Training Exercises

Exercise Setup

- Folders for each Exercise
- Save input/output to folders for each Exercise
- Exercises require MS Office 2007 (Excel).

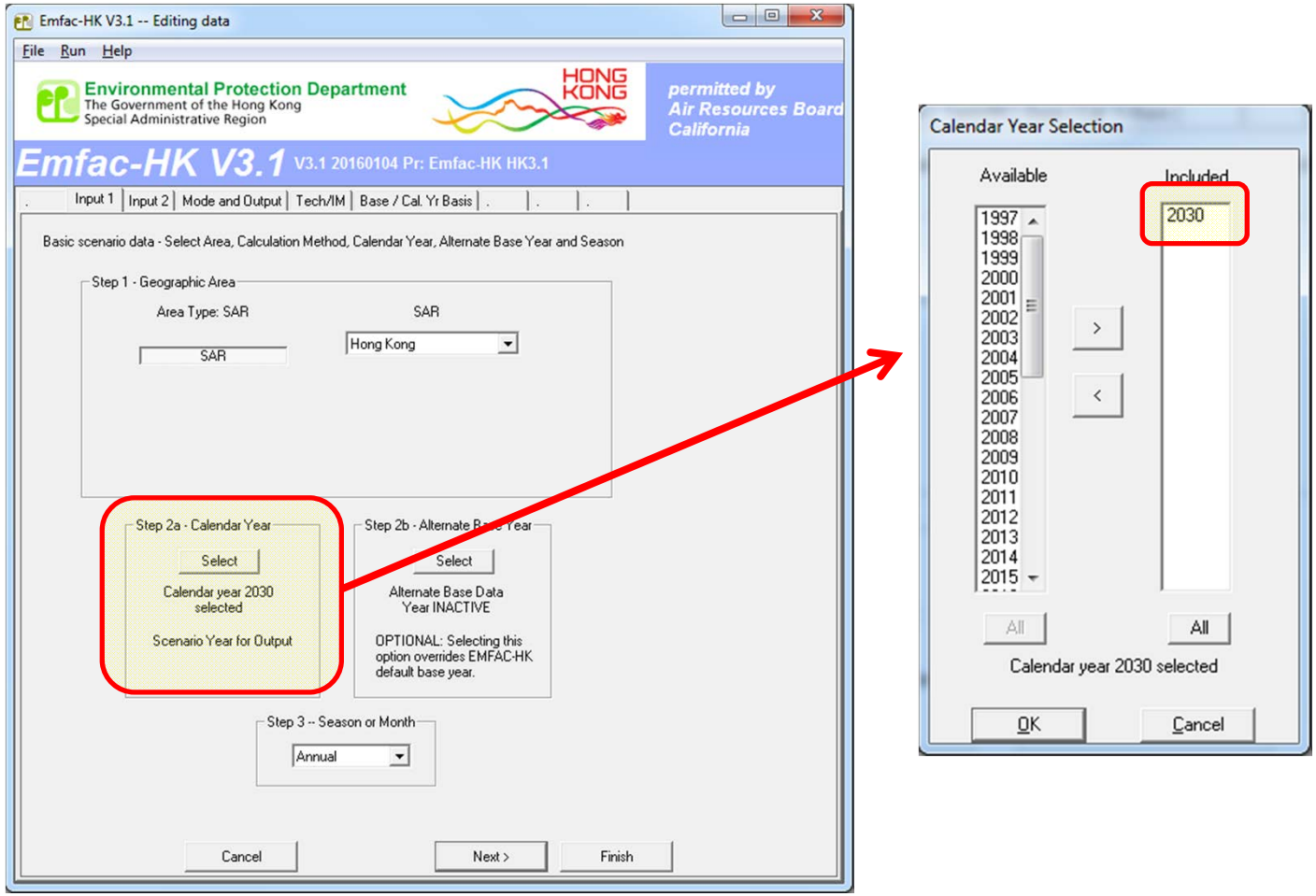
Exercise #1: Daily Emissions Inventory

- Problem: This exercise will generate an average daily emissions inventory for Hong Kong for calendar year 2030. Assume model defaults, except as noted below. I/M programs begin in 2014.
- Purpose: familiarization with emission inventories; using BURDEN output formats
- Scenario input data:
  - Geographic Area: Hong Kong SAR
  - Calendar Years: 2030
  - No Alternate Baseline Year
  - Season: Annual
  - Scenario Type: BURDEN
  - Output File types: Detailed Planning Inventory (CSV), MVEI7G (BCD)
  - Output Frequency: daily
  - Pollutants: PM10, VOC

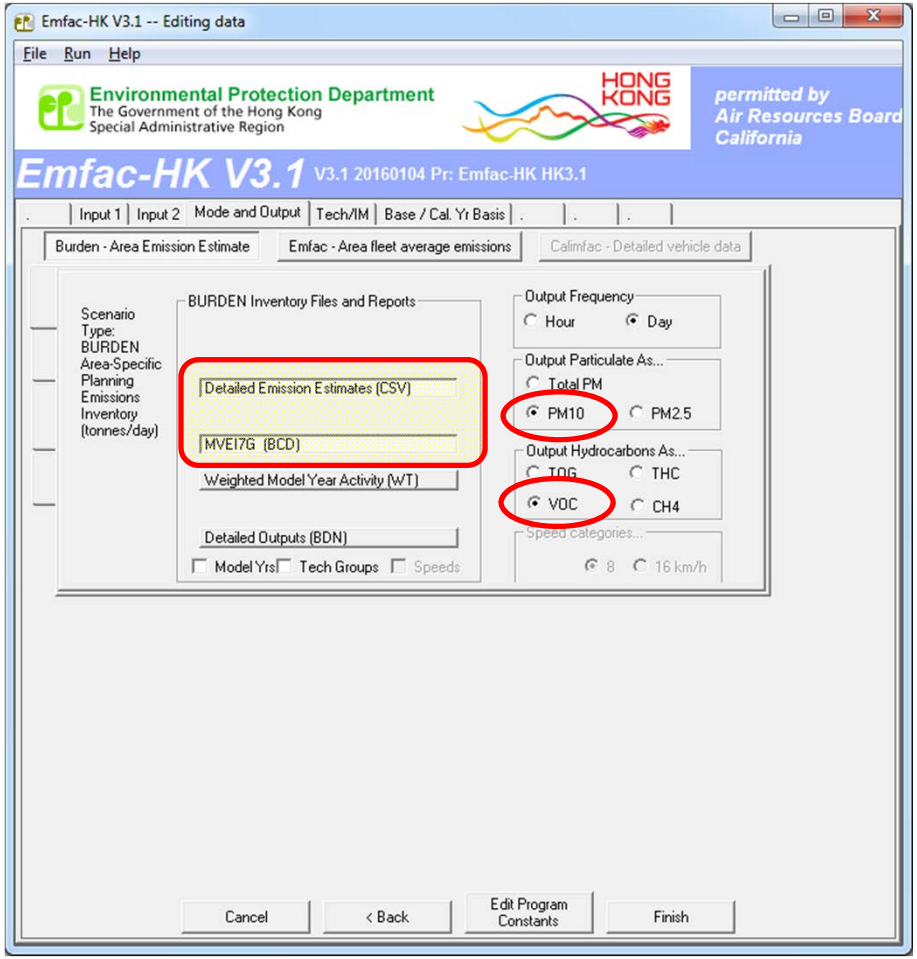
Exercise #1: Notes

- Requires 1 scenario for calendar year 2030
- Save Input File As: HK_2030_Burden.inp

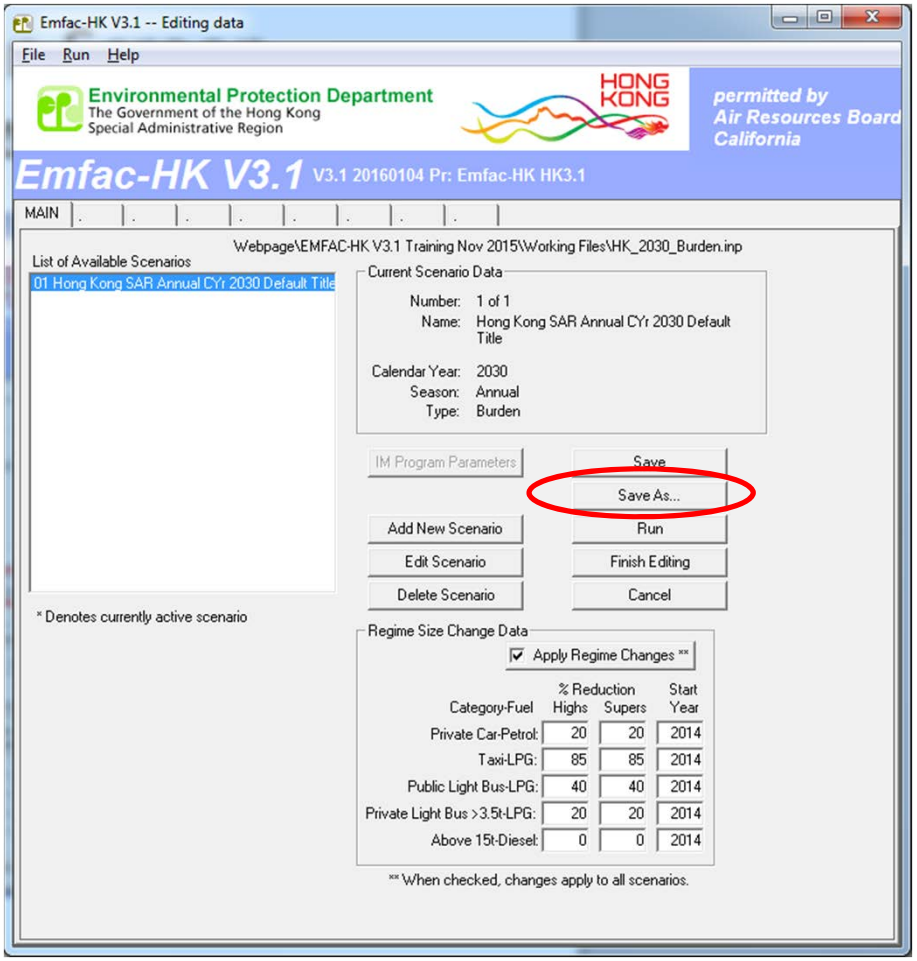
Exercise #1: Input 1 Tab



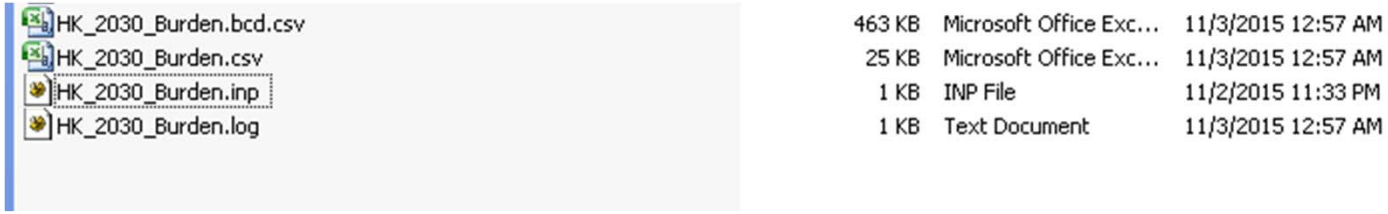
Exercise #1: Mode and Output Tab



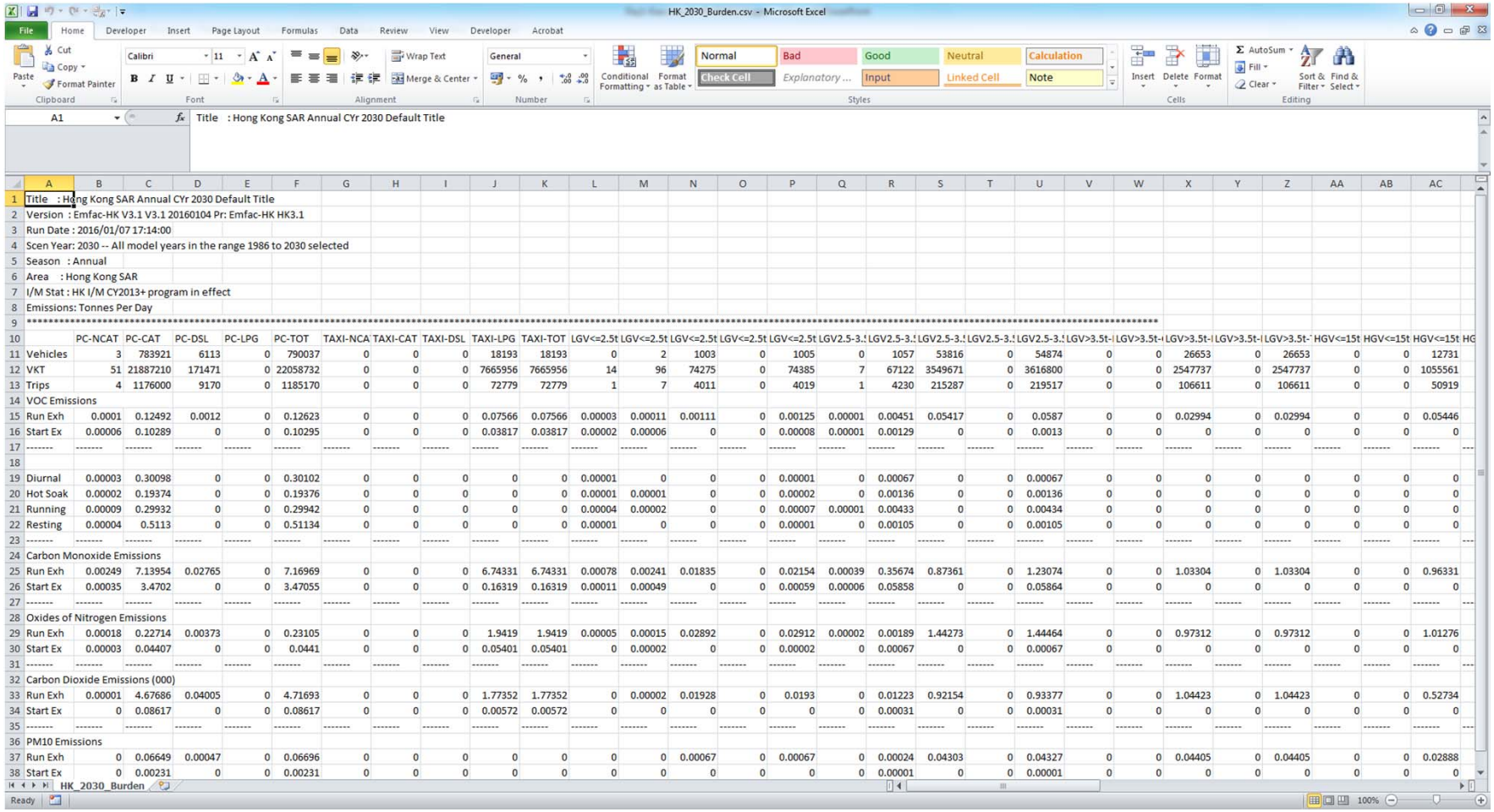
Exercise #1: Main Screen After All Edits Applied



Exercise #1: Output Generated



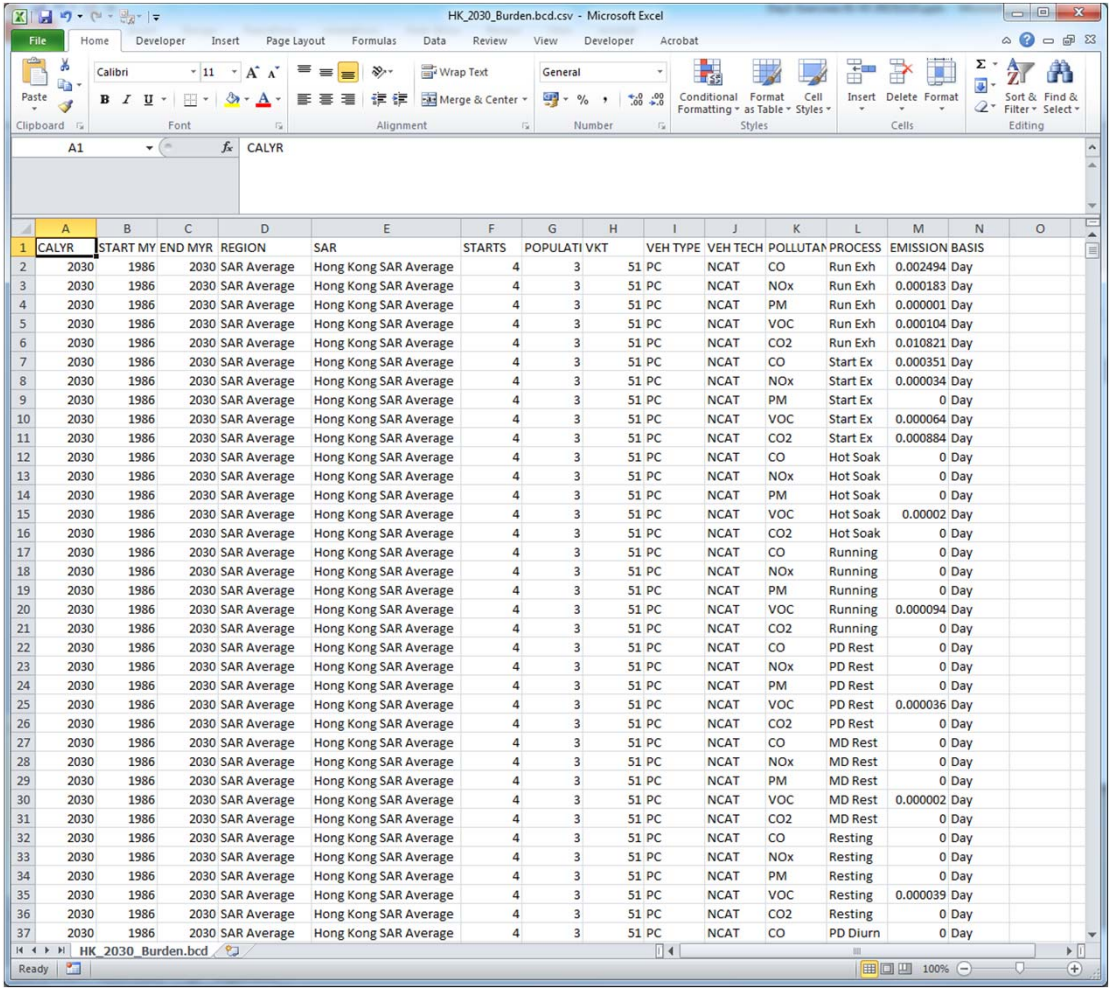
Exercise #1: Format of the BURDEN Text File with *.CSV extension



