

EMFAC-HK

Basic Training

April 24-25, 2012

Basic Training Components

- Model Overview
- EMFAC-HK Upgrades
- Using the Program
- Examples and Exercises

Model Introduction/Overview

- What you'll learn
 - Step by step tutorial to demonstrate examples of emission data routinely run by EMFAC-HK
 - Overview of what pollutants and processes are modeled
 - Editing fundamental data
 - Review sample output files

Reference Materials

- Software
- User's Manual
- Guideline on Modeling Vehicle Emissions, EPD, April 2012

EMFAC-HK

Model Overview

Model Overview

- Introduction
- Pollutants and Processes Modeled
- Overview of Basic Terminology
- Scenario Data
- Modeling Modes
- Editing Fundamental Data
- Exercises

Introduction

- **Emission estimate:** ‘product of an emission rate (e.g. grams per pollutant emitted over a mile or km) and vehicle activity (e.g. miles or km driven per day)’

Emission Factor X Source Activity = Emissions

Introduction (cont.)

- Vehicle tailpipe emissions are sensitive to driving patterns (In EMFAC, they are characterized by average vehicle speeds, ambient conditions, etc.)
- A common set of fleet-averaged vehicle emission factors, irrespective of driving patterns, are no longer accepted by advanced countries like the EU and the USA.

What is *EMFAC-HK*?

- A mobile source emissions model that calculates emission rates and emission estimates for motor vehicles operating on roads in Hong Kong.
- Adaptation of the California Air Resources Board (CARB) **EM**ission **FAC**tors (EMFAC) with modifications to cater for local factors such as local vehicle fleet characteristics.

What Is *EMFAC-HK*? (cont.)

- History
 - EMFAC-HK Version 1.2
 - used in HK since 2005
 - adapted from EMFAC2002 by CARB
 - EMFAC-HK Version 2.1
 - Released April 3, 2012
 - Adapted from EMFAC2009 by CARB

EMFAC-HK Version 1.2

- Consisted of Two Sub-models:
 - MC
 - 9 vehicle classes
 - TAXI
 - 7 vehicle classes
- 2003 calendar year baseline activity data

Introducing EMFAC-HK Version 2.1

- Released April 3, 2012
- Replaces EMFAC-HK Version 1.2
- Adapted from EMFAC 2009 from the California Air Resources Board (EMFAC2007)
- Modification of Vehicle Classes
 - Merged EMFAC-HK Version 1.2 MC and Taxi sub-models into single version.
- Increased Exhaust Technology Groups
- Hong Kong-Specific Data Added
- Increased Speed Distribution Bins

EMFAC-HK Version 2.1 (cont.)

- Consists of Two Sub-models:
 - **EmfacHKV2_1_BC.EXE**: Base Case Version. Valid for Calendar Years 1997-2012. NO Inspection and Maintenance (No I&M) applied. Used for back-casting.
 - 2010 calendar year baseline activity data forecasted for 2011-2012, or back-casted for 1997-2009).
 - **EmfacHKV2_1_I&M.EXE**: I&M Version. Programs Implemented. Valid for Calendar Years 2013-2040.
 - 2010 calendar year baseline activity data forecasted to the simulated calendar year (2013+)

Pollutants

- Hydrocarbons (HC) – can be expressed as the following:
 - TOG (**T**otal **O**rganic **G**ases, regardless of reactivity)
 - VOC (**V**olatile **O**rganic **C**ompounds), also known as reactive organic gases (**ROG**)
 - THC (**T**otal **H**ydro**C**arbons, compounds with H and C atoms only, carbonyls and halogens are not included)
 - CH₄ (methane)
- Carbon monoxide (CO)
- Nitrogen oxides (NO_x)

Pollutants (cont.)

- Carbon dioxide (CO₂)
- Particulate matter (PM)
 - PM estimates are provided either as total suspended particulate (30 microns or less), particulate matter 10 microns or less in diameter (PM₁₀), or particulate matter 2.5 microns or less in diameter (PM_{2.5}).
- Lead (do not use)
- Fuel consumption (by fuel type) (do not use)
 - calculated based on the emissions of CO, CO₂ and THC using the carbon balance equation

Exhaust

Evaporative

Other

EMISSIONS PROCESSES

Emission Processes

- Running Exhaust
- Idle Exhaust (should not use)
- Starting Exhaust
- Diurnal Evap (partial day, multi-day)
- Resting Loss Evap (partial day, multi-day)
- Hot Soak Evap
- Running Evap
- Tire Wear (should not use)
- Brake Wear (should not use)

Running Exhaust Emissions

- emissions that come out of the vehicle tailpipe while it is traveling on the road, including at speed, and idling that occurs as part of normal driving, such as at intersections.

