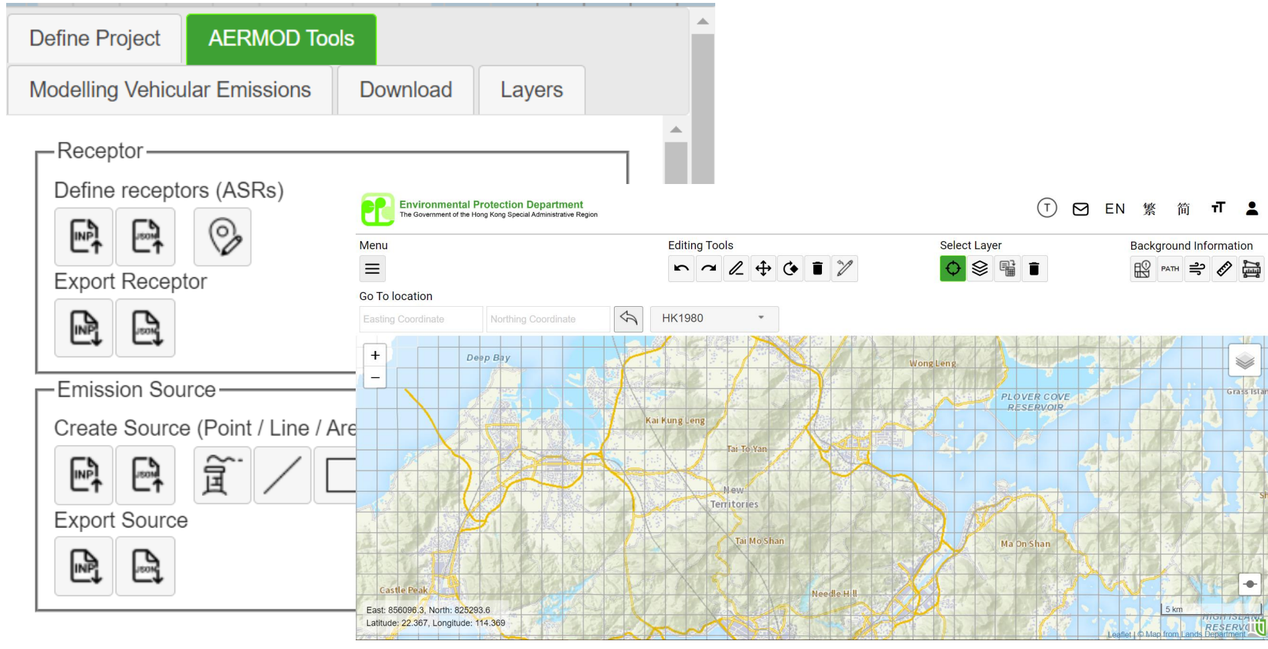
Model Setup	Use commercial GUI and GIS for model setup
Met data preparation	Analyse land use to determine surface characteristics in AERMET
Tier 2 source inventory	chimney survey and SP License search
Vehicular emissions	Run EMFAC-HK model, set up road links and input emission factors
Information	Consultants to gather information

Before

After

Smart Air Modelling Platform

- GIS-based platform and better understand the situation of the assessment area
- One-click function for creating site-specific MET data for model runs
- Avoid repetitive work for setup model for vehicular emission
- One-stop platform to display the geospatial data



EXPECTED KPI

>50%
Development Time Reduction

Development

PATH V2.1: ~4yrs
PATH V3: ~1yr

>90%
AQIA Preparation Time Reduction

AQIA

Without SAMS: ~weeks
With SAMS: ~hours

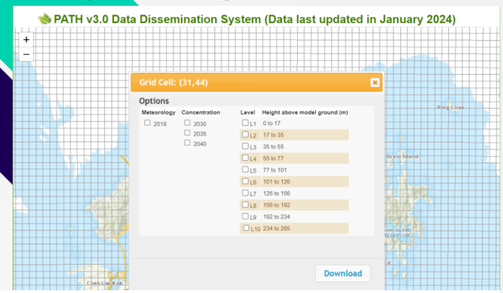
Introduction to the updated PATH (v3.0) and the air modelling guidelines