HK_2030_Burden.csv - Microsoft Excel

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC
1	Title : Hong Kong SAR Annual CYr 2030 Default Title																												
2	Version : Emfac-HK V3.1 V3.1 20160104 Pr: Emfac-HK HK3.1																												
3	Run Date : 2016/01/07 17:14:00																												
4	Scen Year: 2030 -- All model years in the range 1986 to 2030 selected																												
5	Season : Annual																												
6	Area : Hong Kong SAR																												
7	I/M Stat : HK I/M CY2013+ program in effect																												
8	Emissions: Tonnes Per Day																												
9	**********																												
10		PC-NCAT	PC-CAT	PC-DSL	PC-LPG	PC-TOT	TAXI-NCA	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	LGV2.5-3.5	LGV>3.5t-1	LGV>3.5t-1	LGV>3.5t-1	LGV>3.5t-1	LGV>3.5t-1	HGV<=15t	HGV<=15t	HGV<=15t	HG
11	Vehicles	3	783921	6113	0	790037	0	0	0	18193	18193	0	2	1003	0	1005	0	1057	53816	0	54874	0	0	26653	0	26653	0	0	12731
12	VKT	51	21887210	171471	0	22058732	0	0	0	7665956	7665956	14	96	74275	0	74385	7	67122	3549671	0	3616800	0	0	2547737	0	2547737	0	0	1055561
13	Trips	4	1176000	9170	0	1185170	0	0	0	72779	72779	1	7	4011	0	4019	1	4230	215287	0	219517	0	0	106611	0	106611	0	0	50919
14	VOC Emissions																												
15	Run Exh	0.0001	0.12492	0.0012	0	0.12623	0	0	0	0.07566	0.07566	0.00003	0.00011	0.00111	0	0.00125	0.00001	0.00451	0.05417	0	0.0587	0	0	0.02994	0	0.02994	0	0	0.05446
16	Start Ex	0.00006	0.10289	0	0	0.10295	0	0	0	0.03817	0.03817	0.00002	0.00006	0	0	0.00008	0.00001	0.00129	0	0	0.0013	0	0	0	0	0	0	0	0
17	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	---
18																													
19	Diurnal	0.00003	0.30098	0	0	0.30102	0	0	0	0	0	0.00001	0	0	0	0.00001	0	0.00067	0	0	0.00067	0	0	0	0	0	0	0	0
20	Hot Soak	0.00002	0.19374	0	0	0.19376	0	0	0	0	0	0.00001	0.00001	0	0	0.00002	0	0.00136	0	0	0.00136	0	0	0	0	0	0	0	0
21	Running	0.00009	0.29932	0	0	0.29942	0	0	0	0	0	0.00004	0.00002	0	0	0.00007	0.00001	0.00433	0	0	0.00434	0	0	0	0	0	0	0	0
22	Resting	0.00004	0.5113	0	0	0.51134	0	0	0	0	0	0.00001	0	0	0	0.00001	0	0.00105	0	0	0.00105	0	0	0	0	0	0	0	0
23	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	---
24	Carbon Monoxide Emissions																												
25	Run Exh	0.00249	7.13954	0.02765	0	7.16969	0	0	0	6.74331	6.74331	0.00078	0.00241	0.01835	0	0.02154	0.00039	0.35674	0.87361	0	1.23074	0	0	1.03304	0	1.03304	0	0	0.96331
26	Start Ex	0.00035	3.4702	0	0	3.47055	0	0	0	0.16319	0.16319	0.00011	0.00049	0	0	0.00059	0.00006	0.05858	0	0	0.05864	0	0	0	0	0	0	0	0
27	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	---
28	Oxides of Nitrogen Emissions																												
29	Run Exh	0.00018	0.22714	0.00373	0	0.23105	0	0	0	1.9419	1.9419	0.00005	0.00015	0.02892	0	0.02912	0.00002	0.00189	1.44273	0	1.44464	0	0	0.97312	0	0.97312	0	0	1.01276
30	Start Ex	0.00003	0.04407	0	0	0.0441	0	0	0	0.05401	0.05401	0	0.00002	0	0	0.00002	0	0.00067	0	0	0.00067	0	0	0	0	0	0	0	0
31	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	---
32	Carbon Dioxide Emissions (000)																												
33	Run Exh	0.00001	4.67686	0.04005	0	4.71693	0	0	0	1.77352	1.77352	0	0.00002	0.01928	0	0.0193	0	0.01223	0.92154	0	0.93377	0	0	1.04423	0	1.04423	0	0	0.52734
34	Start Ex	0	0.08617	0	0	0.08617	0	0	0	0.00572	0.00572	0	0	0	0	0	0	0.00031	0	0	0.00031	0	0	0	0	0	0	0	0
35	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	---
36	PM10 Emissions																												
37	Run Exh	0	0.06649	0.00047	0	0.06696	0	0	0	0	0	0	0	0.00067	0	0.00067	0	0.00024	0.04303	0	0.04327	0	0	0.04405	0	0.04405	0	0	0.02888
38	Start Ex	0	0.00231	0	0	0.00231	0	0	0	0	0	0	0	0	0	0	0	0.00001	0	0	0.00001	0	0	0	0	0	0	0	0

Exercise #1: Format of the MVEI7G File with *.BCD.CSV Extension



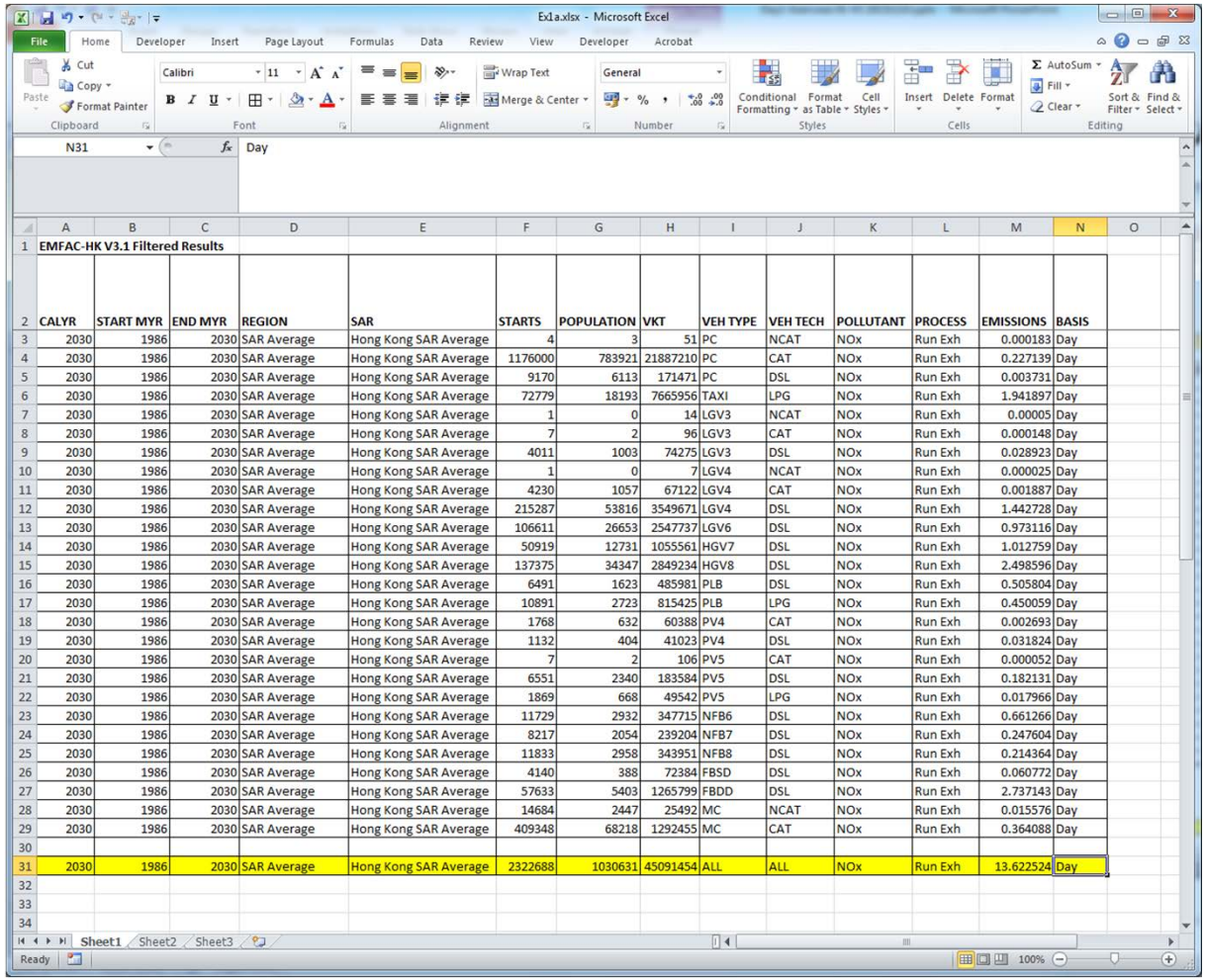
HK_2030_Burden.bcd.csv - Microsoft Excel

CALYR	START MY	END MYR	REGION	SAR	STARTS	POPULATI	VKT	VEH TYPE	VEH TECH	POLLUTAN	PROCESS	EMISSION	BASIS
2030	1986	2030	SAR Average	Hong Kong SAR Average	4	3	51	PC	NCAT	CO	Run Exh	0.002494	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	4	3	51	PC	NCAT	NOx	Run Exh	0.000183	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	4	3	51	PC	NCAT	PM	Run Exh	0.000001	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	4	3	51	PC	NCAT	VOC	Run Exh	0.000104	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	4	3	51	PC	NCAT	CO2	Run Exh	0.010821	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	4	3	51	PC	NCAT	CO	Start Ex	0.000351	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	4	3	51	PC	NCAT	NOx	Start Ex	0.000034	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	4	3	51	PC	NCAT	PM	Start Ex	0	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	4	3	51	PC	NCAT	VOC	Start Ex	0.000064	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	4	3	51	PC	NCAT	CO2	Start Ex	0.000884	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	4	3	51	PC	NCAT	CO	Hot Soak	0	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	4	3	51	PC	NCAT	NOx	Hot Soak	0	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	4	3	51	PC	NCAT	PM	Hot Soak	0	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	4	3	51	PC	NCAT	VOC	Hot Soak	0.00002	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	4	3	51	PC	NCAT	CO2	Hot Soak	0	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	4	3	51	PC	NCAT	CO	Running	0	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	4	3	51	PC	NCAT	NOx	Running	0	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	4	3	51	PC	NCAT	PM	Running	0	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	4	3	51	PC	NCAT	VOC	Running	0.000094	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	4	3	51	PC	NCAT	CO2	Running	0	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	4	3	51	PC	NCAT	CO	PD Rest	0	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	4	3	51	PC	NCAT	NOx	PD Rest	0	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	4	3	51	PC	NCAT	PM	PD Rest	0	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	4	3	51	PC	NCAT	VOC	PD Rest	0.000036	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	4	3	51	PC	NCAT	CO2	PD Rest	0	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	4	3	51	PC	NCAT	CO	MD Rest	0	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	4	3	51	PC	NCAT	NOx	MD Rest	0	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	4	3	51	PC	NCAT	PM	MD Rest	0	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	4	3	51	PC	NCAT	VOC	MD Rest	0.000002	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	4	3	51	PC	NCAT	CO2	MD Rest	0	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	4	3	51	PC	NCAT	CO	Resting	0	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	4	3	51	PC	NCAT	NOx	Resting	0	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	4	3	51	PC	NCAT	PM	Resting	0	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	4	3	51	PC	NCAT	VOC	Resting	0.000039	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	4	3	51	PC	NCAT	CO2	Resting	0	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	4	3	51	PC	NCAT	CO	PD Diurn	0	Day

Exercise #1a: Processing BCD Output

- Problem: using BCD output from Exercise #1, determine total NOx running exhaust emissions for 2030.
- Purpose: post processing of BCD output, single year scenario
- Hints:
  - Import *.BCD.CSV directly into spreadsheet
  - Use data filters
    - pollutant (NOx), process (“Run Exh”)
  - Copy filtered results to a separate tab in spreadsheet for analysis

Exercise #1a: Solution



Ex1a.xlsx - Microsoft Excel

N31: Day

EMFAC-HK V3.1 Filtered Results

CALYR	START MYR	END MYR	REGION	SAR	STARTS	POPULATION	VKT	VEH TYPE	VEH TECH	POLLUTANT	PROCESS	EMISSIONS	BASIS
2030	1986	2030	SAR Average	Hong Kong SAR Average	4	3	51	PC	NCAT	NOx	Run Exh	0.000183	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	1176000	783921	21887210	PC	CAT	NOx	Run Exh	0.227139	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	9170	6113	171471	PC	DSL	NOx	Run Exh	0.003731	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	72779	18193	7665956	TAXI	LPG	NOx	Run Exh	1.941897	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	1	0	14	LGV3	NCAT	NOx	Run Exh	0.00005	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	7	2	96	LGV3	CAT	NOx	Run Exh	0.000148	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	4011	1003	74275	LGV3	DSL	NOx	Run Exh	0.028923	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	1	0	7	LGV4	NCAT	NOx	Run Exh	0.000025	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	4230	1057	67122	LGV4	CAT	NOx	Run Exh	0.001887	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	215287	53816	3549671	LGV4	DSL	NOx	Run Exh	1.442728	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	106611	26653	2547737	LGV6	DSL	NOx	Run Exh	0.973116	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	50919	12731	1055561	HGV7	DSL	NOx	Run Exh	1.012759	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	137375	34347	2849234	HGV8	DSL	NOx	Run Exh	2.498596	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	6491	1623	485981	PLB	DSL	NOx	Run Exh	0.505804	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	10891	2723	815425	PLB	LPG	NOx	Run Exh	0.450059	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	1768	632	60388	PV4	CAT	NOx	Run Exh	0.002693	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	1132	404	41023	PV4	DSL	NOx	Run Exh	0.031824	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	7	2	106	PV5	CAT	NOx	Run Exh	0.000052	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	6551	2340	183584	PV5	DSL	NOx	Run Exh	0.182131	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	1869	668	49542	PV5	LPG	NOx	Run Exh	0.017966	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	11729	2932	347715	NFB6	DSL	NOx	Run Exh	0.661266	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	8217	2054	239204	NFB7	DSL	NOx	Run Exh	0.247604	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	11833	2958	343951	NFB8	DSL	NOx	Run Exh	0.214364	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	4140	388	72384	FBSD	DSL	NOx	Run Exh	0.060772	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	57633	5403	1265799	FBDD	DSL	NOx	Run Exh	2.737143	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	14684	2447	25492	MC	NCAT	NOx	Run Exh	0.015576	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	409348	68218	1292455	MC	CAT	NOx	Run Exh	0.364088	Day
2030	1986	2030	SAR Average	Hong Kong SAR Average	2322688	1030631	45091454	ALL	ALL	NOx	Run Exh	13.622524	Day

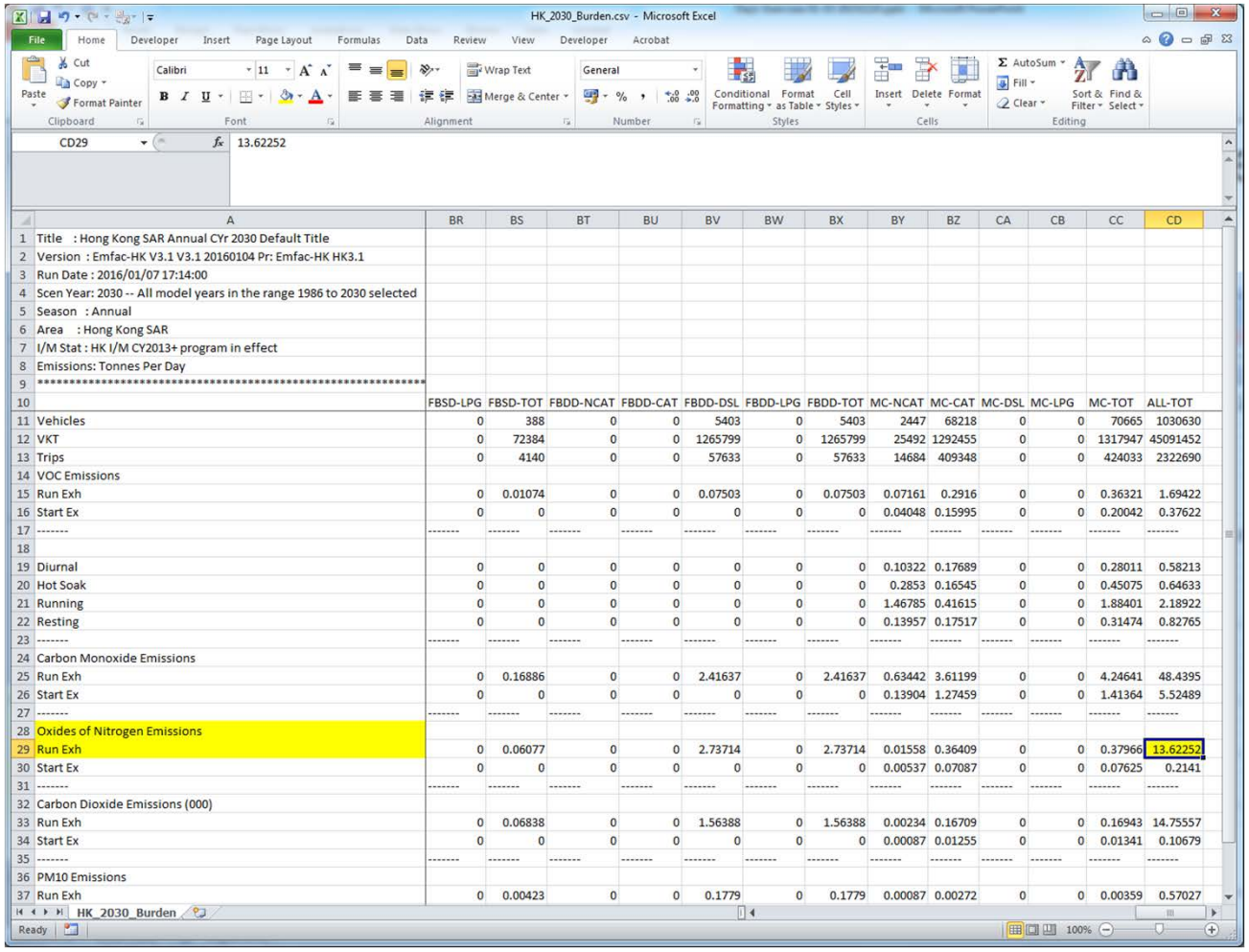
Sheet1 Sheet2 Sheet3

Ready

Exercise #1b: Processing Text/CSV Output

- Problem: using Text/CSV output from Exercise #1, determine total NOx running exhaust emissions for 2030.
- Post processing of Text/CSV output