Idle Exhaust Emissions – Do Not Use

- emissions that come out of the vehicle tailpipe while it is operating but not traveling any significant distance.
- This process captures emissions from vehicles that idle for extended periods of time.

Starting Exhaust Emissions

- tailpipe emissions that occur as a result of starting a catalyst-equipped vehicle when the catalyst is cold.
- These emissions are independent of running exhaust emissions and can be thought of as a slug of emissions associated with starting a vehicle .
- The magnitude of these emissions is dependent on how long the vehicle has been sitting prior to starting.

Diurnal Evaporative Emissions

- Hydrocarbon (HC) emissions that occur when rising ambient temperatures cause fuel evaporation from vehicles sitting throughout the day.
- These losses are from leaks in the fuel system, fuel hoses, connectors, and as a result of breakthrough of vapors from the carbon canister.
- If a vehicle is sitting for a period of time after running, emissions from the first 35 minutes are counted as hot soak and emissions from the remaining period are counted as diurnal emissions, provided that the ambient temperature is *increasing* during the remaining period of time.

Resting Loss Evaporative Emissions

- HC emissions from fuel permeation through rubber and plastic components while vehicle is sitting.
- Emissions are counted as resting loss emissions if the vehicle has not been operated for 35 minutes and vehicle is still stationary, but the ambient temperature is either constant or *decreasing*.

Hot Soak Evaporative Emissions

- HC emissions that occur immediately after a trip end due to fuel heating and the fact that the engine remains hot for a short time after being switched off.
- In older, carbureted vehicles these emissions are attributed to vapor losses from the carburetor float bowl. In newer, fuel-injected vehicles, these vapor losses come from leaky fuel injectors or from fuel hoses.

Running Losses Evap Emissions

- evaporative HC emissions that occur when hot fuel vapors escape from the fuel system or overwhelm the carbon canister while the vehicle is operating.

Tire Wear / Brake Wear (PM Only) (Do Not Use)

- **Tire wear:** particulate matter emissions from tires as a result of wear.
- **Brake wear:** particulate matter emissions from brake use (i.e., brake dust).

Vehicle Fleet and Vehicle Class

Fuel Type

Technology Group

Model Year

Activity

Population

VKT

Trips

BASIC TERMINOLOGY

Vehicle Fleet / Vehicle Class

- “Vehicle Fleet”
 - “**Vehicle fleet**” refers to the mixture of all the different types of motor vehicles operating on roads in Hong Kong.
- “Vehicle Class”
 - The fleet is broken into multiple categories called “**vehicle classes**” (for example, class 1, or private cars). These classes are based on the type of vehicle, but they also take weight class, fuel type (i.e. gas, diesel, or LPG), and usage into account.
 - EMFAC-HK Version 2.1 contains 16 vehicle classes, plus 5 unused “placeholders” for a total of 21 vehicle classes.

Fuel Type

- petrol vehicles (exhaust, evap)
- diesel vehicles (exhaust)
- **L**iquified **P**etroleum **G**as (LPG) vehicles (exhaust)

EMFAC-HK Version 2.1

Vehicle Classification Chart

Index	Vehicle Class Description	Fuel Type*	Gross Vehicle Weight (tonnes)	Code
1	Private Cars (PC)	ALL	ALL	PC
2	Placeholder (P1)	--	--	P1
3	Taxi	ALL	ALL	TAXI
4	Light Goods Vehicles (<=2.5t)	ALL	≤ 2.5	LGV3
5	Light Goods Vehicles (2.5-3.5t)	ALL	2.5-3.5	LGV4
6	Light Goods Vehicles (3.5-5.5t)	ALL	3.5-5.5	LGV6
7	Medium & Heavy Goods Vehicles (5.5-15t)	ALL	5.5-15	HGV7
8	Medium & Heavy Goods Vehicles (≥15t)	ALL	≥ 15	HGV8
9	Placeholder (P2)	--	--	P2
10	Placeholder (P3)	--	--	P3
11	Public Light Buses	ALL	ALL	PLB

* All: petrol, diesel, or LPG.