PATH V3.0

PATH - Pollutants in the Atmosphere and their Transport over Hong Kong

	PATH v2.1(current)	PATH v3.0 (new)
A. Scientific modules*	WRF v3.7.1 SMOKE v3.1 CMAQ v5.0.1	WRF v4.1 SMOKE v4.9 CMAQ v5.3.3
B. Simulation domains and resolution	Same	
C. Meteorology Data*	2015	2019
D. Emission Data*	2022 - 2025 With breakdowns into layers: 1. Vehicle; 2. Marine; 3. Other areas sources; and 4. Point sources and aviation	2025 - 2030 With breakdowns into layers: 1. Vehicle; 2. Marine; 3. Other areas sources; and 4. Point sources and aviation
E. Pollutant Concentration Outputs	2022 to 2025 Parameters: 1. FSP; 2. RSP; 3. NO2; 4. NO; 5. O3; 6. SO2; & 7. CO	2024 to 2030 2035 & 2040 (Scenario Projection) Parameters: 1. FSP; 2. RSP; 3. NO2; 4. NO; 5. O3; 6. SO2; & 7. CO

** NO Adjustments to PATH v3.0 to RSP and FSP concentration outputs are required



- **Air Quality Module**
  - PATH_v2.1 **(Last updated: 27-Sep-2021 Size: 162MB md5sum: e8e3f1461875fb6114a9c23b7187eff8)**
  - Readme **(Last updated: 01-Jul-2021)**
- **Meteorology Input**
  - Year 2015 **(Last updated: 01-Jul-2021 Size: 74GB md5sum: d019a597417e454b2d59cb1b3ad5ec7d)**
- **Emission Input**
  - Year 2022 **(Last updated: 01-Jul-2021 Size: 14GB md5sum: 7317b940d6045eff6fc7cddb48c744bb)**
  - Year 2023 **(Last updated: 01-Jul-2021 Size: 14GB md5sum: 345694e6c41177c8eba3bc4e86c8d799)**
  - Year 2024 **(Last updated: 01-Jul-2021 Size: 14GB md5sum: 35f1d109221d4d0c093542aaa225b1f8)**
  - Year 2025 **(Last updated: 01-Jul-2021 Size: 12GB md5sum: a5998d1e9f373ca5f9e2f60379147dd8)**
- **Emission Editor and Extractor**
  - Emission Editor and Extractor **(Last updated: 01-Jul-2021 Size: 66MB md5sum: 60189df67d858dc3f29074a34fed882f)**
  - Readme **(Last updated: 01-Jul-2021)**
- **Initial and Boundary Conditions**
  - Year 2022 **(Last updated: 01-Jul-2021 Size: 75GB md5sum: 2ad65feb2da6c4e47519ac03406ce1f9)**
  - Year 2023 **(Last updated: 01-Jul-2021 Size: 75GB md5sum: c3d63b4b2b3240f74c07979cd3500681)**
  - Year 2024 **(Last updated: 01-Jul-2021 Size: 75GB md5sum: 8e95f37fe477df31bf5faa694f519b4d)**
  - Year 2025 **(Last updated: 01-Jul-2021 Size: 75GB md5sum: 2efaf399b9f4022194b8fa2b6ba3899e)**

Hong Kong Emission and Air Quality Scenario Projections beyond 2025

Introduction

To provide a reference on the overall projected air quality in Hong Kong for the air quality impact assessment (AQIA) beyond 2025, the EPD has reviewed the latest emission & air quality trends, and air emission control strategies to derive scenario projections for the following assessment year(s).

1. Year 2030
2. Year 2035

It should be noted that the assumptions for the scenario projection(s), as provided below, are derived based on the expected outcomes at the specified time. It is not a policy commitment by the Government, and interested parties should evaluate the appropriateness of the assumptions with respect to each case's specific conditions & requirements at the time of AQIA, and make appropriate adjustments/refinements as necessary.