Exercise #1b: Processing Text/CSV Output

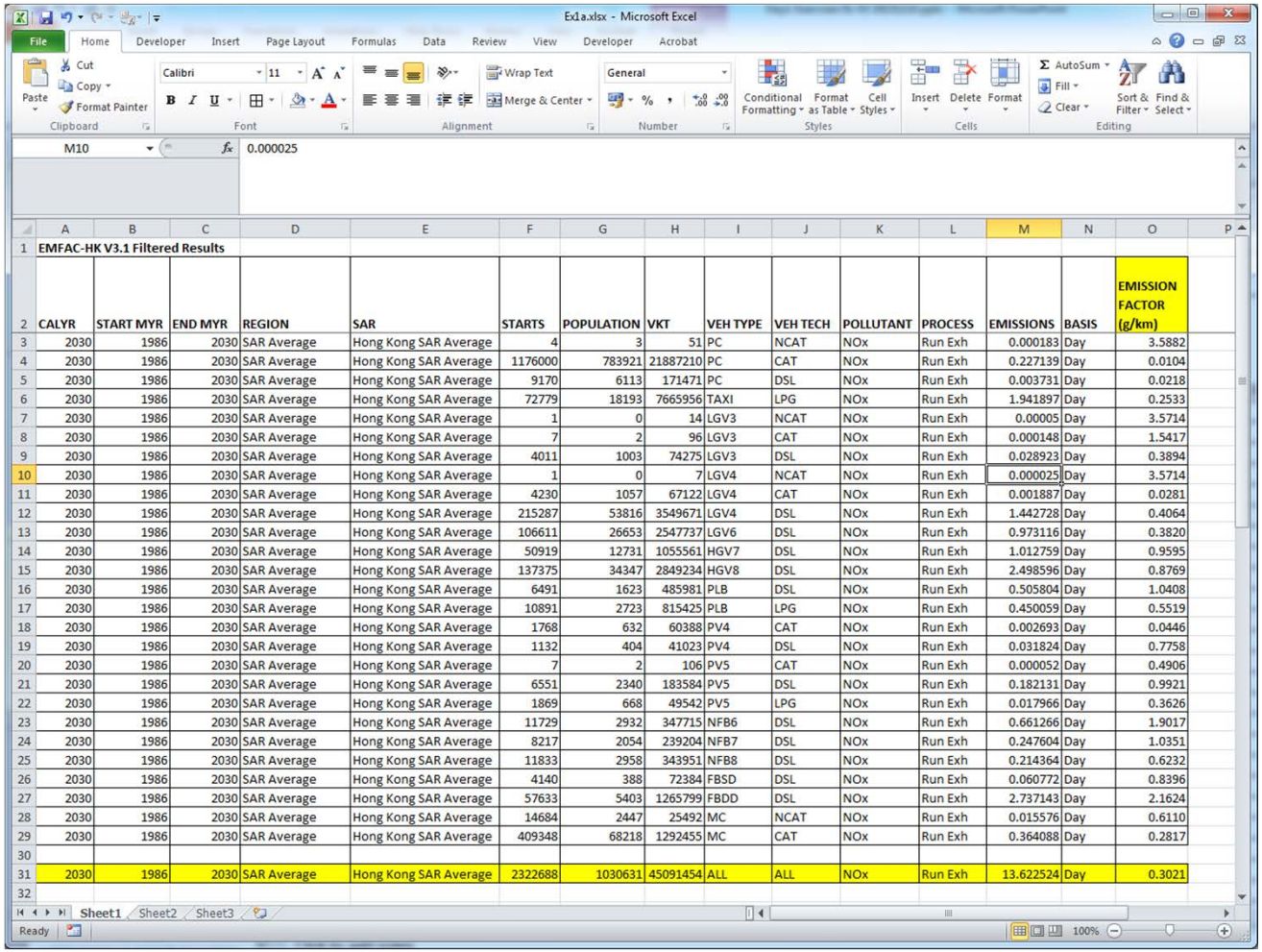


	A	BR	BS	BT	BU	BV	BW	BX	BY	BZ	CA	CB	CC	CD
1	Title : Hong Kong SAR Annual CYr 2030 Default Title													
2	Version : Emfac-HK V3.1 V3.1 20160104 Pr: Emfac-HK HK3.1													
3	Run Date : 2016/01/07 17:14:00													
4	Scen Year: 2030 -- All model years in the range 1986 to 2030 selected													
5	Season : Annual													
6	Area : Hong Kong SAR													
7	I/M Stat : HK I/M CY2013+ program in effect													
8	Emissions: Tonnes Per Day													
9	**********													
10		FBSD-LPG	FBSD-TOT	FBDD-NCAT	FBDD-CAT	FBDD-DSL	FBDD-LPG	FBDD-TOT	MC-NCAT	MC-CAT	MC-DSL	MC-LPG	MC-TOT	ALL-TOT
11	Vehicles	0	388	0	0	5403	0	5403	2447	68218	0	0	70665	1030630
12	VKT	0	72384	0	0	1265799	0	1265799	25492	1292455	0	0	1317947	45091452
13	Trips	0	4140	0	0	57633	0	57633	14684	409348	0	0	424033	2322690
14	VOC Emissions													
15	Run Exh	0	0.01074	0	0	0.07503	0	0.07503	0.07161	0.2916	0	0	0.36321	1.69422
16	Start Ex	0	0	0	0	0	0	0	0.04048	0.15995	0	0	0.20042	0.37622
17	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
18														
19	Diurnal	0	0	0	0	0	0	0	0.10322	0.17689	0	0	0.28011	0.58213
20	Hot Soak	0	0	0	0	0	0	0	0.2853	0.16545	0	0	0.45075	0.64633
21	Running	0	0	0	0	0	0	0	1.46785	0.41615	0	0	1.88401	2.18922
22	Resting	0	0	0	0	0	0	0	0.13957	0.17517	0	0	0.31474	0.82765
23	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
24	Carbon Monoxide Emissions													
25	Run Exh	0	0.16886	0	0	2.41637	0	2.41637	0.63442	3.61199	0	0	4.24641	48.4395
26	Start Ex	0	0	0	0	0	0	0	0.13904	1.27459	0	0	1.41364	5.52489
27	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
28	Oxides of Nitrogen Emissions													
29	Run Exh	0	0.06077	0	0	2.73714	0	2.73714	0.01558	0.36409	0	0	0.37966	13.62252
30	Start Ex	0	0	0	0	0	0	0	0.00537	0.07087	0	0	0.07625	0.2141
31	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
32	Carbon Dioxide Emissions (000)													
33	Run Exh	0	0.06838	0	0	1.56388	0	1.56388	0.00234	0.16709	0	0	0.16943	14.75557
34	Start Ex	0	0	0	0	0	0	0	0.00087	0.01255	0	0	0.01341	0.10679
35	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
36	PM10 Emissions													
37	Run Exh	0	0.00423	0	0	0.1779	0	0.1779	0.00087	0.00272	0	0	0.00359	0.57027

Exercise #1c: Determine Fleet-Average Emissions

- Problem: using spreadsheet results obtained in Exercise #1a, determine the *fleet-average* NOx emission factor (gram/km) for all vehicles for 2030.
- Purpose: Convert emission rate to an emission factor
- Steps
  - Divide EMISSIONS Column by VKT Column
  - Sum over all vehicle classes to get composite.
  - Convert units to obtain grams/km

Exercise #1c: Solution



Ex1a.xlsx - Microsoft Excel

M10: 0.000025

EMFAC-HK V3.1 Filtered Results

CALYR	START MYR	END MYR	REGION	SAR	STARTS	POPULATION	VKT	VEH TYPE	VEH TECH	POLLUTANT	PROCESS	EMISSIONS	BASIS	EMISSION FACTOR (g/km)
2030	1986	2030	SAR Average	Hong Kong SAR Average	4	3	51	PC	NCAT	NOx	Run Exh	0.000183	Day	3.5882
2030	1986	2030	SAR Average	Hong Kong SAR Average	1176000	783921	21887210	PC	CAT	NOx	Run Exh	0.227139	Day	0.0104
2030	1986	2030	SAR Average	Hong Kong SAR Average	9170	6113	171471	PC	DSL	NOx	Run Exh	0.003731	Day	0.0218
2030	1986	2030	SAR Average	Hong Kong SAR Average	72779	18193	7665956	TAXI	LPG	NOx	Run Exh	1.941897	Day	0.2533
2030	1986	2030	SAR Average	Hong Kong SAR Average	1	0	14	LGV3	NCAT	NOx	Run Exh	0.00005	Day	3.5714
2030	1986	2030	SAR Average	Hong Kong SAR Average	7	2	96	LGV3	CAT	NOx	Run Exh	0.000148	Day	1.5417
2030	1986	2030	SAR Average	Hong Kong SAR Average	4011	1003	74275	LGV3	DSL	NOx	Run Exh	0.028923	Day	0.3894
2030	1986	2030	SAR Average	Hong Kong SAR Average	1	0	7	LGV4	NCAT	NOx	Run Exh	0.000025	Day	3.5714
2030	1986	2030	SAR Average	Hong Kong SAR Average	4230	1057	67122	LGV4	CAT	NOx	Run Exh	0.001887	Day	0.0281
2030	1986	2030	SAR Average	Hong Kong SAR Average	215287	53816	3549671	LGV4	DSL	NOx	Run Exh	1.442728	Day	0.4064
2030	1986	2030	SAR Average	Hong Kong SAR Average	106611	26653	2547737	LGV6	DSL	NOx	Run Exh	0.973116	Day	0.3820
2030	1986	2030	SAR Average	Hong Kong SAR Average	50919	12731	1055561	HGV7	DSL	NOx	Run Exh	1.012759	Day	0.9595
2030	1986	2030	SAR Average	Hong Kong SAR Average	137375	34347	2849234	HGV8	DSL	NOx	Run Exh	2.498596	Day	0.8769
2030	1986	2030	SAR Average	Hong Kong SAR Average	6491	1623	485981	PLB	DSL	NOx	Run Exh	0.505804	Day	1.0408
2030	1986	2030	SAR Average	Hong Kong SAR Average	10891	2723	815425	PLB	LPG	NOx	Run Exh	0.450059	Day	0.5519
2030	1986	2030	SAR Average	Hong Kong SAR Average	1768	632	60388	PV4	CAT	NOx	Run Exh	0.002693	Day	0.0446
2030	1986	2030	SAR Average	Hong Kong SAR Average	1132	404	41023	PV4	DSL	NOx	Run Exh	0.031824	Day	0.7758
2030	1986	2030	SAR Average	Hong Kong SAR Average	7	2	106	PV5	CAT	NOx	Run Exh	0.000052	Day	0.4906
2030	1986	2030	SAR Average	Hong Kong SAR Average	6551	2340	183584	PV5	DSL	NOx	Run Exh	0.182131	Day	0.9921
2030	1986	2030	SAR Average	Hong Kong SAR Average	1869	668	49542	PV5	LPG	NOx	Run Exh	0.017966	Day	0.3626
2030	1986	2030	SAR Average	Hong Kong SAR Average	11729	2932	347715	NFB6	DSL	NOx	Run Exh	0.661266	Day	1.9017
2030	1986	2030	SAR Average	Hong Kong SAR Average	8217	2054	239204	NFB7	DSL	NOx	Run Exh	0.247604	Day	1.0351
2030	1986	2030	SAR Average	Hong Kong SAR Average	11833	2958	343951	NFB8	DSL	NOx	Run Exh	0.214364	Day	0.6232
2030	1986	2030	SAR Average	Hong Kong SAR Average	4140	388	72384	FBSD	DSL	NOx	Run Exh	0.060772	Day	0.8396
2030	1986	2030	SAR Average	Hong Kong SAR Average	57633	5403	1265799	FBDD	DSL	NOx	Run Exh	2.737143	Day	2.1624
2030	1986	2030	SAR Average	Hong Kong SAR Average	14684	2447	25492	MC	NCAT	NOx	Run Exh	0.015576	Day	0.6110
2030	1986	2030	SAR Average	Hong Kong SAR Average	409348	68218	1292455	MC	CAT	NOx	Run Exh	0.364088	Day	0.2817
2030	1986	2030	SAR Average	Hong Kong SAR Average	2322688	1030631	45091454	ALL	ALL	NOx	Run Exh	13.622524	Day	0.3021

Sheet1 Sheet2 Sheet3

Ready

Exercise #2: Hourly Emissions Inventory

- Problem: Repeat Exercise #1, except generate an hourly emissions estimates for Hong Kong for calendar year 2030 only.
- Context: This output is useful to ambient air quality modelers who are interested in hourly emission estimates.
- Scenario data:
  - Geographic Area: Hong Kong SAR
  - Calendar Years: 2030
  - Season: Annual
  - Scenario Type: BURDEN
  - Output File types: Text (CSV), BCD
  - Output Frequency: hourly
  - Pollutants: PM10, VOC
- Purpose: generating/processing BURDEN hourly output formats

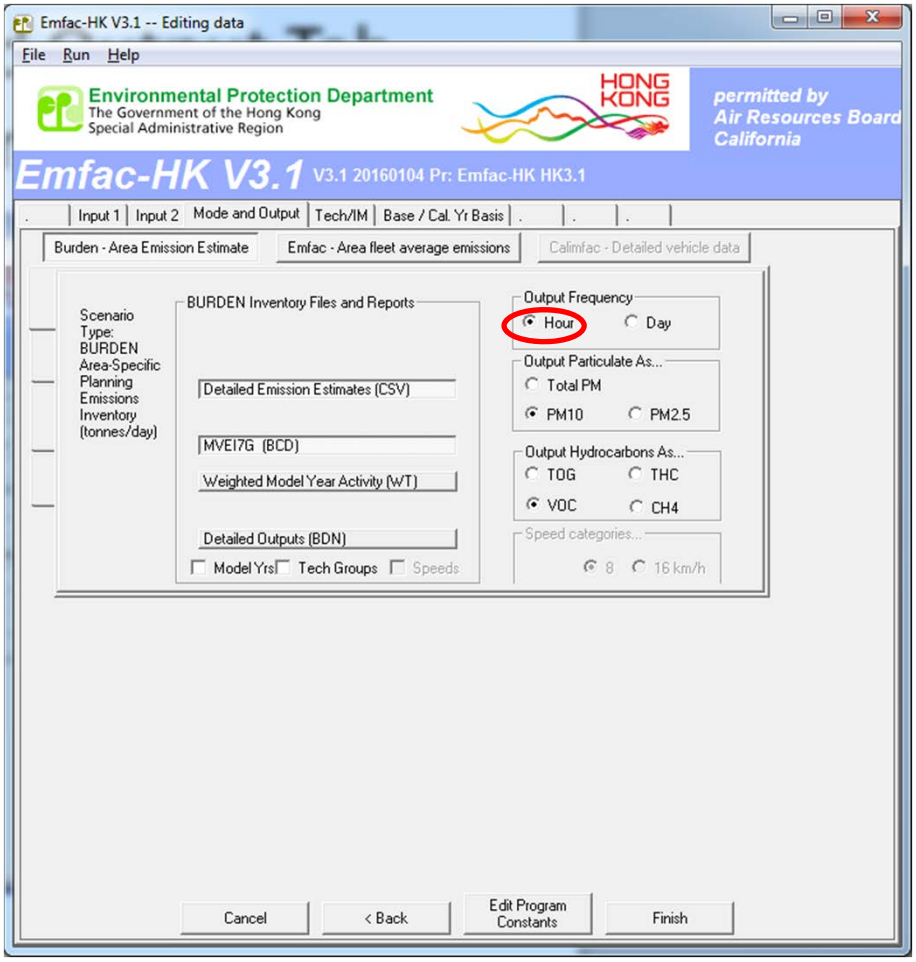
Exercise #2: Hourly Emissions Estimates

- Problem: Repeat Exercise #1, except generate an hourly emissions inventory for Hong Kong for calendar year 2030 only.

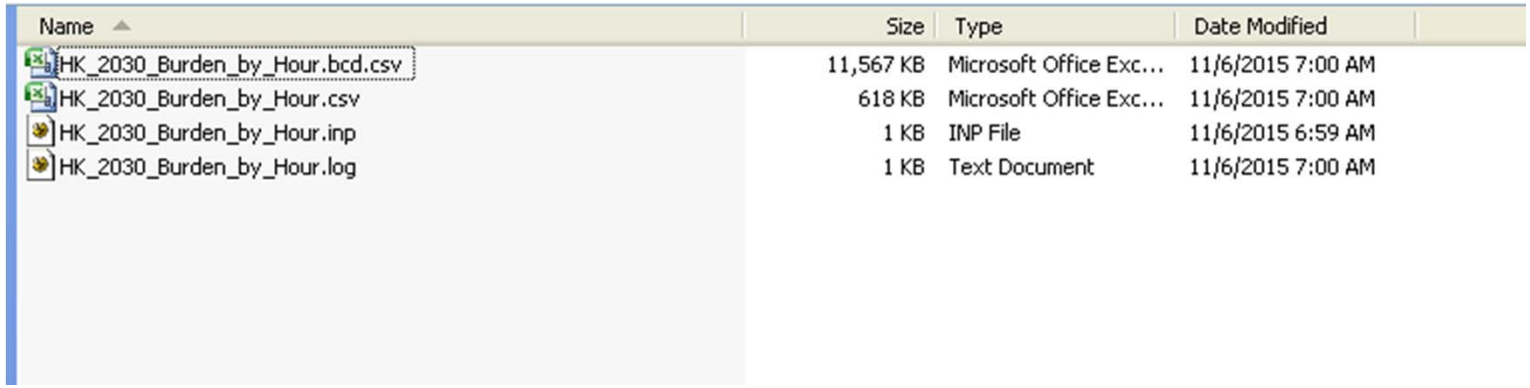
- Purpose: generating/processing BURDEN hourly output formats

- Context: This output is useful to ambient air quality modelers who are interested in hourly emission inventories.
- In this run the Burden inventories are calculated on an hourly basis, and then aggregated to show an inventory for the entire day. The hourly inventories are mainly based on disaggregating daily activity to an hourly basis. The data provide default diurnal distribution of hourly trip starts, and vehicle kilometers travelled.

Exercise #2: Mode and Output Tab – Hourly Output Frequency



Exercise #2: Output Generated

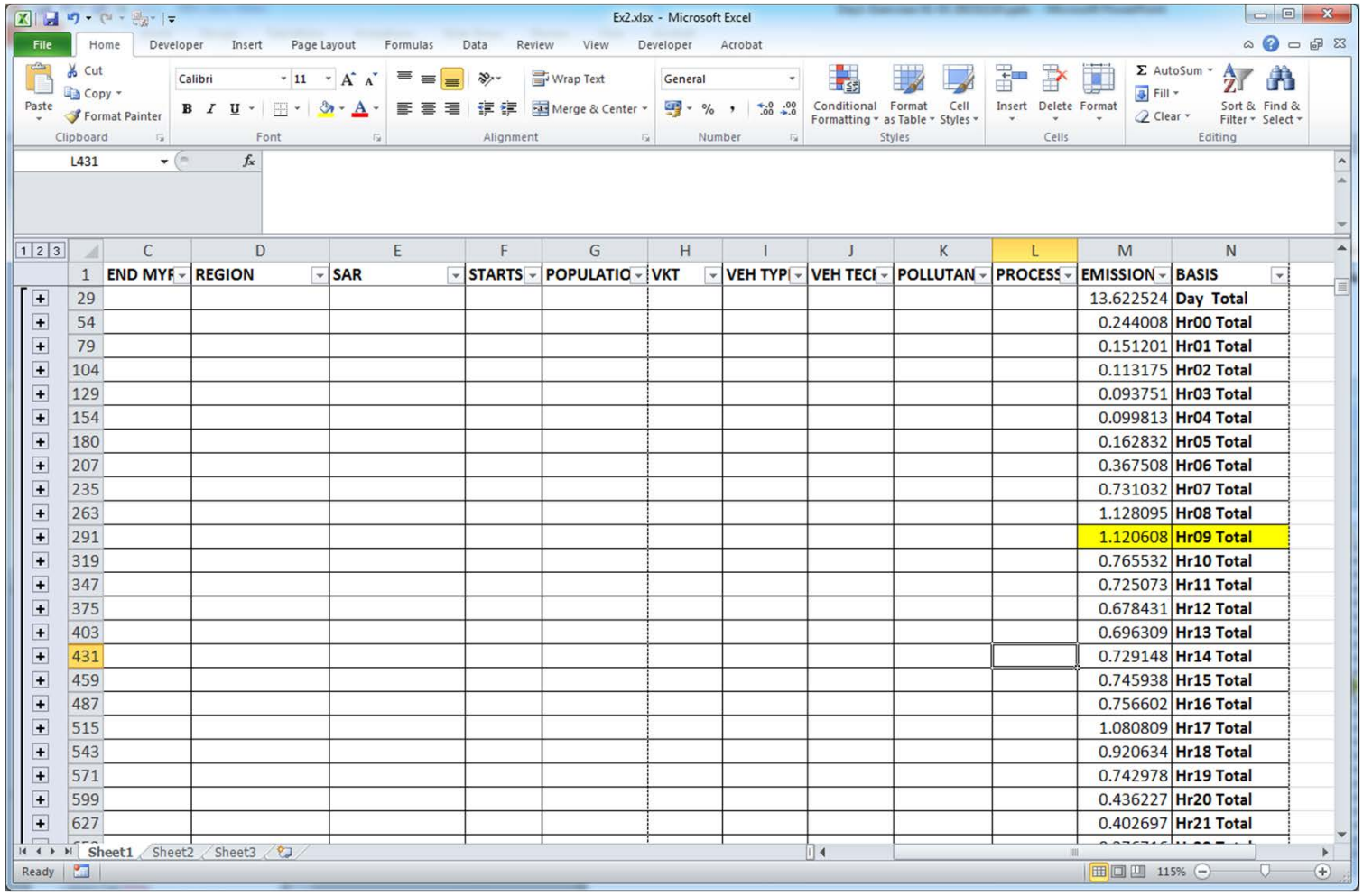


Name	Size	Type	Date Modified
HK_2030_Burden_by_Hour.bcd.csv	11,567 KB	Microsoft Office Exc...	11/6/2015 7:00 AM
HK_2030_Burden_by_Hour.csv	618 KB	Microsoft Office Exc...	11/6/2015 7:00 AM
HK_2030_Burden_by_Hour.inp	1 KB	INP File	11/6/2015 6:59 AM
HK_2030_Burden_by_Hour.log	1 KB	Text Document	11/6/2015 7:00 AM