EMFAC-HK Version 2.1

Vehicle Classification Chart

Index	Vehicle Class Description	Fuel Type*	Gross Vehicle Weight (tonnes)	Code
12	Private Light Buses ($\leq 3.5t$)	ALL	≤ 3.5	PV4
13	Private Light Buses ($>3.5t$)	ALL	> 3.5	PV5
14	Non-franchised Buses ($<6.4t$)	ALL	< 6.4	NFB6
15	Non-franchised Buses (6.4-15t)	ALL	6.4-15	NFB7
16	Non-franchised Buses ($>15t$)	ALL	>15	NFB8
17	Single Deck Franchised Buses	ALL	ALL	FBSD
18	Double Deck Franchised Buses	ALL	ALL	FBDD
19	Motor Cycles	ALL	ALL	MC
20	Placeholder (P4)	--	--	P4
21	Placeholder (P5)	--	--	P5

* All: petrol, diesel, or LPG.

Technology Groups

- represents vehicles from the same class but have distinct emission control technologies; have similar in-use deterioration rates; and, respond the same to repair.
- can represent vehicles whose emissions standards (i.e., pre-Euro, Euro-I) are the same, or those that have specific equipment installed on them (e.g., multi-port fuel injection, three-way catalyst, adaptive fuel controls, etc.) which makes them behave the same.
- Separate technology groups for exhaust and evap

Exhaust Technology Group Indexes

Diesel Heavy Goods Vehicles with GVW of 5.5-15 t (HGV7)

HK Standard	Version 1.2 Technology Group Index	Version 2.1 Technology Group Index
pre-Euro	123	
pre-Euro with DOC	124	
Euro I	125	
Euro II	126	
Euro III	129	
Euro IV	130	
Euro V	131	
Euro VI	NA	135

Diesel Non-franchised Buses with GVW of 6.4-15 t except Franchised Buses (NFB7)

HK Standard	Version 1.2 Technology Group Index	Version 2.1 Technology Group Index
pre-Euro	123	43
pre-Euro with DOC	124	44
Euro I	125	45
Euro II	126	46
Euro III	129	99
Euro IV	130	100
Euro V	131	101
Euro VI	NA	105

Model Years

- Within each vehicle class, each model year is represented by a combination of technology groups (“phase-in” schedules).
- model calculates emission rates for 1965 to 2040 model years.

Calendar Years

- EMFAC-HK v 2.1 Base Case (BC) processes vehicle emission estimates for calendar years 1997 to 2012.
- EMFAC-HK v 2.1 Inspection & Maintenance (IM) processes vehicle emission estimates for calendar years 2013 to 2040.

Age

- How old a particular model year vehicle is relative to the calendar year
- Difference between the calendar year and model year, plus 1

Activity

- for each vehicle class and fuel type these terms are commonly referred to as vehicle activity:
 - Population
 - Accrual
 - Odometer
 - Vehicle Kilometers/Miles Travelled (VKT/VMT)
 - Trips

Population

- determined through an analysis of licensed vehicle database obtained from Transport Department. These data are used in developing vehicle age matrices for the base year, as well as forecast/backcasting population to other calendar years
 - EMFAC-HK v2.1: 2010 base year

Accrual

- Vehicle accrual is the total number of kilometers a vehicle accumulates in a year, and varies by vehicle age.
- Newer cars driven more than older cars

Vehicle Kilometers Traveled (VKT)

- represents total distance travelled on a weekday
- calculate based on vehicle population and vehicle accrual
- from estimates of VKT by vehicle type obtained from Annual Traffic Census. These VKT estimates matched by modifying either or both the vehicle population and accrual rates.

Starts/Trips

- Number of trips or starts is the number of times a vehicle is started for separate trips made per weekday
- Petrol and LPG emissions are affected by starts/trips.