Assumptions for Scenario Projection

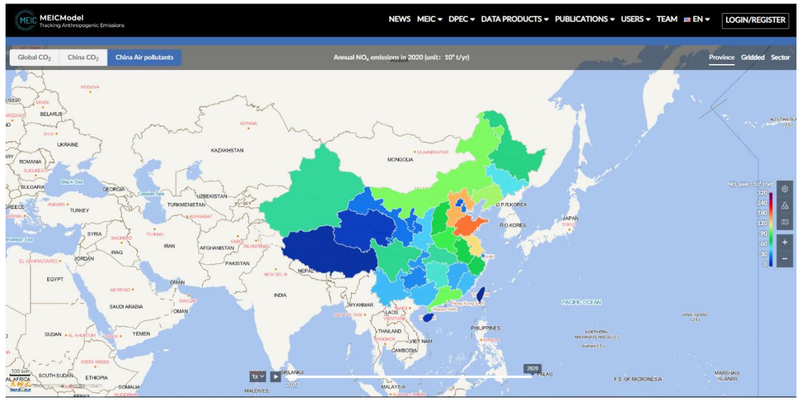
- Year 2030 Scenario Projection for Hong Kong **(Last updated: Nov-2022)**
- Year 2035 Scenario Projection for Hong Kong **(Last updated: Dec-2022)**
- Annex A - Road Transport 2030 & 2035 **(Last updated: Dec-2022)**

Emission Input

- Year 2030 **(Last updated: Sep-2022 Size: 16GB md5sum: 3d37409a6a89f159217aac5e4c8ee175)**
- Year 2030 (area) **(Last updated: Sep-2022 Size: 1.2GB md5sum: 4670d2bc9229eda2627d76626d3ff28a)**
- Year 2030 (marine) **(Last updated: Sep-2022 Size: 2.5GB md5sum: 08afc116948a8fd5ce17104044959 97f)**
- Year 2030 (point+aviation) **(Last updated: Sep-2022 Size: 585MB md5sum: 66ef9d8400467d355d773a0fc74d885c)**
- Year 2030 (mobile) **(Last updated: Sep-2022 Size: 999MB md5sum: cfc93b65095435d036fa058f0734ea24)**
- Year 2035 **(Last updated: Dec-2022 Size: 16GB md5sum: d2d940acd9d47f8e9cd421d586a53dc5)**

Air Quality Improvement Measures in Hong Kong

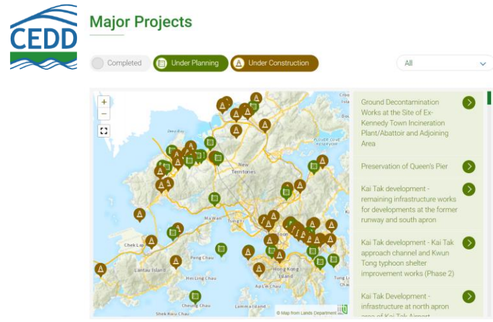
Emissions outside Hong Kong



Planned development

Projects Under Planning / Design

- Improvement of Lion Rock Tunnel
- Hiram's Highway Improvement Stage 2
- Upgrading of Deep Bay Road
- Route 11 (section between Yuen Long and North Lantau)
- Improvement works at Tsuen Tsing Interchange
- Tuen Mun Bypass (TMB)
- Extension Works to Major Roads in Tuen Mun
- Nim Wan Road (South)
- Widening of Tsuen Wan Road and the Associated Junction Improvement Works
- Upgrading of Nim Wan Road (North)
- Upgrading of Remaining Sections of Kam Tin Road and Lam Kam Road
- Widening of T6 Bridge of Tate's Cairn Highway
- Tsing Yi – Lantau Link
- Widening of Yuen Long Highway (section between Lam Tei and Tong Yan San Tsuen)



^The emission assumptions for the year 2035 & 2040 projection(s) adopted in PATH v3.0 are derived based on the expected outcomes at the specified time for EIA purpose only.

While the assumptions are not policy commitment, it should be evaluated with respect to each EIA case and make appropriate adjustments, if necessary.