Exercise #2a: Hourly Emission Rate

- Problem: using BCD output from Exercise #2, determine total NOx running exhaust emission rates by hour for 2030. What is the peak emission rate, and which hour?
- Purpose: determine peak hourly emission rates using hourly BCD output.
- Steps
  - Open *.BCD.CSV (allows BCD file to be directly loaded into spreadsheets)
  - Use data filters
    - pollutant (NOx), process ("Run Exh")
  - Copy filtered results to a separate tab in spreadsheet for analysis
  - Sort by **BASIS**, **VEH TYPE**
  - Perform a group subtotal by **BASIS**
  - Collapse Subtotal Group #2 to see values by hour

Exercise #2a: Solution



	C	D	E	F	G	H	I	J	K	L	M	N
1	END MYF	REGION	SAR	STARTS	POPULATIO	VKT	VEH TYP	VEH TEC	POLLUTAN	PROCESS	EMISSION	BASIS
29											13.622524	Day Total
54											0.244008	Hr00 Total
79											0.151201	Hr01 Total
104											0.113175	Hr02 Total
129											0.093751	Hr03 Total
154											0.099813	Hr04 Total
180											0.162832	Hr05 Total
207											0.367508	Hr06 Total
235											0.731032	Hr07 Total
263											1.128095	Hr08 Total
291											1.120608	Hr09 Total
319											0.765532	Hr10 Total
347											0.725073	Hr11 Total
375											0.678431	Hr12 Total
403											0.696309	Hr13 Total
431											0.729148	Hr14 Total
459											0.745938	Hr15 Total
487											0.756602	Hr16 Total
515											1.080809	Hr17 Total
543											0.920634	Hr18 Total
571											0.742978	Hr19 Total
599											0.436227	Hr20 Total
627											0.402697	Hr21 Total

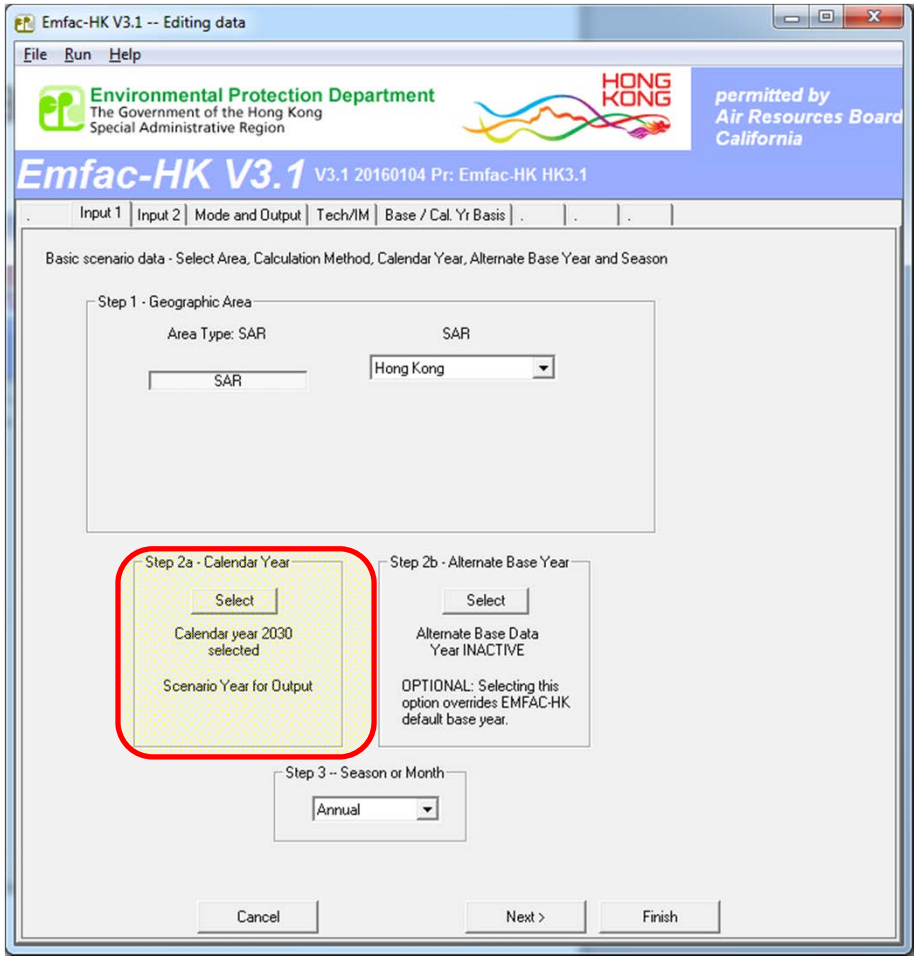
Exercise #3: EMFAC Mode

- Problem: Generate emission factors for 25 ºC and 40% RH for calendar year 2030 using the EMFAC mode.
- Context: In Emfac mode the model calculates emission factors either in grams per hour or grams per kilometer for each temperature, relative humidity and average speed combination specified by the user.
- fleet-average emission factors (grams/km or g/mile) are useful in roadway modeling

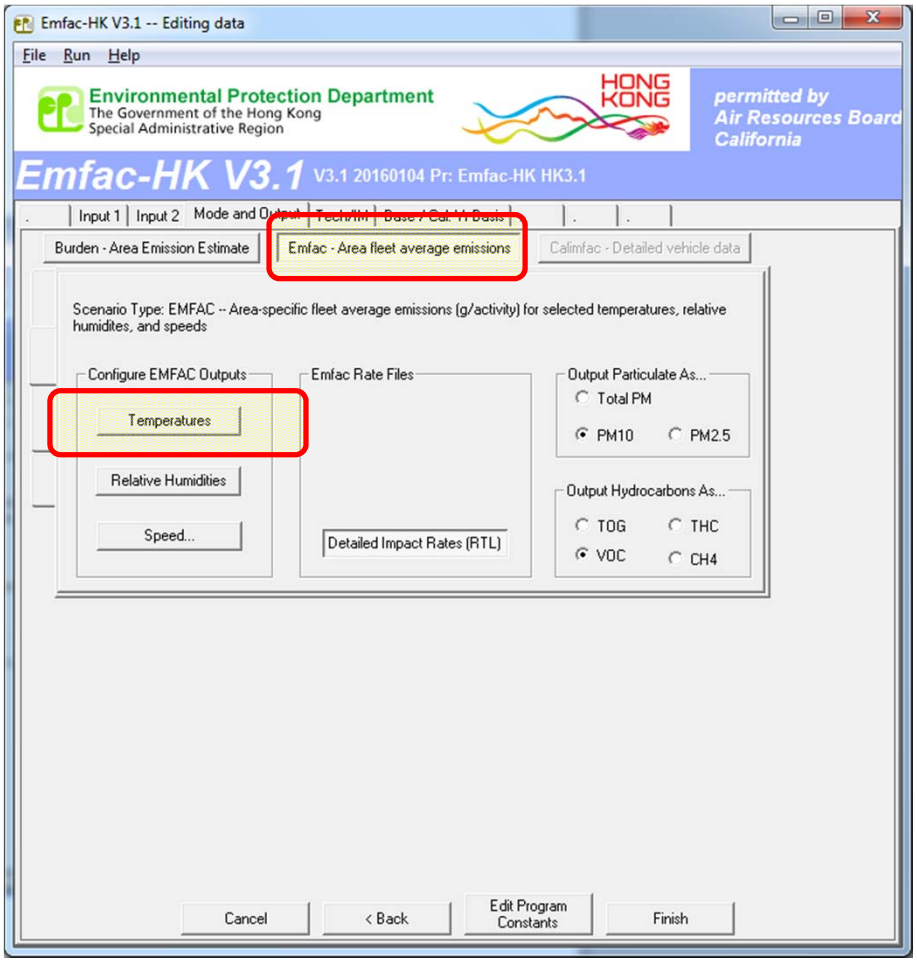
Exercise #3: EMFAC Mode

- Scenario data:
  - Geographic Area: Hong Kong SAR
  - Calendar Years: 2030
  - No Alternate Baseline Year
  - Season: Annual
  - Scenario Type: EMFAC
  - Output File types: Impact Rate Detail (RTL)
  - Temperatures: 25 ºC
  - Relative Humidity: 40%
  - Pollutants: PM10, VOC
- Purpose: generating/processing EMFAC formats

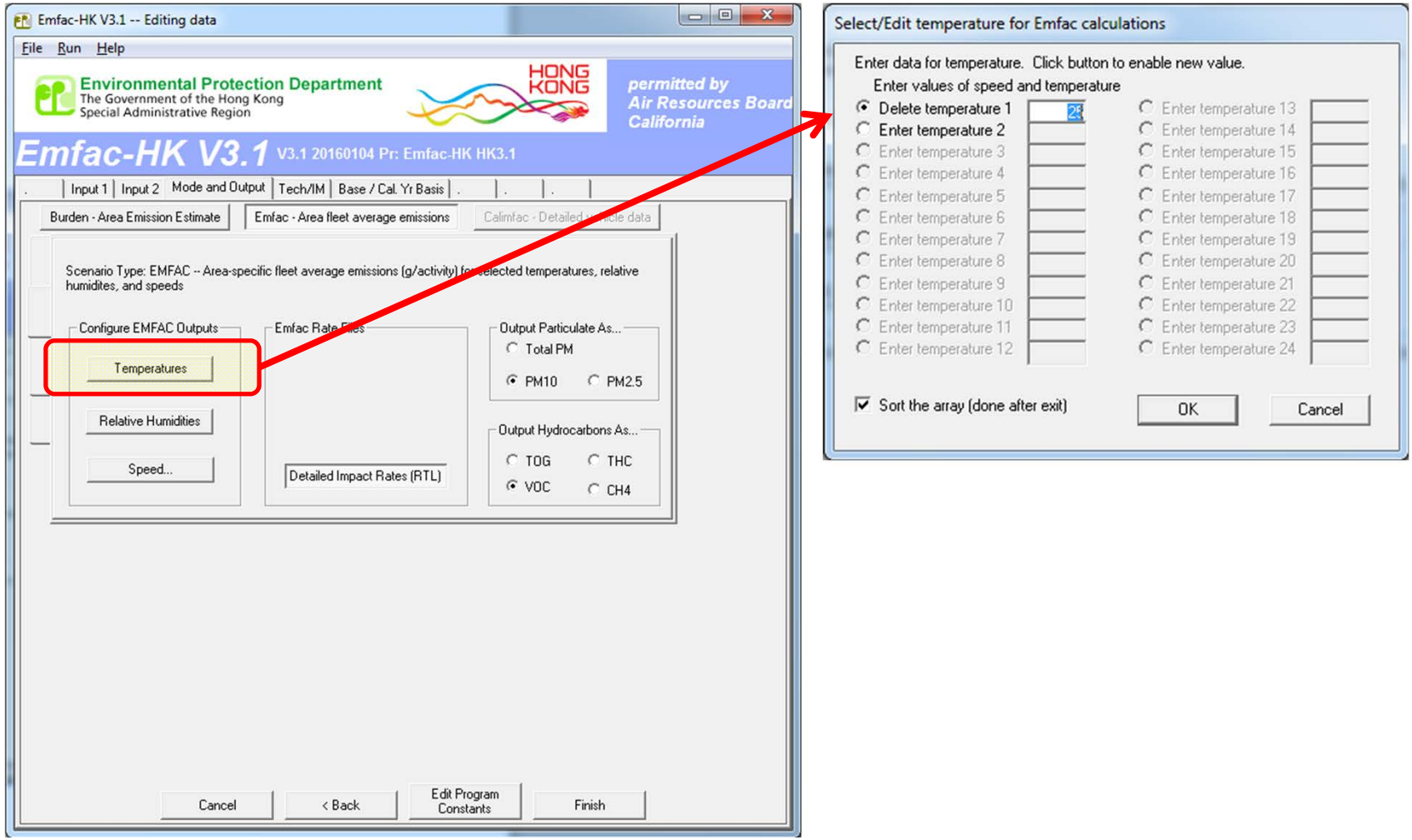
Exercise #3: Input 1 Tab (populated)



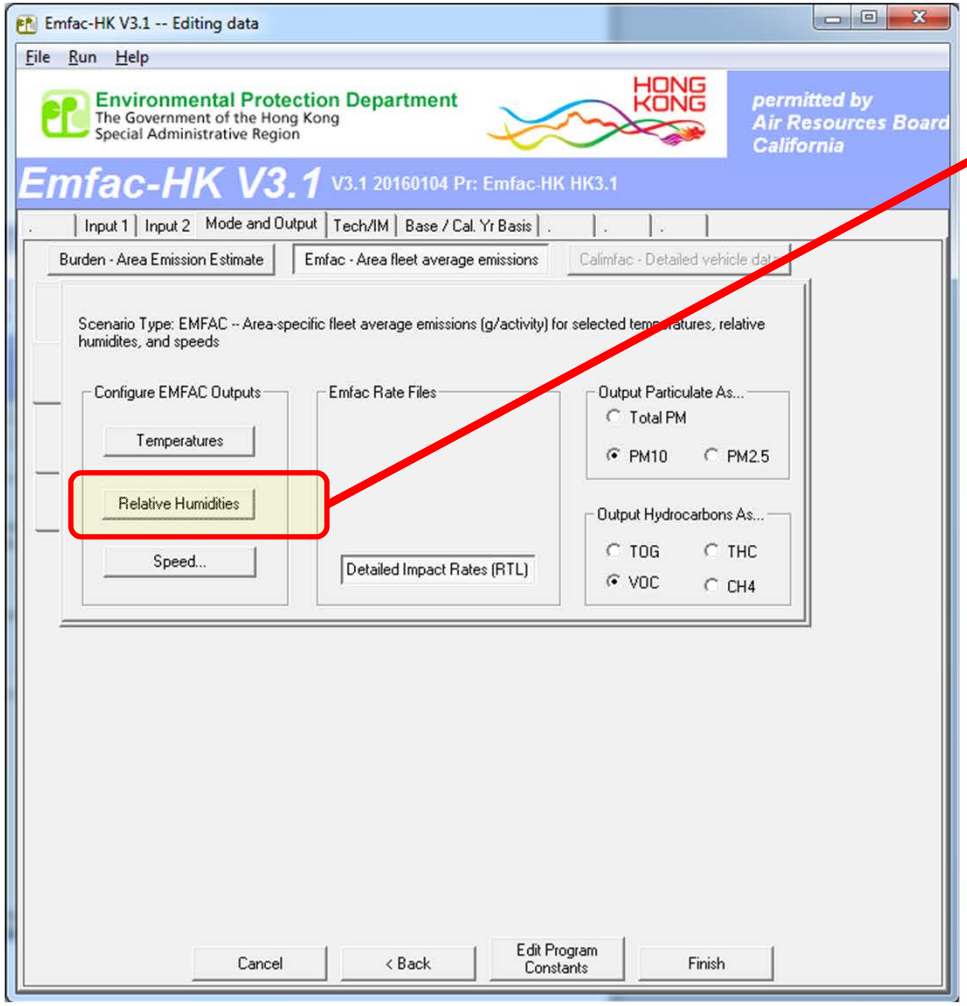
Exercise #3: Mode and Output Tab

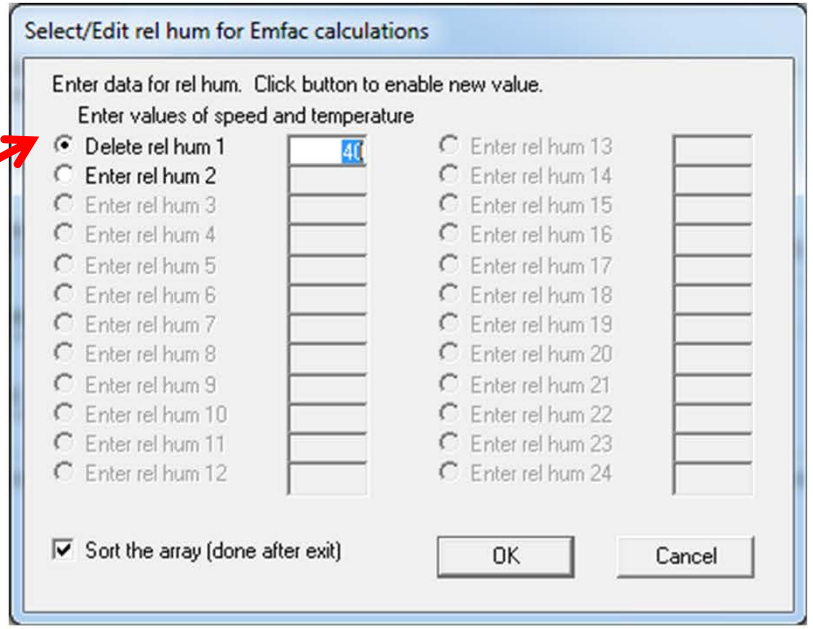


Exercise #3: Select/Edit Temps (delete until just 1. set to 25 deg C)

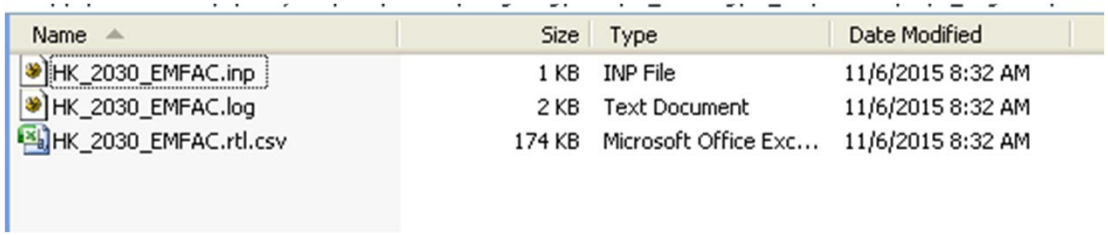


Exercise #3: Select/Edit RH (delete until just 1. set to 40%)





Exercise #3: Output Generated



Name	Size	Type	Date Modified
HK_2030_EMFAC.inp	1 KB	INP File	11/6/2015 8:32 AM
HK_2030_EMFAC.log	2 KB	Text Document	11/6/2015 8:32 AM
HK_2030_EMFAC.rtl.csv	174 KB	Microsoft Office Exc...	11/6/2015 8:32 AM

Exercise #4: Changing Technology Group Fractions

- Context: This example evaluates emission changes if the Government introduces a tax incentive program. In this case, introducing Euro V in 2010 for light goods vehicles greater than 3.5 tonnes (vehicle class LGV6).
- The table below shows the accelerate phase-in of Euro V for LGV6
  - Model Year: 2010-2012 40% Euro V
  - Model Year: 2013+ 100%

Exercise #4: Changing TG Fractions

- Scenario data:
  - Geographic Area: Hong Kong SAR
  - Calendar Years: 2030
  - Season: Annual
  - Scenario Type: BURDEN
  - Output File types: Detailed Estimates (CSV)
  - Output Frequency: daily
  - Pollutants: PM10, VOC
- Perform a Base Case Run
- Update TG distribution using data on next slide

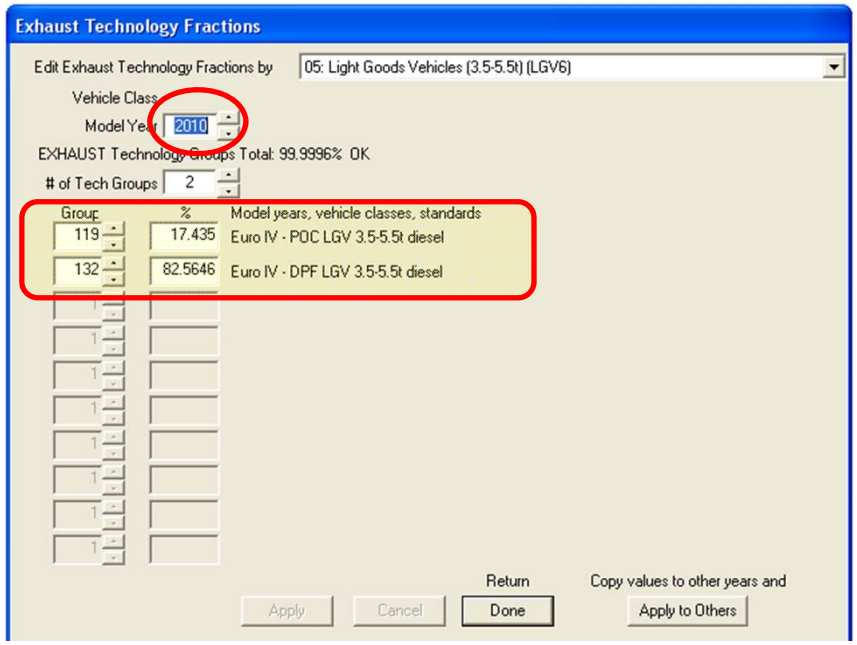
Exercise #4: New LGV6 Exhaust TG Fractions to Apply