Geographic Area

Calendar Year

Season or Month

Title

Model Years Included

Emissions Mode

Output Options

BASIC DATA FOR A SCENARIO

Basic Data for a Scenario

- Geographic area (Hong Kong)
- Calendar Years
 - EMFAC-HK v 2.1 BC: 1997 – 2012
 - EMFAC-HK v 2.1 IM: 2013 – 2040
- Title
- Month
- Model Years Included in calculation
- Emissions mode (Burden or EMFAC)
- Output formats, and
- Output options (frequency, pollutant form)

Mode Comparison

BURDEN

- Emissions estimates
- total emissions as tonnes per period (weekday or hour) for each pollutant, by vehicle class and the total vehicle fleet
- emission factors--corrected for ambient conditions and speeds--combined with vehicle activity to calculate emissions in tonnes per day

EMFAC

- Emission Factors (EFs) in terms of grams of pollutant emitted per vehicle activity
- Calculates matrix of EFs at specific values of T (0°C to 40°C), RH (0% to 100%), and vehicle speed (10 kph to 130 kph) for each vehicle class/technology combination.

BURDEN Output Options

- **Detailed Planning Inventory (CSV)** - a comma-separated file (with a “csv” extension) which can be read by any spreadsheet program. It contains emission estimates for all 16-vehicle classes by fuel type. It is recommended that new users select this as an output option to get an idea of the entire emissions.

BURDEN Output (cont.)

- **MVEI7G (BCD) File** - This is also a comma-separated file but it has a “bcd” extension. This file is in the same format as that produced by the MVEI7G model. This file has the same information as “Detailed Planning Inventory” but in columnar format, which makes it suitable for sorting using spreadsheets.

BURDEN Output (cont.)

- Weighted Model Year Activity Output (*.WT)
Gives the activity components like population, VKT, Trips, Accrual Rate and Odometer by model year.

BURDEN Output (cont.)

- **Detailed Outputs (BDN) File** - gives the Burden output for each vehicle class and emissions process by Model year, Tech groups and Speed bin (1.6, 8, or 16 kph) in a columnar, record-style format, which makes it suitable for importing to a spreadsheet or database. This format is useful for the air pollution modeling and planning communities.

Burden Report Output Types

Report Type	Description	Format	File Extension
Detailed Planning Inventory (CSV)	Contains emission estimates for all 16-vehicle classes by fuel type.	comma-separated	*.CSV
MVEI7G (BCD) File	Emissions Database for Planning.	comma-separated	*.BCD.CSV
Detailed Outputs (BDN)	Gives the Burden output by Model year, Tech groups and Speed bin.	comma-separated	*.BDN.CSV
Weighted Model Year Activity Output (WT)	Gives the Activity components like population, VKT, trips, accrual, and odometer by model year.	No delimiters	*.WT

Detailed Planning Inventory (*.csv)