AIR QUALITY MODELLING GUIDELINES FOR EIAS

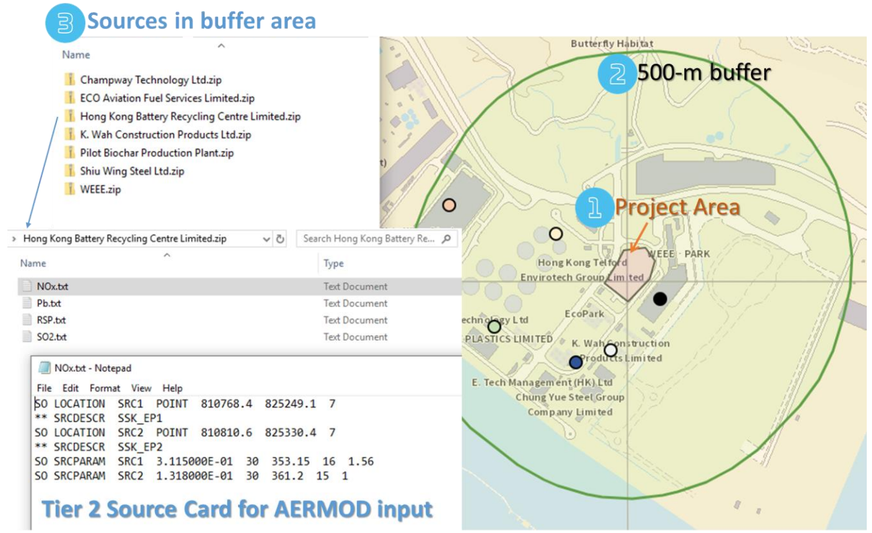
1. **Guidelines on Assessing the 'Total' Air Quality Impacts**
2. **Guidelines on Choice of Models and Model Parameters**
3. Guidelines on the Use of Alternative Computer Models in Air Quality Assessment (No updates)
4. ~~Guidelines on the Estimation of PM2.5 for Air Quality Assessment in Hong Kong (Latest Revision: May 2012)~~ << already obsoleted in PATH v2.1 release
5. Guidelines on the Estimation of 10-minute Average SO2 Concentration for Air Quality Assessment in Hong Kong (No updates)

UPDATE OF MODELLING GUIDELINE

① PATH v2.1 to be replaced by **PATH v3.0**

② The air quality impact assessment should be conducted taken into account the **best available information at the time of assessment**.

③ Information of the **source characteristics** of some Tier 2 emission sources can be found in the Smart Air Modelling Toolkits.



'TOTAL' Air Quality Impacts → 3 Tiers Approach

- **Tier 1: Primary contributions (project induced)**
  - ➢ Modelling tools: AERMOD ~~& CALINE4~~
- **Tier 2: Secondary contributions (emission in the immediate neighbourhood)**
  - ➢ Modelling tools: AERMOD ~~& CALINE4~~
- **Tier 3: Background contributions**
  - ➢ Modelling tools: PATH + AERMOD for 4km major point sources

⑤ **No change** in Three-tier approach, 4km major point source, NOx to NO2 post-processing method

⑥ Dispersion model for vehicular emissions should adopt AERMOD to replace CALINE 4 to align with latest scientific knowledge

NEW RELEASE OF TECHNICAL NOTES

① Publish technical guidelines to specify the modelling assumptions

- **General assumptions:**
  - AERMET and AERMOD version, coordinate system, urban / rural options, building downwash, terrain option, non-regulatory option
- **Vehicular emissions:**
  - Source Parameters
- **Industrial emissions:**
  - Adoption of emission profiles of relevant sources would be allowed to produce more realistic and practical results
- **Marine emissions**
  - Source types
  - Notes on specific vessel types

NEW RELEASE OF TECHNICAL NOTES

② For project induced emissions should be prepared by project proponent while the non-project induced could be referred to the modelling platform The applicability and validity of the data should be reviewed at the time of preparing the assessment

TRANSITIONAL ARRANGEMENT

FOR use of PATH model in EIA studies

- As for EIA studies being conducted, a 6-month period after the availability date of the new PATH model will be allowed for project proponents and their study teams to adapt to the new model and to reduce abortive work (same as the current arrangement)

- During the transition period, EIA reports submitted under Section 6 of the EIAO may continue to use the previous old model version for the air quality impact assessment. After the transition period, all EIA report submissions must use the new model version

- General Notice on the transitional arrangement is available under “Cyber Help Bench for EIA” in the EIAO website
- (https://www.epd.gov.hk/eia/hb/materials/path&emfac.pdf)