Exh TG ->	119	132	133
Model Year	Euro IV POC LGV 3.5-5-5t Dsl	Euro IV DPF LGV 3.5-5-5t Dsl	Euro V DPF LGV 3.5-5-5t Dsl
2010	17.435%	42.5646%	40%

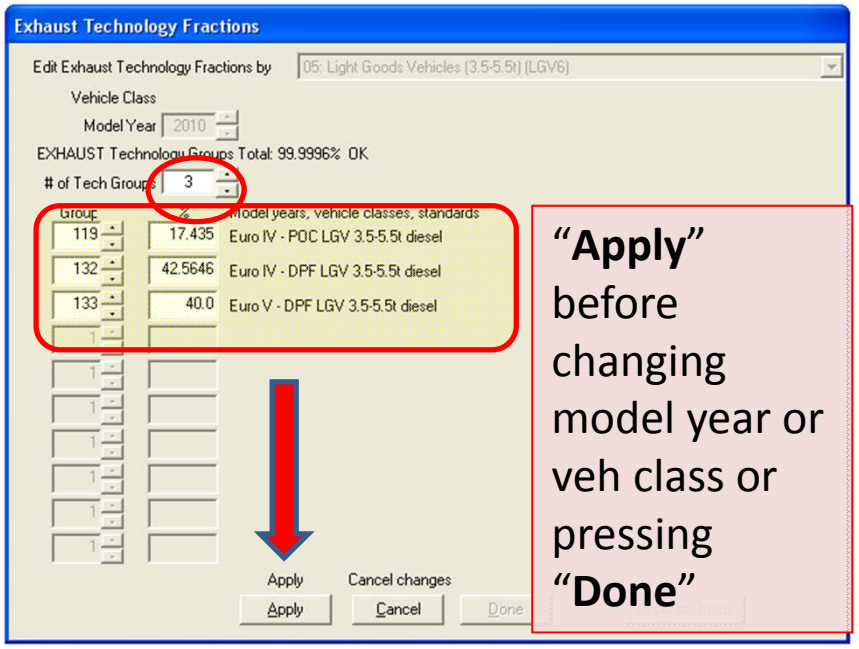
Source: http://www.epd.gov.hk/epd/sites/default/files/epd/2013_Licensed_Vehicle_by_Age_and_Technology_Group_Fractions.xls

Exercise #4: Exhaust TG Modification Tab

Before Edit



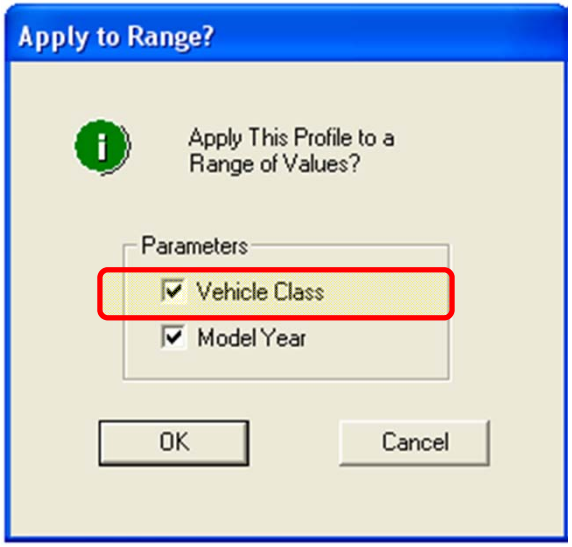
After Edit



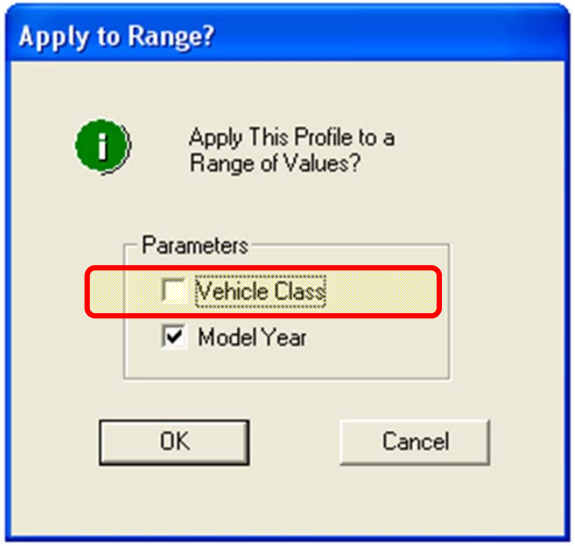
"**Apply**" before changing model year or veh class or pressing "**Done**"

Exercise #4: “Apply to Others – Model Year Only”

Before Edit

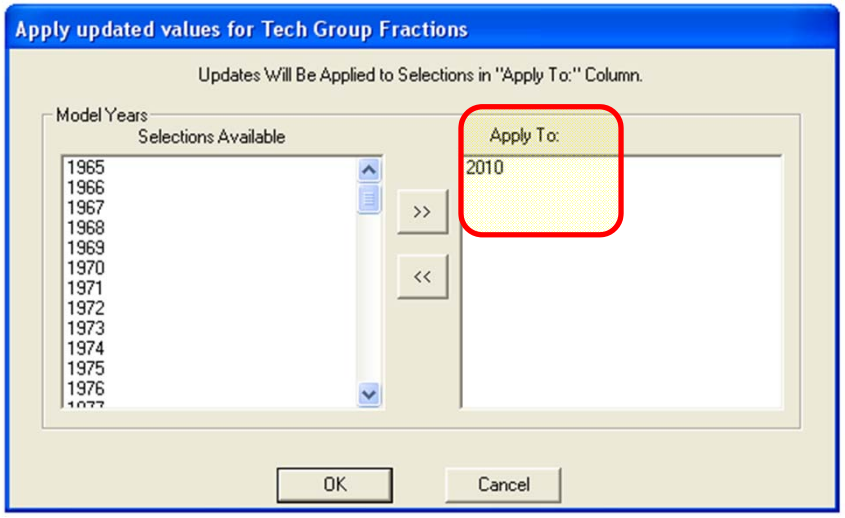


After Edit

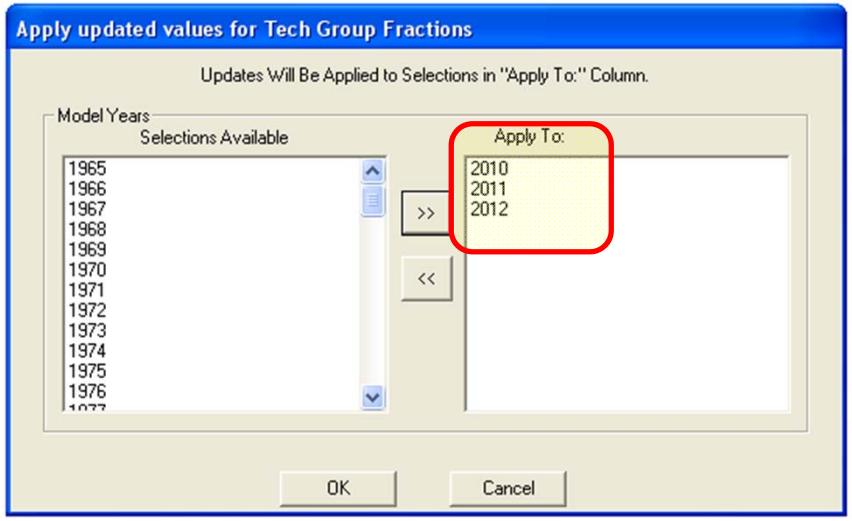


Exercise #4: “Apply to Others”

Before Edit



After Edit



Exercise #4: Solution

	I	J	K	L	M	N	O
	VEH TYPE	VEH TECH	POLLUTANT	PROCESS	EMISSIONS	BASIS	Case
3	LGV6	DSL	NOx	Run Exh	0.973116	Day	Base Case
3	LGV6	DSL	NOx	Run Exh	0.962865	Day	Euro V
2							
3	LGV6	DSL	NOx		0.010251	Day	Difference

Exercise #5: Changing VKT

- Context: EMFAC users involved with planning are frequently asked to estimate emissions for an area, say Kwai Chung, in Hong Kong. The territory-wide VKT by vehicle class and fuel type will not be applicable here resulting in a change in VKT. VKT by class will have to be changed. We take one vehicle class and one fuel type, say petrol private cars, as an example.

- Two ways the user can change VKT:
  1) adjust the population to match desired VKT since VKT is calculated from Population*Accrual (i.e., “conformity” approach); or,
  2) directly alter via the VKT GUI

  – If VKT only is changed, the model alters number of trips/starts in order to match VKT.

Exercise #5: Changing VKT

- Problem: Determine emissions in 2030 for petrol private cars (Vehicle Class 1) given a *forecasted* VKT of 1,609,000 km/day.
- This Exercise will be conducted in three phases:
  - 5: “base” case
  - 5a: “conformity” adjustment
  - 5b: direct VKT adjustment

Exercise #5a: Changing VKT ("Conformity" Approach)

- Scenario data:
  - Geographic Area: Hong Kong SAR
  - Calendar Years: 2030
  - Season: Annual
  - Scenario Type: BURDEN
  - Output File types: Text (CSV), BCD
  - Output Frequency: hourly
  - Pollutants: PM_{10}, VOC

- VKT for private cars = 1,609,000 km/day

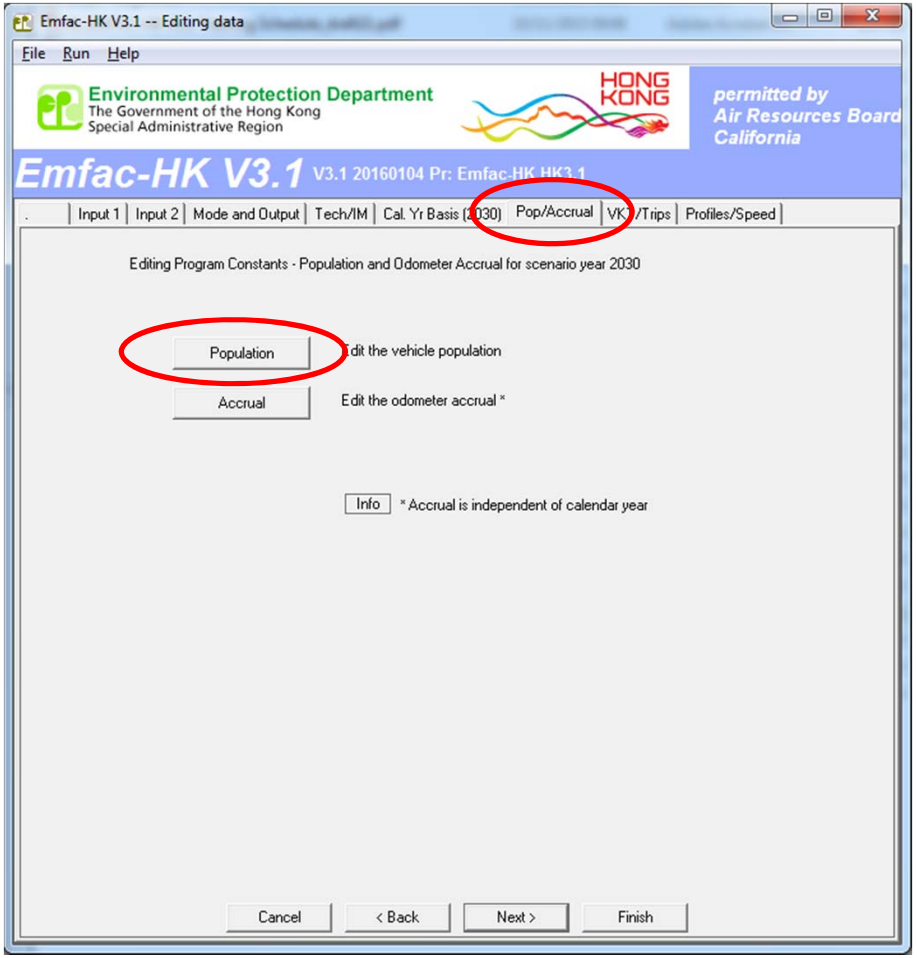
- Use "conformity" approach: adjust population to match desired VKT

Exercise #5a: Notes

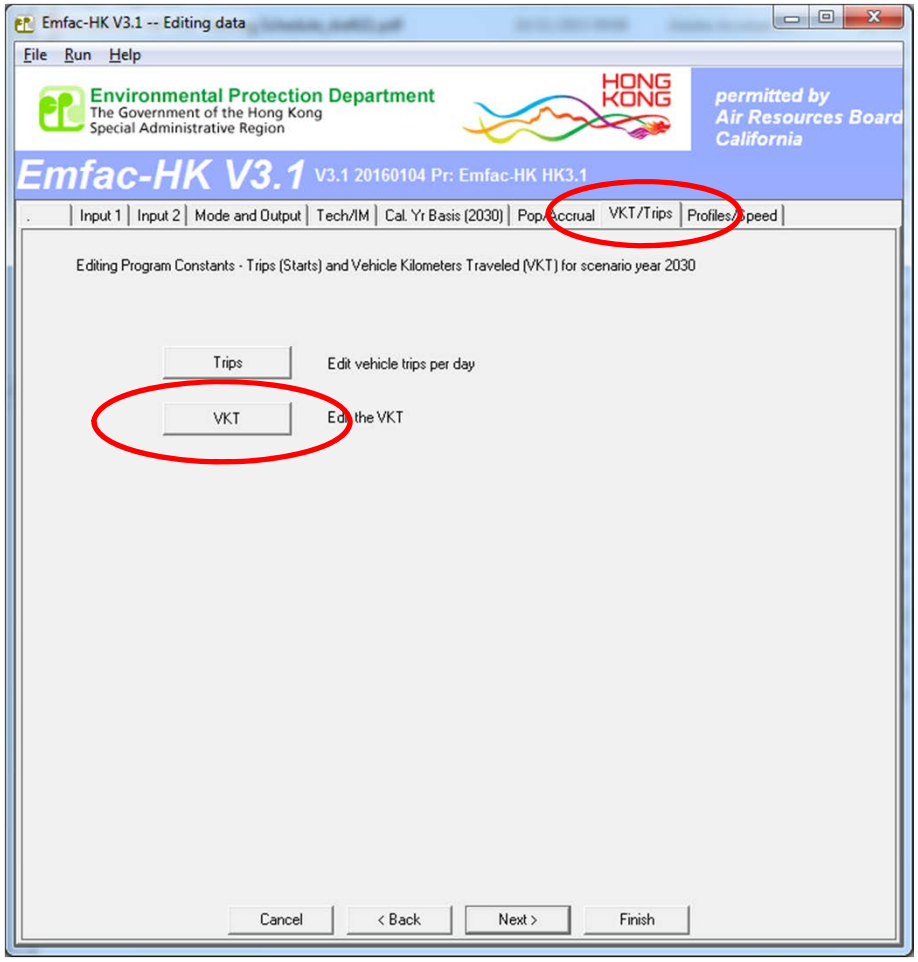
- Determine Population Adjustment to Match VKT
  - Find “base” population and VKT for vehicle class and fuel for 2030.
    - Enter scenario data in Input 1 screen
    - Edit Program Constants
    - Click “Population” key in Tab Pop/Accrual Screen
      - Select *By Vehicle and Fuel*:
      - PC petrol population? (Vehicle Class 1, Fuel=1):
    - Advance to VKT Screen
      - Tab *By Vehicle and Fuel*:
      - PC VKT (Vehicle Class=1, Fuel=1)?:
  - Determine VKT adjustment factor?

- Multiply population by VKT adjustment factor:

Exercise #5a: Pop/Accrual Tab

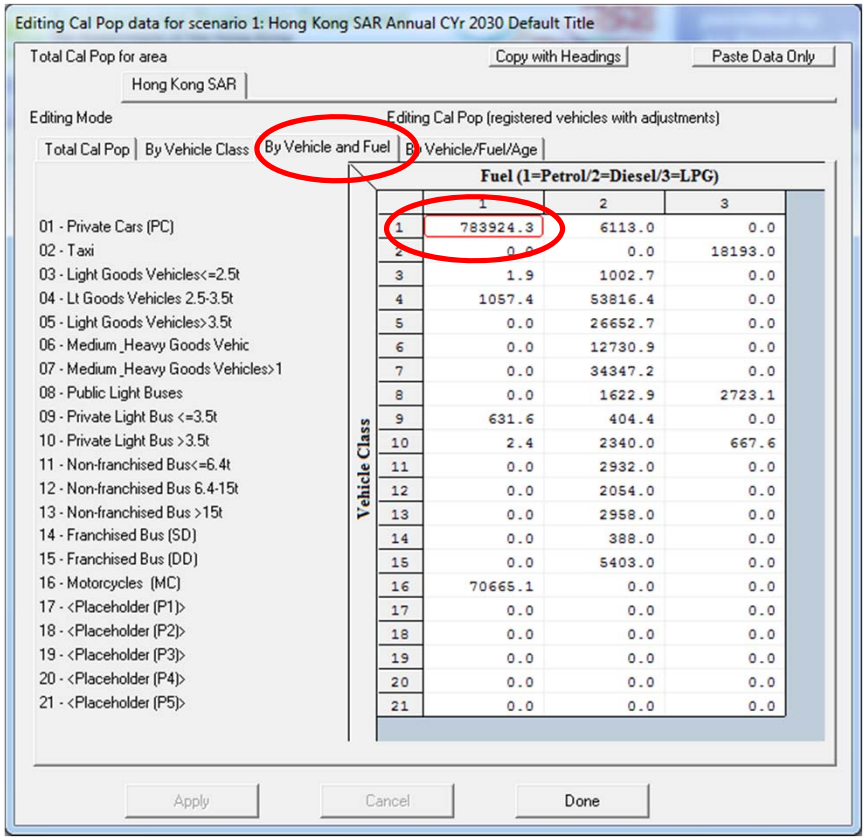


Exercise #5a: VKT/Trips Tab

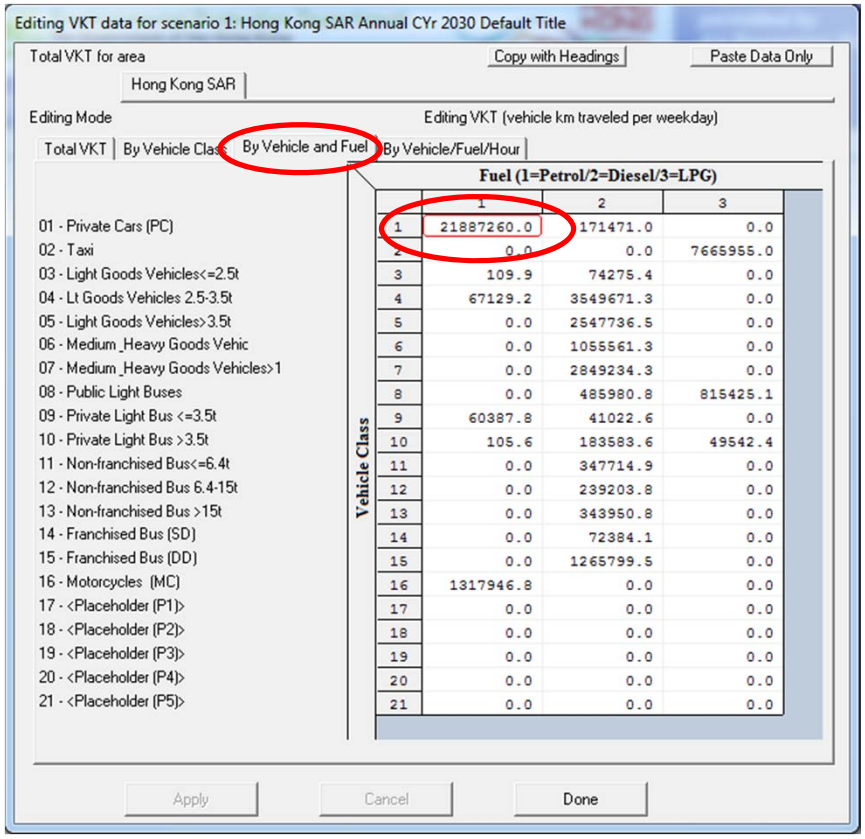


Exercise #5a: Base Case Values

2030 Population by Fuel
783,924 vehicles (gas/petrol)



2030 VKT by Fuel
21,887,260 km/day (1=gas/petrol)

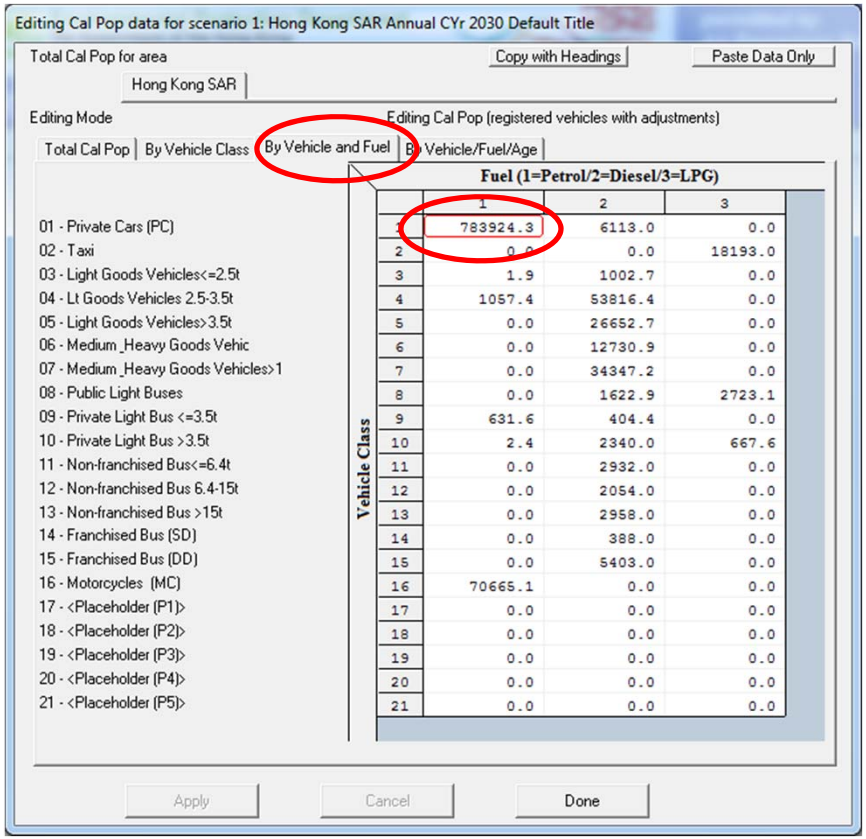


Exercise #5a: VKT Adjustment using Population

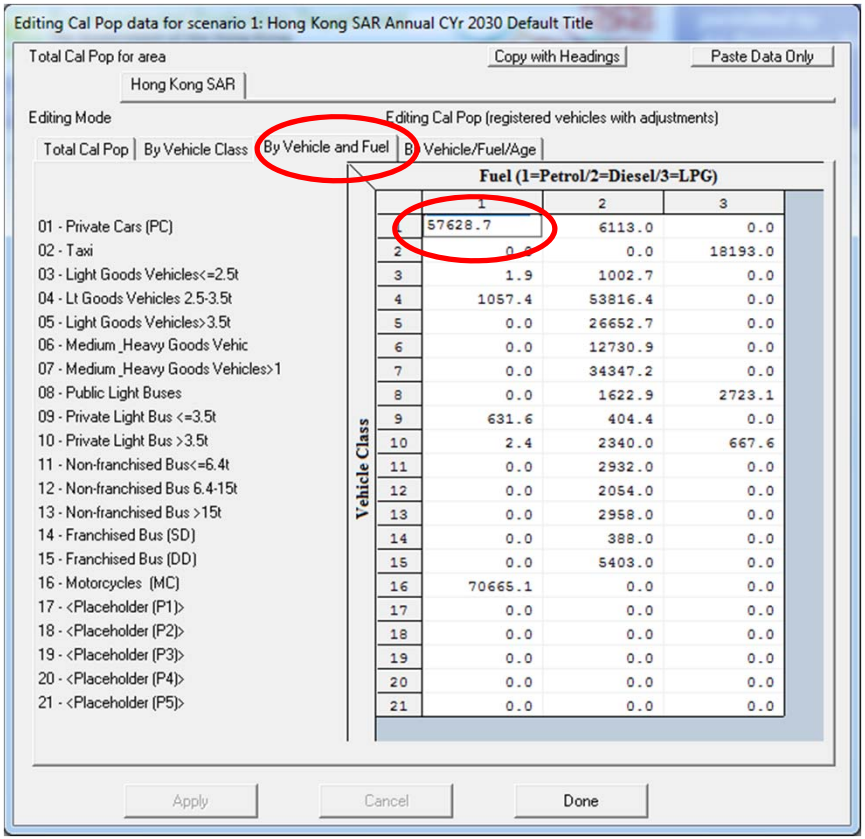
- Find “base” population and VKT for vehicle class and fuel (PC petrol) for 2030:
  - Population (2030): 783,924 vehicles
  - VKT (2030 base): 21,887,260 kilometers
- Determine VKT adjustment factor:
  - 1,609,000/ 21,887,260 = 0.0735
- Multiply population by factor:
  - 783,924 * 0.0735 = 57,629

Exercise #5a: Population Edits

2030 Population (Base Case)

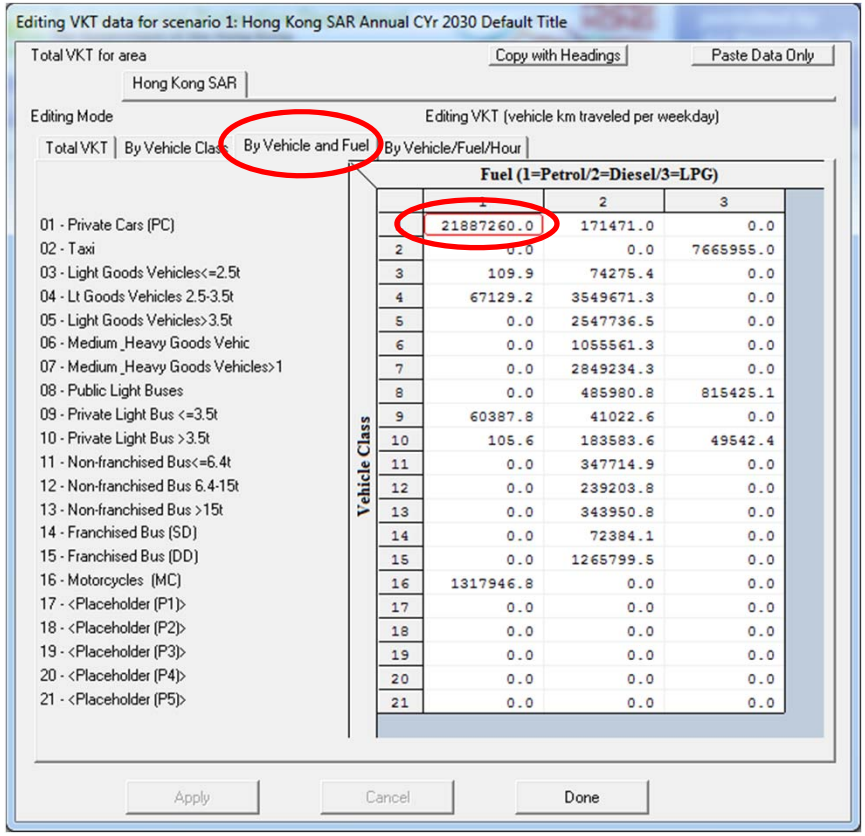


2030 Population (Edited for VKT Match)

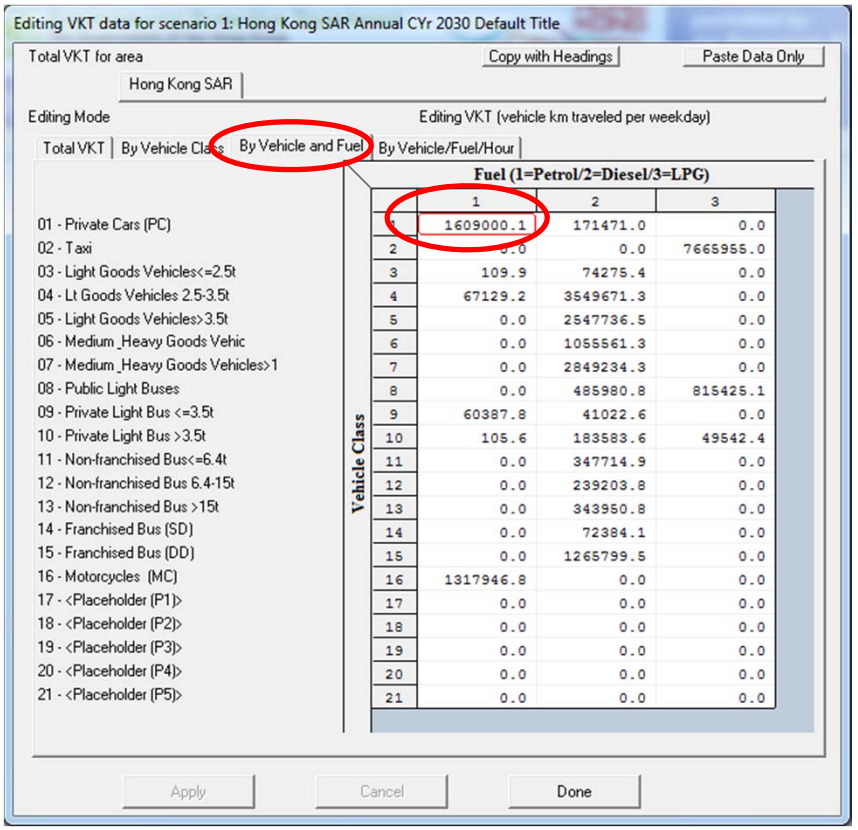


Exercise #5a: Verify VKT Adjustment

2030 VKT
(Base Case)



2030 VKT
(After Pop Edit)



Exercise #5b: Changing VKT (Directly)

- Problem: Determine emissions in 2030 for petrol private cars (Vehicle Class 1) given a forecasted VKT of 1,609,000 km/day.

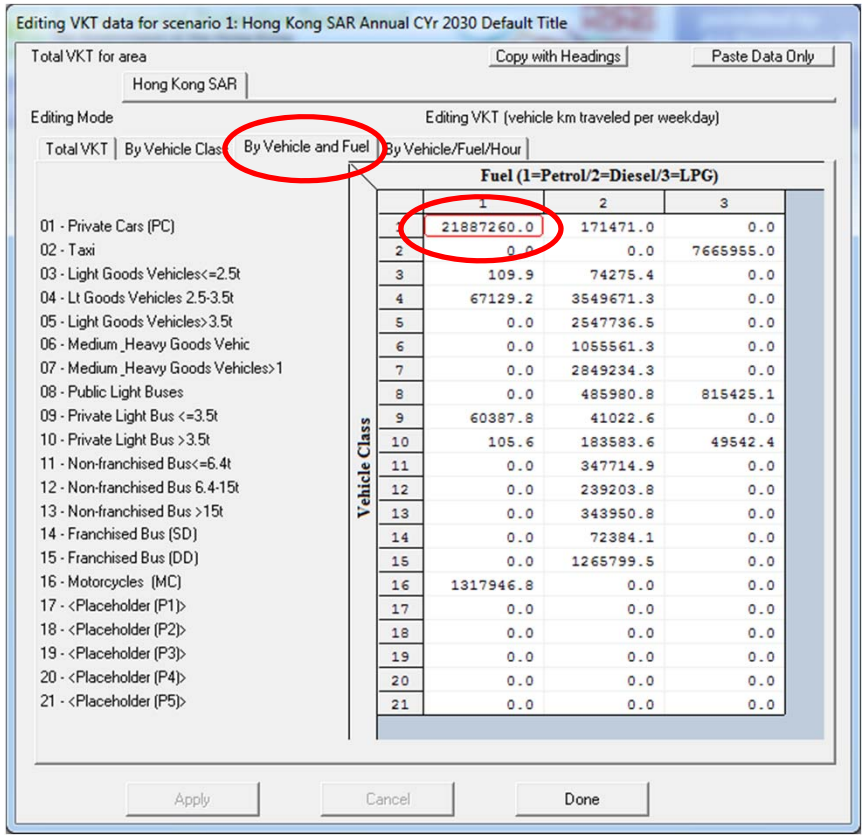
- Scenario data:
  - Geographic Area: Hong Kong SAR
  - Calendar Years: 2030
  - Season: Annual
  - Scenario Type: BURDEN
  - Output File types: Text (CSV), BCD
  - Output Frequency: hourly
  - Pollutants: PM_{10}, VOC

- VKT for petrol private cars = 1,609,000 km/day

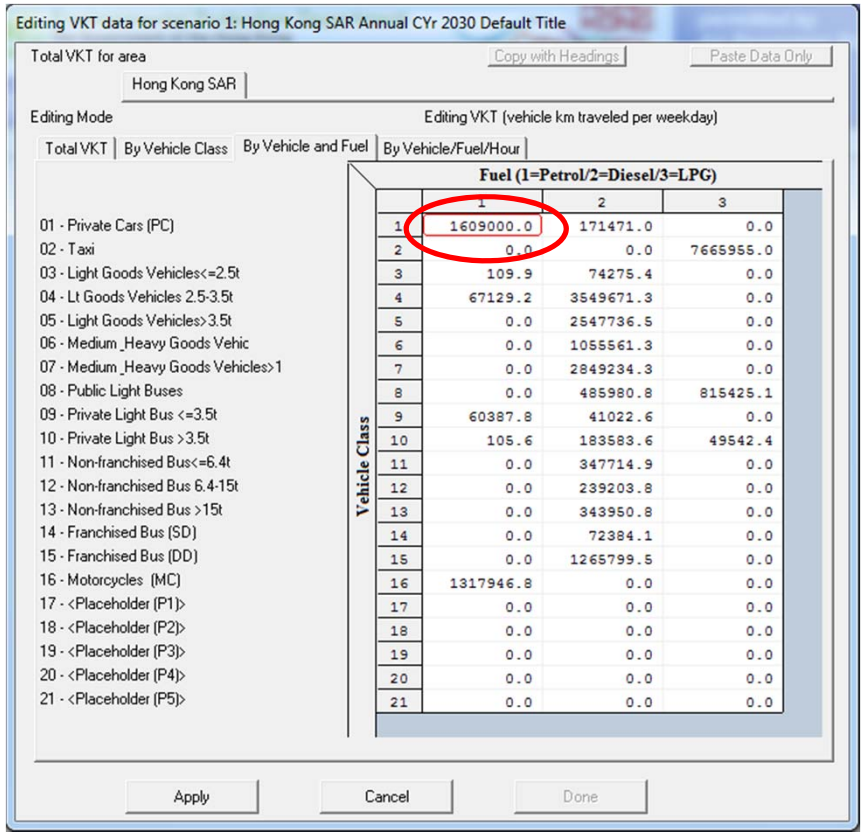
- Direct entry of new VKT

Exercise #5b: Editing VKT Screen

2030 VKT
(Base Case)



2030 VKT
(After VKT Edit)



Exercise #5c: Changing VKT - Comparison of #5a and #5b Output

- Problem: determine difference in NOx running and starting exhaust emissions output from Exercises #5a and #5b for petrol private cars.
- Purpose: examine results from alternate VKT edit approaches
- Extract/compare NOx running and starting exhaust emissions from Text/*.CSV. Use values for the day.
  - Note: day is at bottom of CSV after results by hour
  - Note: you'll need to add results for NCAT and CAT

Exercise #5c: Solution

Process	Base	#5a: Pop-adjusted VKT	#5b: VKT direct
Vehicles	783,924	**57,629**	783,924
VKT	21,887,260	1,609,000	1,609,000
Trips	1,176,004	**86,452**	1,176,004
NOx Run Exhaust (tonne/day)	0.2273	0.0167	0.0167
Nox Start Exhaust (tonne/day)	0.0441	**0.0032**	0.0441

Notes:
Results show how the model adjusted trips in Exercise #5a, thus, starting exhaust as well. Running exhaust emissions do not differ.
Exercise #5b shows it is possible to directly input VKT into EMFAC-HK; however, it is generally not recommended to do this independent of vehicle population because of the desire to properly estimate start and evaporative emissions tied to the size of the vehicle fleet.

Exercise #6: Changing Trips

- Context: If Hong Kong institutes a new Transportation Control Measure (TCM) that reduces trips for petrol Private Cars in 2015 to 250,000 trips per day. The planner is then asked to estimate the potential emission reductions from this new TCM. There are two potential methods for doing this analysis and both are examined in this Exercise.

  1) Adjust the population to match desired trips (i.e., “conformity” approach);
  2) Directly alter via the Trips GUI

  – If VKT only is changed, the model alters number of trips/starts in order to match VKT.

- This Exercise will be conducted in two phases:
  – 6a: “conformity” adjustment
  – 6b: direct trips adjustment

Exercise #6a: Changing Trips ("Conformity" Approach)

- Problem: Determine emissions in 2030 for PC petrol given forecasted trips of 250,000 trips/day.

- Scenario data:
  - Geographic Area: Hong Kong SAR
  - Calendar Years: 2030
  - Season: Annual
  - Scenario Type: BURDEN
  - Output File types: Text (CSV), BCD
  - Output Frequency: day
  - Pollutants: PM_{10}, VOC

- Trips for PC petrol cars = 250,000 trips/day

- Use "conformity" approach: adjust population to match desired trips

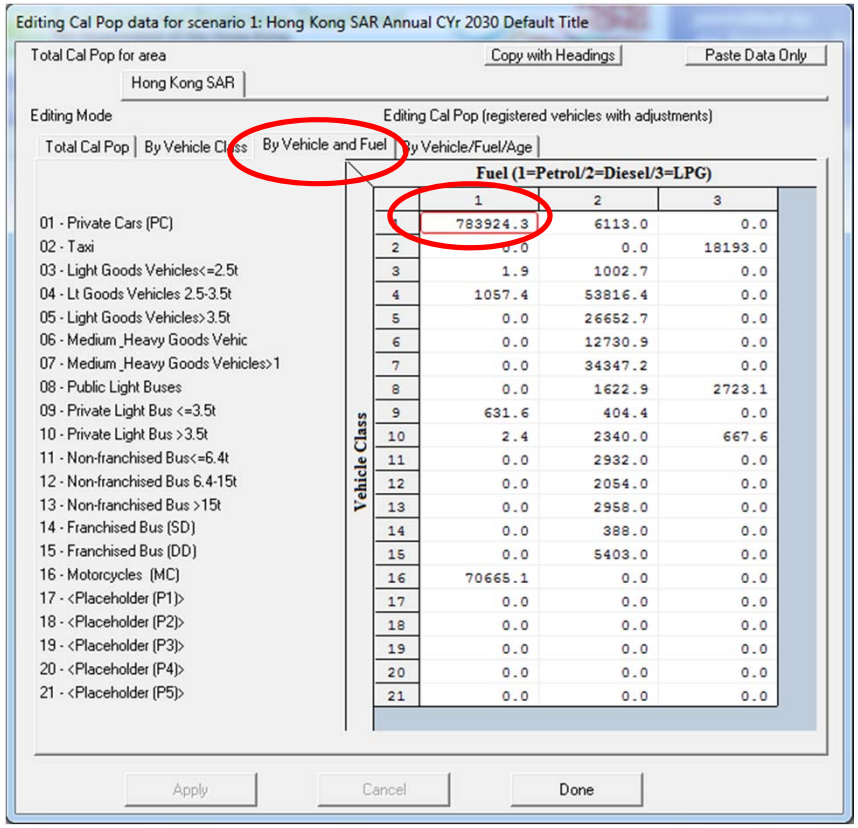
Exercise #6a: Notes

- Determine Population Adjustment to Match Trips
  - use “base” population and trips for vehicle class and fuel (PC petrol) for 2030.
    - Enter scenario data in Input 1 screen
    - Edit Program Constants
    - Advance to Population Screen
      - Tab *By Vehicle and Fuel*:
      - PC petrol population? (Vehicle Class 1, Fuel=1):
    - Advance to Trips Screen
      - Tab *By Vehicle and Fuel*:
      - PC petrol trips (Vehicle Class=1, Fuel=1):
  - Determine Trips adjustment factor?