HK_2015_2020_2030_Burden.csv - Microsoft Excel

Home Insert Page Layout Formulas Data Review View Add-Ins

Clipboard: Cut, Copy, Paste, Format Painter

Font: Calibri, 10, A, A, Bold, Italic, Underline, Text Color, Background Color

Alignment: Wrap Text, Merge & Center

Number: General, \$, %, .00, .00

Styles: Normal, Bad, Good, Neutral, Calculation, Check Cell

Cells: Insert, Delete, Format

Editing: AutoSum, Fill, Clear, Sort & Filter, Find & Select

A15 Run Exh

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
1	Title : Hong Kong SAR Annual 3 Yrs 2015 to 2030 Default Title																			
2	Version : Emfac-HK V2.1 (I and M) V2.1.1 120403 I&M Pr: Emfac-HK HK2.1.1 I&M Case																			
3	Run Date : 2012/04/10 10:41:48																			
4	Scen Year: 2015 -- All model years in the range 1971 to 2015 selected																			
5	Season : Annual																			
6	Area : Hong Kong SAR																			
7	I/M Stat : HK I/M program in effect																			
8	Emissions: Tonnes Per Day																			
9	*****																			
10		PC-NCAT	PC-CAT	PC-DSL	PC-LPG	PC-TOT	TAXI-NCAT	TAXI-CAT	TAXI-DSL	TAXI-LPG	TAXI-TOT	LGV<=2.5t	LGV<=2.5t	LGV<=2.5t	LGV<=2.5t	LGV<=2.5t	LGV2.5-3.5	LGV2.5-3.5	LGV2.5-3.5	LGV2.
11	Vehicles	381	460553	1543	0	462476	0	0	6	18237	18243	29	122	1001	0	1152	6	1105	42811	
12	VKT	8300	12734294	44399	0	12786993	0	0	2120	6908678	6910798	1877	8575	77105	0	87558	326	75411	3083650	
13	Trips	571	690829	2314	0	693715	0	0	22	72942	72965	115	487	4004	0	4607	23	4419	171226	
14	VOC Emissions																			
15	Run Exh	0.01735	0.36939	0.00499	0	0.39174	0	0	0.00108	0.45326	0.45433	0.01102	0.01036	0.00481	0	0.02619	0.00106	0.01418	0.13354	
16	Idle Exh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	Start Ex	0.00484	0.12363	0	0	0.12846	0	0	0	0.07527	0.07527	0.00154	0.00295	0	0	0.00448	0.00024	0.00396	0	
18	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
19	Total Ex	0.02219	0.49301	0.00499	0	0.5202	0	0	0.00108	0.52852	0.5296	0.01256	0.01331	0.00481	0	0.03067	0.0013	0.01814	0.13354	
20																				
21	Diurnal	0.00377	0.27071	0	0	0.27448	0	0	0	0	0	0.00048	0.00033	0	0	0.00081	0.00004	0.00147	0	
22	Hot Soak	0.00266	0.15965	0	0	0.16231	0	0	0	0	0	0.00098	0.00068	0	0	0.00166	0.00008	0.00283	0	
23	Running	0.01219	0.19929	0	0	0.21148	0	0	0	0	0	0.00452	0.00112	0	0	0.00564	0.00037	0.00494	0	
24	Resting	0.00509	0.28072	0	0	0.28072	0	0	0	0	0	0.00050	0.00036	0	0	0.00105	0.00006	0.00184	0	

MVEI7G CSV file (*.bcd.csv)

Debug_HK20Data.bcd.csv - Microsoft Excel

Home Insert Page Layout Formulas Data Review View Developer Acrobat

From Access From Web From Text From Other Sources Existing Connections Refresh All Properties Edit Links Connections Sort & Filter Filter Clear Reapply Advanced Text to Columns Remove Duplicates Data Validation Consolidate What-If Analysis Group Ungroup Subtotal Show Detail Hide Detail Outline