TRANSITIONAL ARRANGEMENT

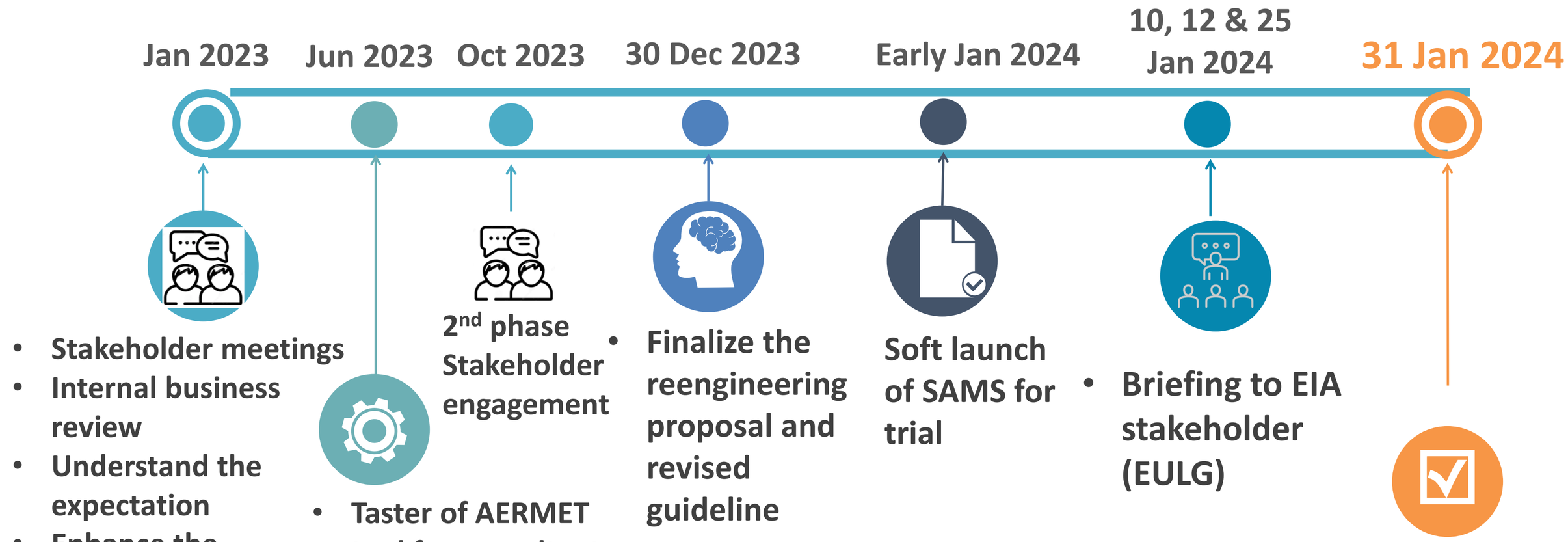
For New AQOs

- The existing AQOs will apply to applications for variation of the concerned conditions of the environmental permits (EPs) lodged within 36 months of the commencement of the new AQOs.

- Similar transitional arrangement was provided in the previous AQOs review and both the ACE and the LegCo EA Panel did not raise any adverse comment on the arrangement.

- We suggest that Government projects for which EIA studies have not yet been commenced should adopt new AQOs as the benchmark for conducting air quality impact assessment under the EIA studies as far as practicable from the time when the amendment bill to tighten the AQOs / set new AQO parameters is introduced into LegCo, which is currently targeted for 2024.

Work Plan (12 months) – Phase 1



Onward Work Plan (12 months) – Phase 2

Jan 2024

Feb 2024 …… Nov 2024

1 Jan 2025

Development of key IT systems

Consultant training

Further development of “MAP” and Tier 2 database

Effective day for new AQO

Proposed Updates of the AQOs

Pollutant	Averaging Time	WHO AQGs (μg /m³)					No. of allowable exceedances of prevailing AQOs (per calendar year)
		Interim Targets				AQG Level	
		1	2	3	4		
FSP / $PM_{2.5}$	Annual	35	25 →	15	10	5	Not applicable
	24-hour	75	50 →	37.5	25	15	35 → 18
RSP / PM_{10}	Annual	70	50 →	30	20	15	Not applicable
	24-hour	150	100 →	75	50	45	9
O_3	Peak season#@	100	70	-	-	60	--
	8-hour	160	120	-	-	100	9
NO_2	Annual	40	30	20	-	10	Not applicable
	24-hour#	120	50	-	-	25	9
	1-hour	-	-	-	-	200	18
SO_2	24-hour	125	50 →			40	3
	10-minute	-	-	-	-	500	3
CO	24-hour#	7 000	-	-	-	4 000	0
	8-hour	-	-	-	-	10 000	0
	1-hour	-	-	-	-	35 000 **(30 000 as HK's AQO)**	0
Pb	Annual	-	-	-	-	0.5	Not applicable

\# New parameters introduced in WHO's AQGs.

Current AQOs adopted.

Proposed updates of the AQOs.

Extracted from AQO review public consultation document

THANK YOU

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