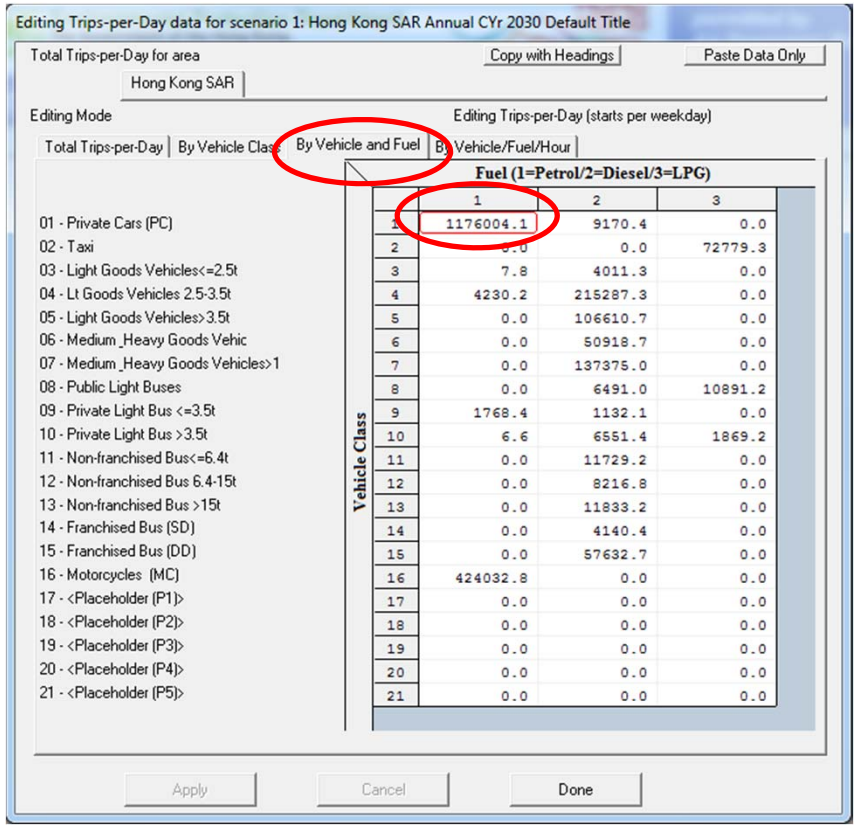
- Multiply population by trips adjustment factor:

Exercise #6a: Base Case Values

2030 Population by Fuel
783,924 vehicles (gas/petrol)



2030 Trips by Fuel
1,176,004 trips (gas/petrol)

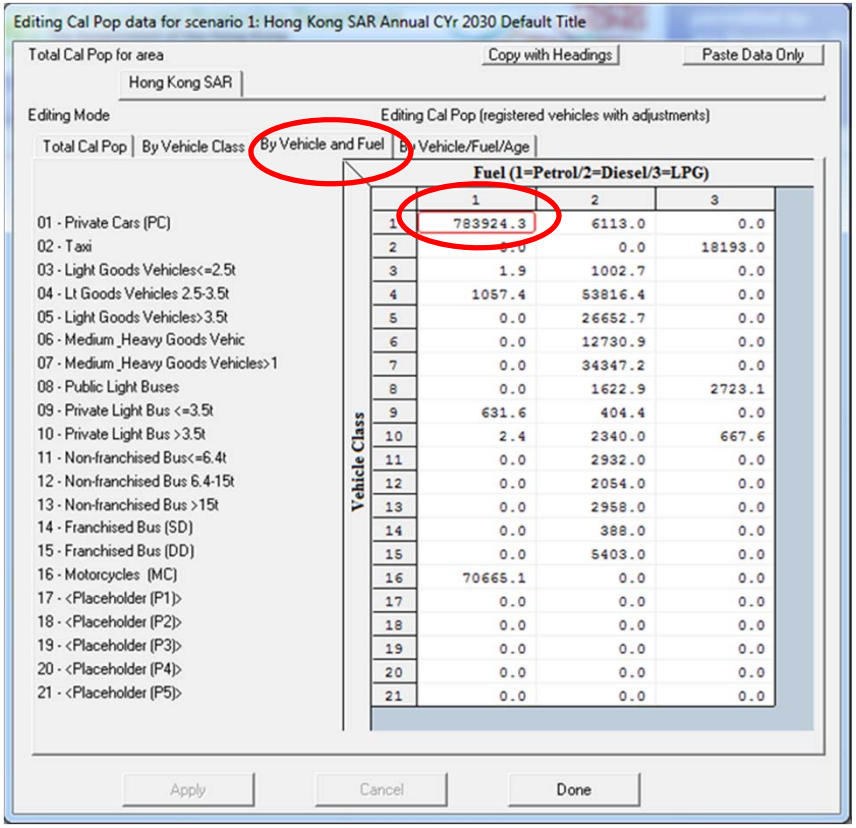


Exercise #6a: Trips Adjustment using Population

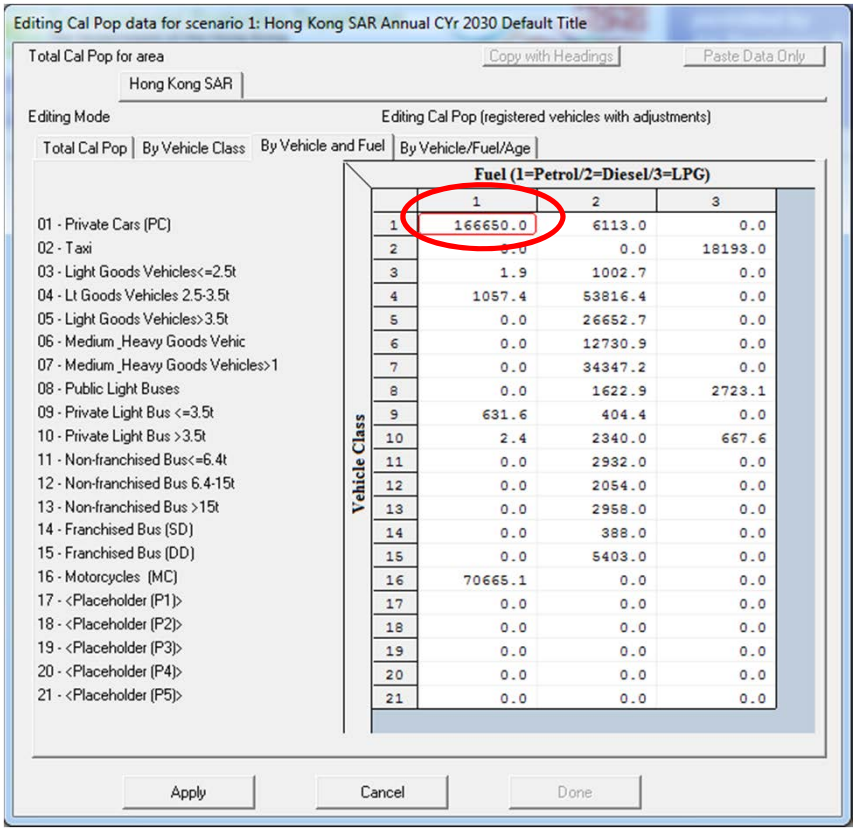
- Find “base” population and trips for vehicle class and fuel (PC petrol) for 2030:
  - Population (2030): 783,924 vehicles
  - Trips (2030 base): 1,176,004 trips
- Determine Trips adjustment factor:
  - 250,000/ 1,176,004 = 0.2126
- Multiply population by factor:
  - 783,924 x 0.2126 = 166,650 vehicles

Exercise #6a: Population Edits

2030 Population (Base Case)

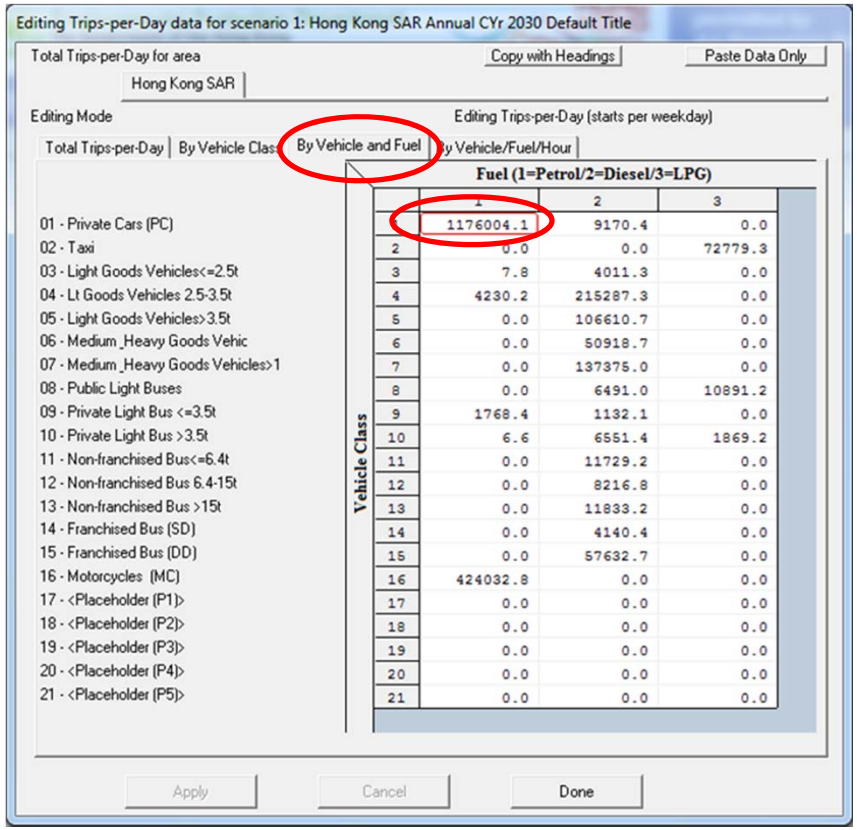


2030 Population (Edited for Trips Match)

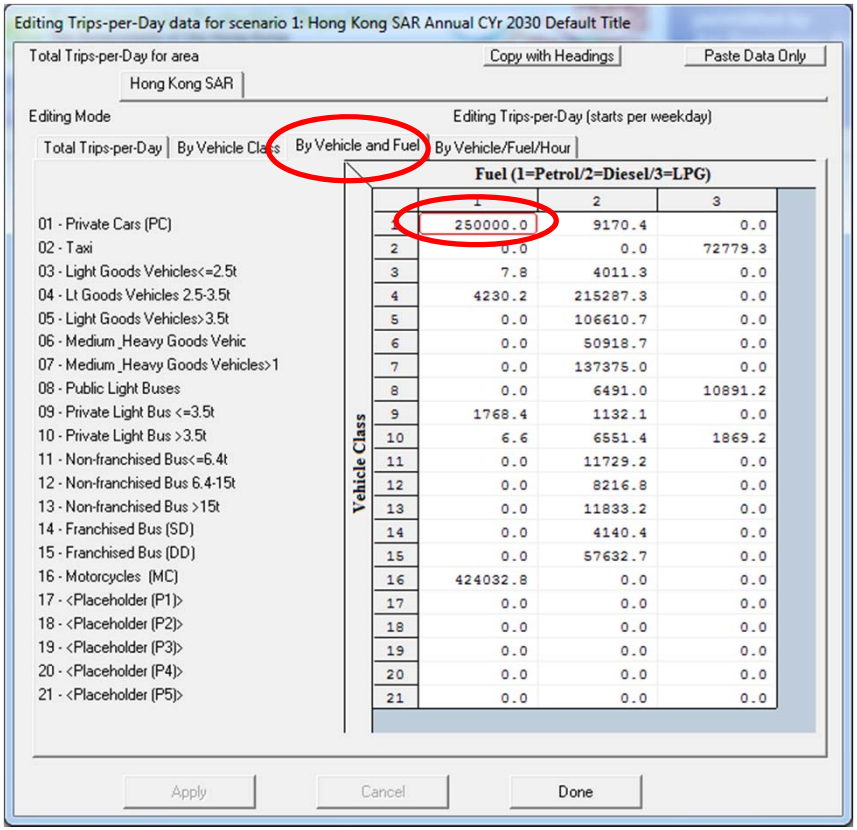


Exercise #6a: Verify Trips Adjustment

2030 Trips (Base Case)

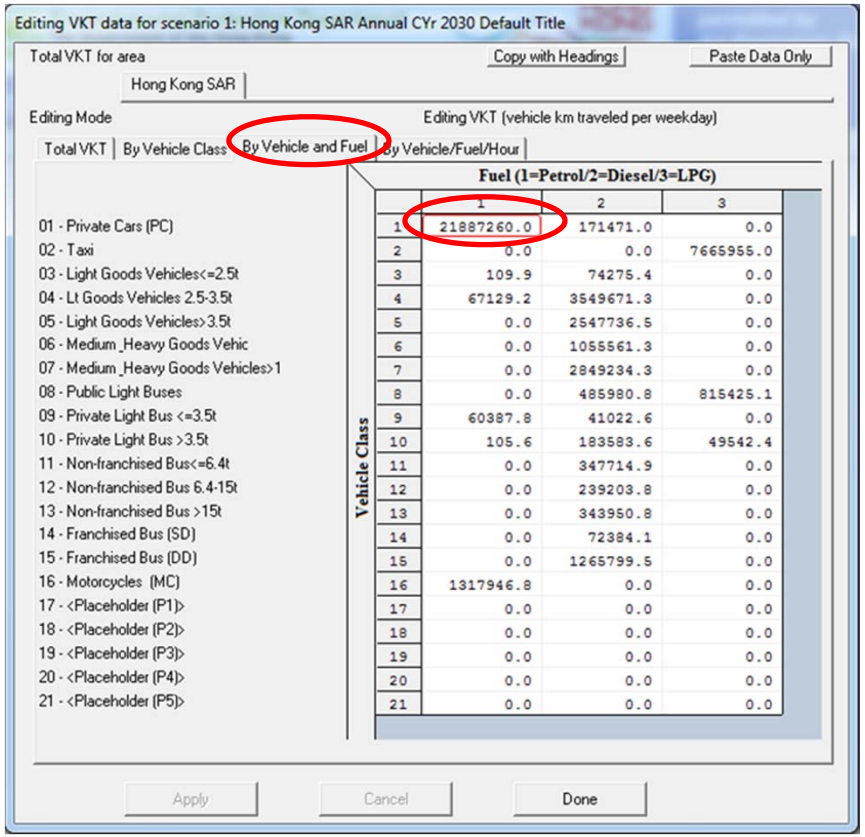


2030 Trips (After Pop Edit)

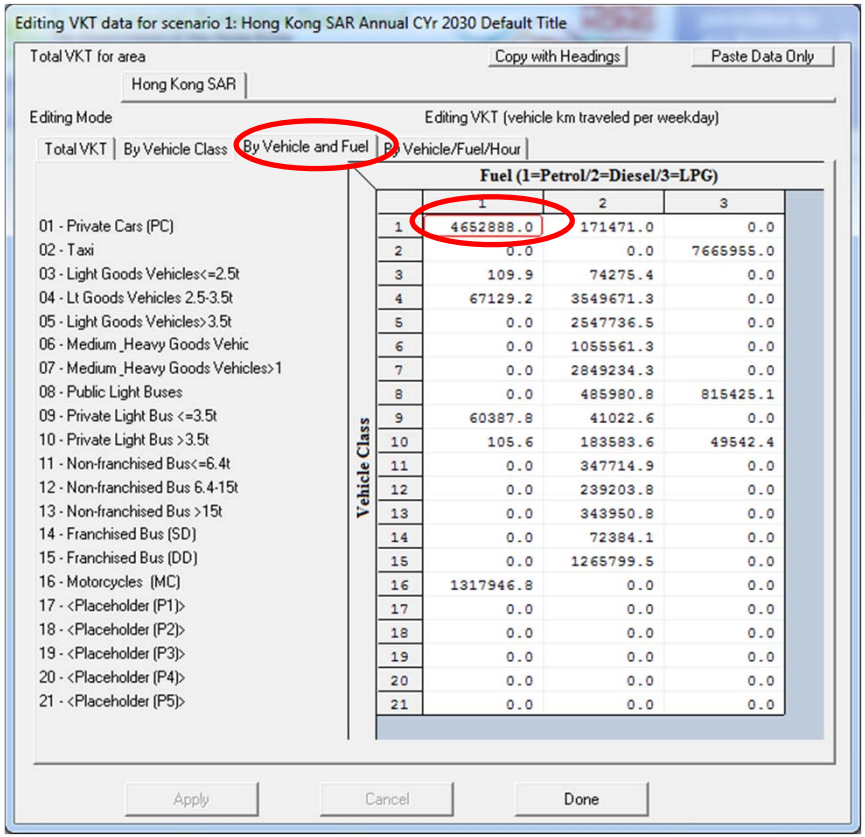


Exercise #6a: VKT Adjustment after Population Adjustment

2030 VKT
(Base Case)



2030 VKT
(After Pop Edit)



Exercise #6b: Changing Trips (Directly)

- Problem: Determine emissions in 2030 for PC petrol (Vehicle Class 1) given a forecast of 250,000 trips/day.