F3 6751

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	CALYR	START MYR	END MYR	REGION	SAR	STARTS	POPULATION	VKT/1000	VEH TYPE	VEH TECH	POLLUTANT	PROCESS	EMISSIONS	BASIS
2	2008	1965	2008	SAR Average	Hong Kong SAR Average	6751	4471	104	PC	NCAT	CO	Run Exh	5.2646	Day
3	2008	1965	2008	SAR Average	Hong Kong SAR Average	6751	4471	104	PC	NCAT	NOx	Run Exh	0.2657	Day
4	2008	1965	2008	SAR Average	Hong Kong SAR Average	6751	4471	104	PC	NCAT	SOx	Run Exh	0	Day
5	2008	1965	2008	SAR Average	Hong Kong SAR Average	6751	4471	104	PC	NCAT	PM	Run Exh	0.0021	Day
6	2008	1965	2008	SAR Average	Hong Kong SAR Average	6751	4471	104	PC	NCAT	Pb	Run Exh	0.0001	Day
7	2008	1965	2008	SAR Average	Hong Kong SAR Average	6751	4471	104	PC	NCAT	ROG	Run Exh	0.3957	Day
8	2008	1965	2008	SAR Average	Hong Kong SAR Average	6751	4471	104	PC	NCAT	CO2	Run Exh	33.1422	Day
9	2008	1965	2008	SAR Average	Hong Kong SAR Average	6751	4471	104	PC	NCAT	CO	Idle Exh	0	Day
10	2008	1965	2008	SAR Average	Hong Kong SAR Average	6751	4471	104	PC	NCAT	NOx	Idle Exh	0	Day
11	2008	1965	2008	SAR Average	Hong Kong SAR Average	6751	4471	104	PC	NCAT	SOx	Idle Exh	0	Day
12	2008	1965	2008	SAR Average	Hong Kong SAR Average	6751	4471	104	PC	NCAT	PM	Idle Exh	0	Day
13	2008	1965	2008	SAR Average	Hong Kong SAR Average	6751	4471	104	PC	NCAT	Pb	Idle Exh	0	Day
14	2008	1965	2008	SAR Average	Hong Kong SAR Average	6751	4471	104	PC	NCAT	ROG	Idle Exh	0	Day
15	2008	1965	2008	SAR Average	Hong Kong SAR Average	6751	4471	104	PC	NCAT	CO2	Idle Exh	0	Day
16	2008	1965	2008	SAR Average	Hong Kong SAR Average	6751	4471	104	PC	NCAT	CO	Start Ex	0.2129	Day
17	2008	1965	2008	SAR Average	Hong Kong SAR Average	6751	4471	104	PC	NCAT	NOx	Start Ex	0.0107	Day
18	2008	1965	2008	SAR Average	Hong Kong SAR Average	6751	4471	104	PC	NCAT	SOx	Start Ex	0	Day
19	2008	1965	2008	SAR Average	Hong Kong SAR Average	6751	4471	104	PC	NCAT	PM	Start Ex	0.0001	Day
20	2008	1965	2008	SAR Average	Hong Kong SAR Average	6751	4471	104	PC	NCAT	Pb	Start Ex	0	Day
21	2008	1965	2008	SAR Average	Hong Kong SAR Average	6751	4471	104	PC	NCAT	ROG	Start Ex	0.0348	Day
22	2008	1965	2008	SAR Average	Hong Kong SAR Average	6751	4471	104	PC	NCAT	CO2	Start Ex	1.357	Day
23	2008	1965	2008	SAR Average	Hong Kong SAR Average	6751	4471	104	PC	NCAT	CO	Total Ex	5.4775	Day
24	2008	1965	2008	SAR Average	Hong Kong SAR Average	6751	4471	104	PC	NCAT	NOx	Total Ex	0.2764	Day
25	2008	1965	2008	SAR Average	Hong Kong SAR Average	6751	4471	104	PC	NCAT	SOx	Total Ex	0	Day
26	2008	1965	2008	SAR Average	Hong Kong SAR Average	6751	4471	104	PC	NCAT	PM	Total Ex	0.0022	Day
27	2008	1965	2008	SAR Average	Hong Kong SAR Average	6751	4471	104	PC	NCAT	Pb	Total Ex	0.0001	Day
28	2008	1965	2008	SAR Average	Hong Kong SAR Average	6751	4471	104	PC	NCAT	ROG	Total Ex	0.4305	Day
29	2008	1965	2008	SAR Average	Hong Kong SAR Average	6751	4471	104	PC	NCAT	CO2	Total Ex	34.4992	Day
30	2008	1965	2008	SAR Average	Hong Kong SAR Average	6751	4471	104	PC	NCAT	CO	Hot Soak	0	Day
31	2008	1965	2008	SAR Average	Hong Kong SAR Average	6751	4471	104	PC	NCAT	NOx	Hot Soak	0	Day
32	2008	1965	2008	SAR Average	Hong Kong SAR Average	6751	4471	104	PC	NCAT	SOx	Hot Soak	0	Day
33	2008	1965	2008	SAR Average	Hong Kong SAR Average	6751	4471	104	PC	NCAT	PM	Hot Soak	0	Day
34	2008	1965	2008	SAR Average	Hong Kong SAR Average	6751	4471	104	PC	NCAT	Pb	Hot Soak	0	Day

Weighted Model Year Activity Output (*.WT)

UltraEdit - [C:\Documents and Settings\Arney\My Documents\My Projects\VERGEMFAC\HongKong\Task 6 - Testing\EPD Comments\20110216\Debug_HK20Data.wt]

File Edit Search Insert Project View Format Column Macro Scripting Advanced Window Help

C:\Documents and Settings\Arney\N

```

1
2 Calendar Year: 2008
3 Model Years: 1965 to 2008
4 Title: Hong Kong SAR Annual CYr 2008 Default Title
5 Area: Hong Kong
6 SubArea: Average
7 Program: Emfac-HK working draft V1.99.6.2 110210 Sp: InProgress; GUI (HK Units); 330 TG; HK2.0 Data; HK TG Desc;
8 Run Date: 2011/02/17 13:08:17
9
10 SCEN VEH VEH POP VKT/1000 TRIPS ACCRUAL ODOMETER
11 YEAR CLS TBCH MYR (number) (km/day) (per day) (km/yr/veh) (km/veh)
12
13 2008 1 NCAT 1965 21. 0.28 32. 4810. 241367.
14 2008 1 NCAT 1966 3. 0.04 5. 4824. 236557.
15 2008 1 NCAT 1967 6. 0.08 9. 4839. 231733.
16 2008 1 NCAT 1968 4. 0.05 6. 4853. 226894.
17 2008 1 NCAT 1969 11. 0.15 17. 4868. 222041.
18 2008 1 NCAT 1970 26. 0.35 39. 4884. 217173.
19 2008 1 NCAT 1971 16. 0.21 24. 4900. 212289.
20 2008 1 NCAT 1972 25. 0.34 38. 4916. 207389.
21 2008 1 NCAT 1973 47. 0.64 71. 4933. 202473.
22 2008 1 NCAT 1974 35. 0.47 53. 4951. 197540.
23 2008 1 NCAT 1975 23. 0.31 35. 4969. 192589.
24 2008 1 NCAT 1976 23. 0.31 35. 4988. 187620.
25 2008 1 NCAT 1977 41. 0.56 62. 5007. 182632.
26 2008 1 NCAT 1978 44. 0.61 66. 5028. 177625.
27 2008 1 NCAT 1979 43. 0.59 65. 5048. 172597.
28 2008 1 NCAT 1980 84. 1.17 127. 5070. 167549.
29 2008 1 NCAT 1981 85. 1.19 128. 5093. 162479.
30 2008 1 NCAT 1982 87. 1.22 131. 5116. 157386.
31 2008 1 NCAT 1983 32. 0.45 48. 5141. 152270.
32 2008 1 NCAT 1984 42. 0.59 63. 5166. 147129.
33 2008 1 NCAT 1985 104. 1.48 157. 5193. 141963.
34 2008 1 NCAT 1986 175. 2.50 264. 5221. 136770.
35 2008 1 NCAT 1987 209. 3.01 316. 5251. 131549.
36 2008 1 NCAT 1988 352. 5.09 532. 5282. 126298.
37 2008 1 NCAT 1989 552. 8.04 834. 5315. 121016.
38 2008 1 NCAT 1990 860. 12.61 1299. 5350. 115701.
39 2008 1 NCAT 1991 1492. 22.02 2253. 5387. 110351.
40 2008 1 NCAT 1992 2. 0.03 3. 5427. 104964.
41 2008 1 NCAT 1993 7. 0.10 11. 5469. 99537.
42 2008 1 NCAT 1994 15. 0.23 23. 5515. 94068.
43 2008 1 NCAT 1995 5. 0.08 8. 5564. 88553.
44 2008 1 NCAT 1996 0. 0.00 0. 0. 0.
45 2008 1 NCAT 1997 0. 0.00 0. 0. 0.

```


EMFAC Output Options

- Impact Rate Detail (RTL). This file generates detailed emission factors (g/km) for each vehicle class and technology group by speed bin. This file has an “RTL” extension, but is in a CSV format. Hence, any spreadsheet program can read this file. It is recommended that new users output this file to get a feel for the type of information generated in *EMFAC* mode.

EMFAC Report Output Types

Report Type	Description	Format	File Extension
Impact Rate Detail (RTL)	generates detailed emission factors by activity (i.e., g/km, g/trip) for each vehicle class and technology group by speed bin.	comma-separated	*.RTL

EMFAC Impact Rate Detail Format (*.RTL)

HK_2015_EMFAC.rtl.csv - Microsoft Excel

Home Insert Page Layout Formulas Data Review View Add-Ins

Clipboard Font Alignment Number Styles Cells Editing

Title : Hong Kong SAR Annual Cvr 2015 Default Title

1	Title : Hong Kong SAR Annual Cvr 2015 Default Title																								
2	Version : Emfac-HK V2.1 (I and M) V2.1.1 120403 I&M Pr: Emfac-HK HK2.1.1 I&M Case																								
3	Run Date : 2012/04/10 10:43:09																								
4	Scen Year: 2015 -- All model years in the range 1971 to 2015 selected																								
5	Season : Annual																								
6	Area : Hong Kong																								
7	*****																								
8	Year: 2015 -- Model Years 1971 to 2015 Inclusive -- Annual																								
9	Emfac-HK V2.1 (I and M) Emission Factors: V2.1.1 120403 I&M Pr: Emfac-HK HK2.1.1 I&M Case																								
10																									
11	SAR Average Hong Kong SAR Average																								
12																									
13	Table 1: Running Exhaust Emissions (grams/km; grams/idle-hour)																								
14																									
15	Pollutant Name: Volatile Org Cpds Temperature: 25C Relative Humidity: 40%																								
16																									
17	Speed	PC	PC	PC	PC	PC	TAXI	TAXI	TAXI	TAXI	TAXI	LGV3	LGV3	LGV3	LGV3	LGV3	LGV4	LGV4	LGV4	LGV4	LGV4	LGV4	LGV6	LGV6	LGV6
18	km/hr	NCAT	CAT	DSL	LPG	ALL	NCAT	CAT	DSL	LPG	ALL	NCAT	CAT	DSL	LPG	ALL	NCAT	CAT	DSL	LPG	ALL	NCAT	CAT	DSL	
19																									
20	10	5.7953	0.1153	0.288	0	0.1195	0	0	1.1457	0.282	0.2822	16.6227	4.1253	0.1616	0	0.9027	9.3446	0.677	0.1122	0	0.1267	0	0	1.9453	
21	20	3.8593	0.0706	0.2154	0	0.0736	0	0	0.8566	0.1563	0.1565	12.4642	1.8887	0.1208	0	0.5586	7.0002	0.3179	0.0839	0	0.0902	0	0	0.8979	
22	30	2.7542	0.0466	0.1666	0	0.0488	0	0	0.6626	0.0932	0.0934	9.0795	1.4335	0.0935	0	0.4174	5.0922	0.2301	0.0649	0	0.0694	0	0	0.3446	
23	40	2.1077	0.033	0.1333	0	0.0347	0	0	0.5302	0.0619	0.0621	6.4689	1.3147	0.0748	0	0.3333	3.6206	0.2043	0.0519	0	0.056	0	0	0.2579	
24	50	1.7311	0.0252	0.1104	0	0.0266	0	0	0.439	0.0453	0.0455	4.6321	1.186	0.0619	0	0.27	2.5853	0.1886	0.043	0	0.0467	0	0	0.1979	

Other Output Options

- Output Frequency (BURDEN mode Only)
 - Daily (average weekday), or
 - hourly (values for all 24-hours, and includes daily total). Note: hourly generates 25 times more output, which can lead to very large output files.
- Output Particulate As...
 - User selects either total PM, PM_{10} (or RSP), or $PM_{2.5}$
- Output Hydrocarbon As..
 - User selects either TOG, THC, VOC, or CH₄

Exhaust Tech Fractions

Evap Tech Fractions

Population

Accrual

Trips

VKT

RVP

Speed Fractions

Temperature

Relative Humidity

EDITING FUNDAMENTAL DATA

Editing Fundamental Data – Tech / IM

! **SEQUENCE** of edits

Multiple Scenario Model

- **Exhaust Technology Fraction**

- *Apply to model year / model year range*

- *Apply to other vehicle classes*

- *Technology specific*

- **Evaporative Technology Fractions**

- *Petrol vehicles only*

Editing Fundamental Data - Activity

! **SEQUENCE** of edits

Edits applied proportionally

- **Population**

- *Edits applied proportionally*

- *Edits by vehicle, fuel, and age*

- *Age distributions*

- **Accrual** (defn.) *annual distance driven*

- *Population weighted accrual rates*

- *Edits by vehicle class, fuel and age*

- **Trips** *based on the number of engine on to off events*

- *Edits by vehicle class, fuel and hour (hourly model!)*

- **VKT**

- *Edits by vehicle class, fuel and hour*

Editing Fundamental Data - Profile/Speeds

- **RVP** (*evap emissions for petrol vehicles only*)
- **Speed Fractions**
 - *Edits by vehicle class, hour and speed bin*
 - *Apply changes to this hour / vehicle class*
 - *Apply to others*

Editing Fundamental Data - Temperature/RH Profiles

- **Temperature**
 - *Edits by hour*
 - *Modify for range of hours*
- **Relative Humidity (RH)**
 - *Edits by hour*
 - *Modify for range of hours*

END OF MODEL OVERVIEW