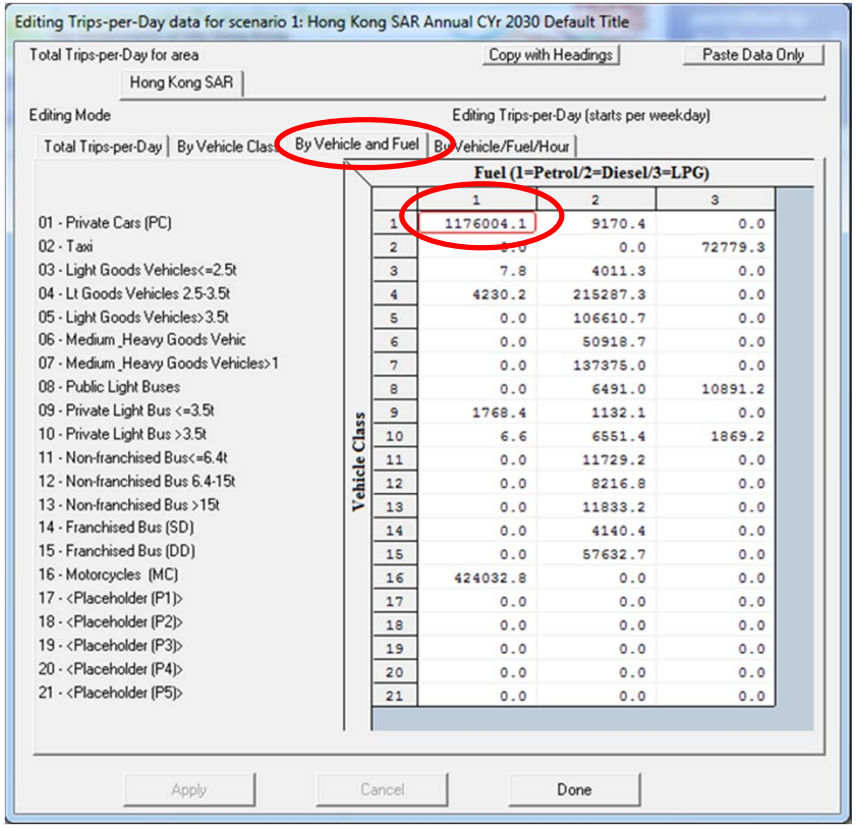
- Scenario data:
  - Geographic Area: Hong Kong SAR
  - Calendar Years: 2030
  - Season: Annual
  - Scenario Type: BURDEN
  - Output File types: Text (CSV), BCD
  - Output Frequency: hourly
  - Pollutants: PM_{10}, VOC

- Trips for PC petrol cars = 250,000

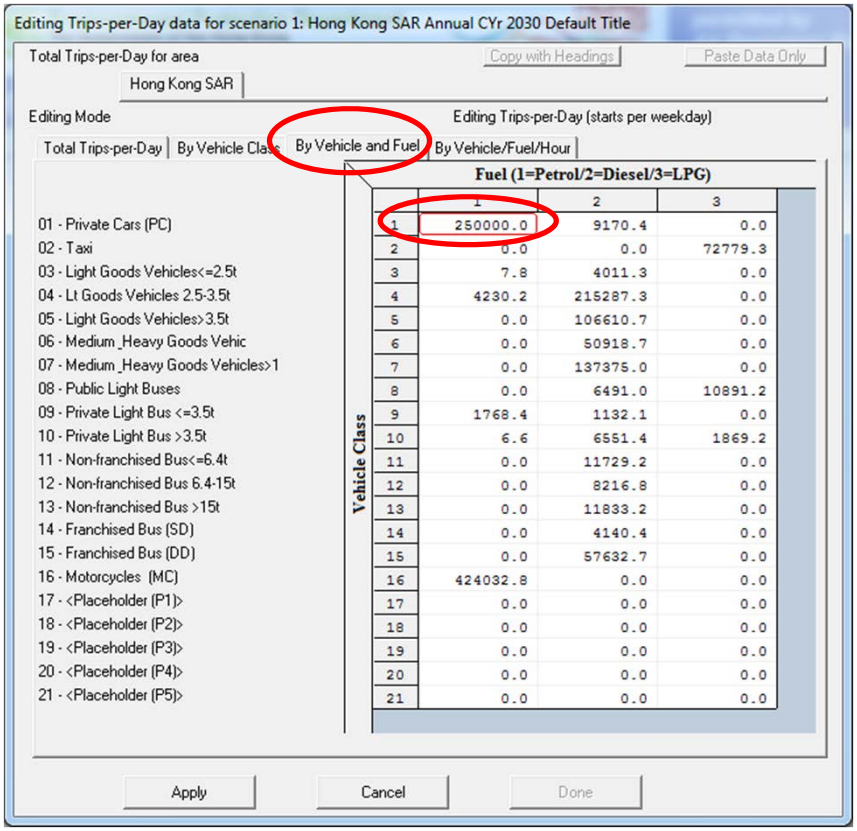
- Direct entry of new trips

Exercise #6b: Editing Trips Screen

2030 Trips
(Base Case)



2030 Trips
(After Trips Edit)



Exercise #6c: Changing VKT - Comparison of #6a and #6b Output

- Problem: determine difference in NOx running and starting exhaust emissions output from Exercises #6a and #6b for PC petrol cars.
- Purpose: examine results from alternate trip edit approaches
- Extract/compare NOx running and starting exhaust emissions from Test/*.CSV. Use values for the day.
  - Note: you'll need to add results for NCAT and CAT

Exercise #6c: Solution

Process	Base	#6a: Pop-adjusted Trips	#6b: Trips direct
Vehicles	783,924	166,650	783,924
VKT	21,887,260	**465,2888**	21,887,260
Trips	1,176,004	250,000	250,000
NOx Run Exhaust	0.2273	**0.0483**	0.2273
NOx Start Exhaust	0.0441	**0.0094**	0.0094

Notes:
Results show how altering trips via population (#6a) also alters VKT; thus, running exhaust is altered, as well. Exercise #6b shows altering trips only reduces starting exhaust.

Exercise #7: Speed Distributions

- Hong Kong has developed a TCM, which requires medium and heavy goods vehicles to only travel between midnight (0-hr) and 8 a.m. and from 10 p.m. to midnight. 5% of the VKT occurs at average speed 1-8 km/hr (Speed Bin #1 in GUI); 25% at 24-32 km/hr (Speed Bin #4); 20% at 48-56 km/hr (Speed Bin #7), 25% at 56-64 km/hr (Speed Bin #8), and 25% at 64-72 km/hr (Speed Bin #9).

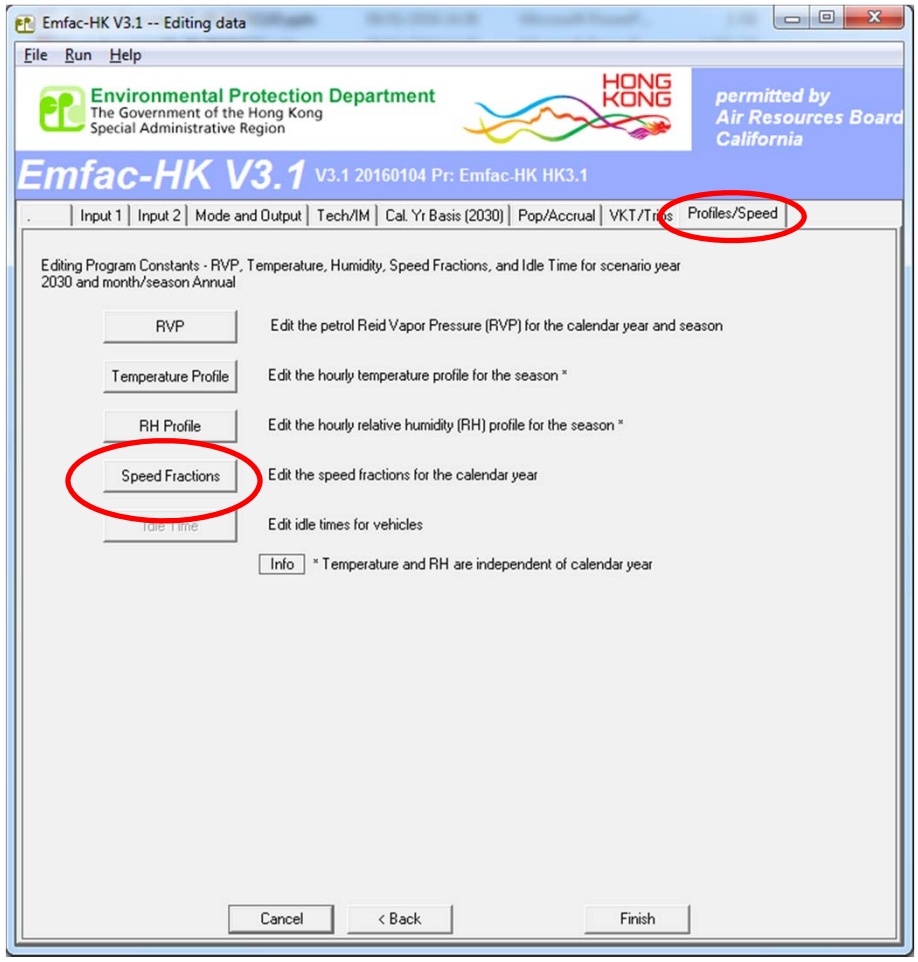
- What is the effect on NOx running exhaust emissions from this change?

Exercise #7: Speed Distributions

- Problem: Determine change in emissions in 2015 for HGV7 (Vehicle Class 6) and HGV8 (Vehicle Class 7) given the revised speed distribution below.
- Scenario data:
  - Geographic Area: Hong Kong SAR
  - Calendar Years: 2015
  - Season: Annual
  - Scenario Type: BURDEN
  - Output File types: Text (CSV), BCD
  - Output Frequency: daily
  - Pollutants: PM_{10}, VOC
- Speed Fractions:

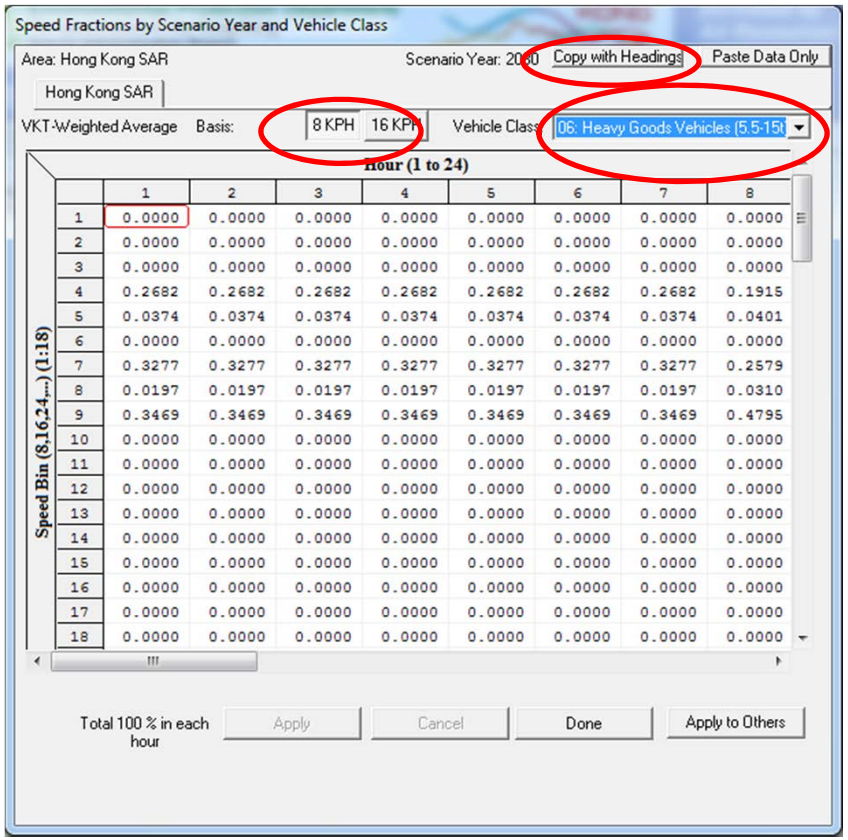
  5% of the VKT occurs at average speed 1-8 km/hr (Speed Bin #1);
  25% at 24-32 km/hr (Speed Bin #4);
  20% at 48-56 km/hr (Speed Bin #7);
  25% at 56-64 km/hr (Speed Bin #8) and
  25% at 64-72 km/hr (Speed Bin #9).

Exercise #7: Profiles/Speed Tab

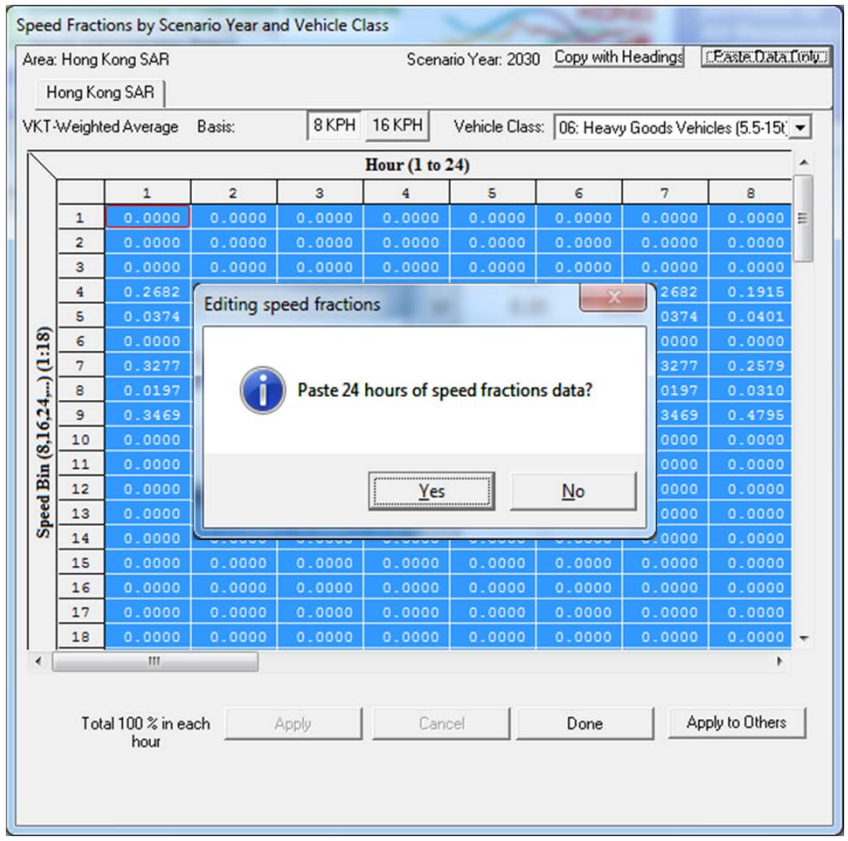


Exercise #7: Editing Speed Fractions

2015 Speed Fractions (HGV7)
Base Case



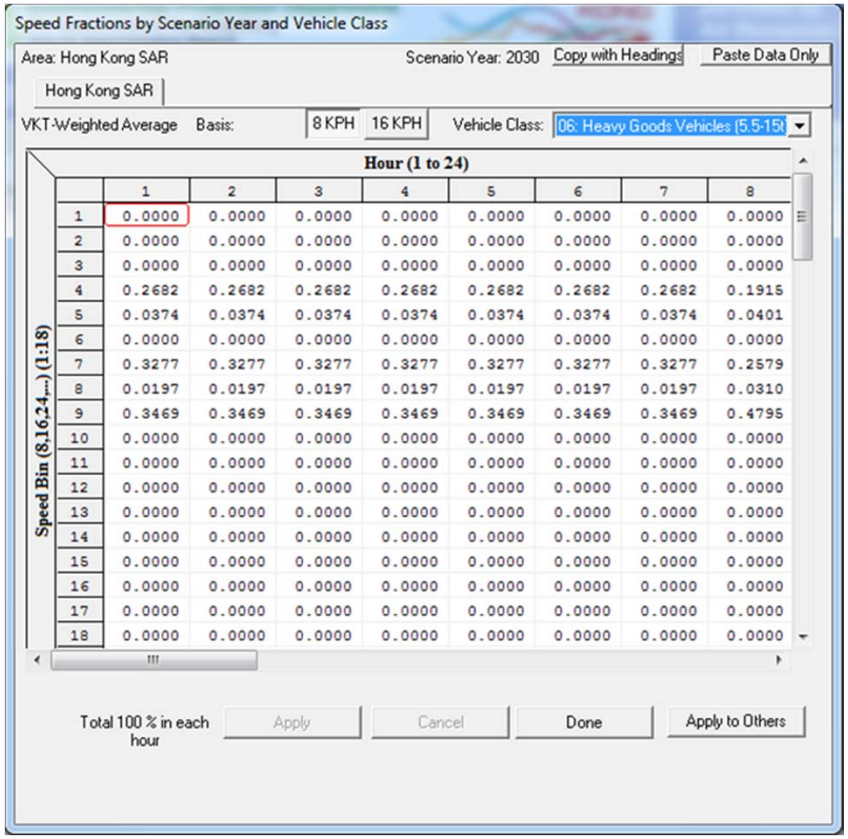
2015 Speed Fractions (HGV7)
About to Copy Edits from Spreadsheet



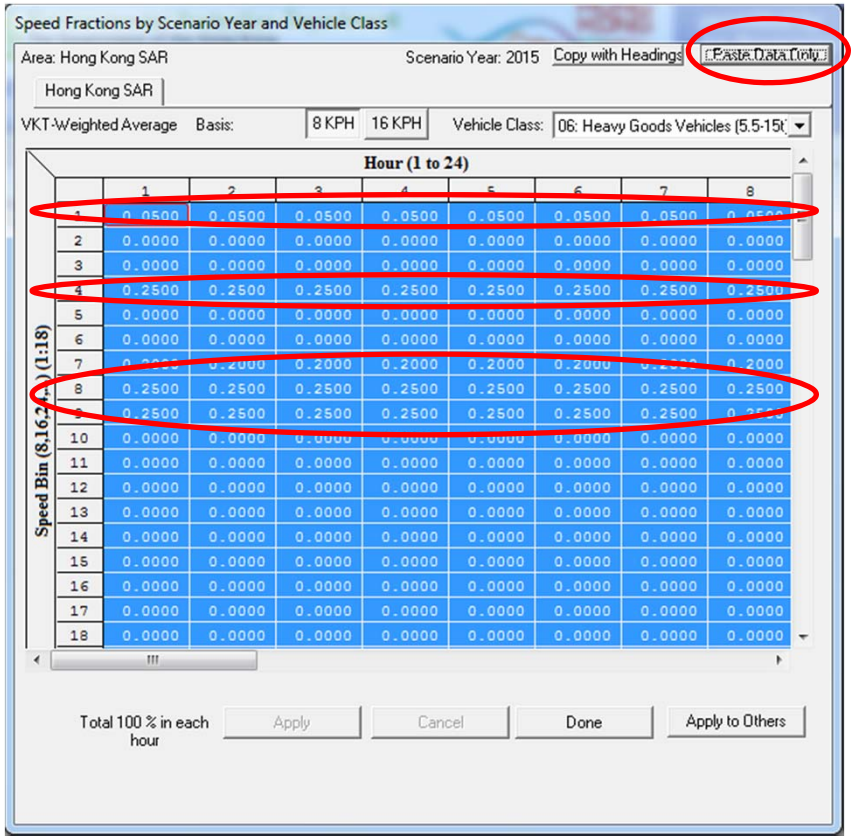
Set the “Basis” tab to “8 KPH” and select the Heavy Goods Vehicles<15t. Then change the VKT speed distribution. Then apply this change to this hour and vehicle class. Then apply this change to other vehicle classes.

Exercise #7: Editing Speed Fractions

2015 Speed Fractions (HGV7)
Base Case

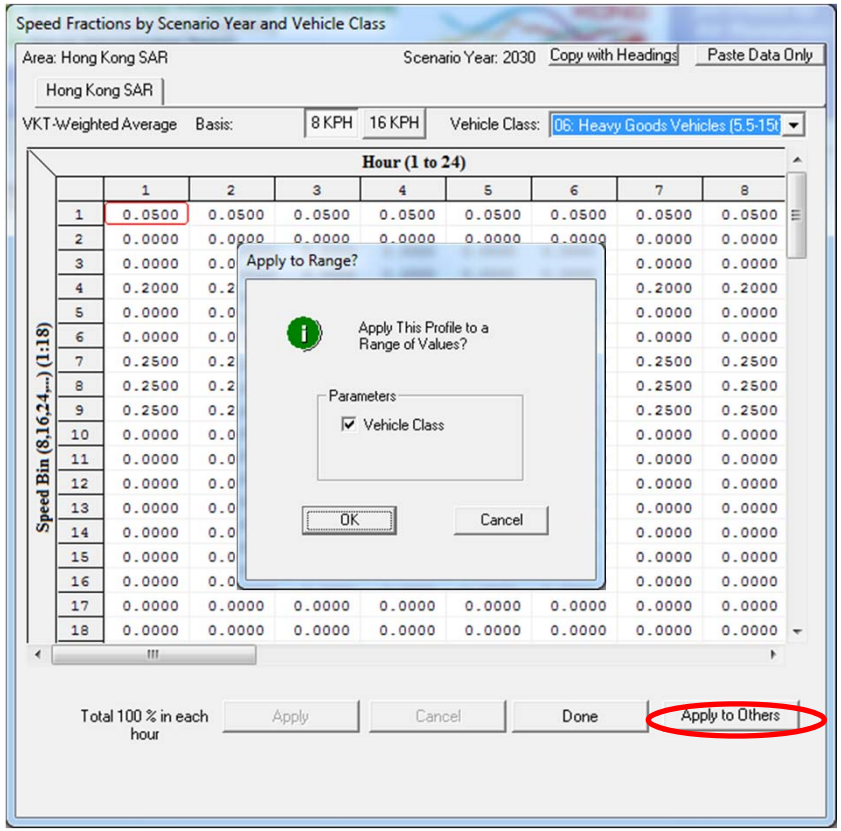


2015 Speed Fractions (HGV7)
Edits Applied

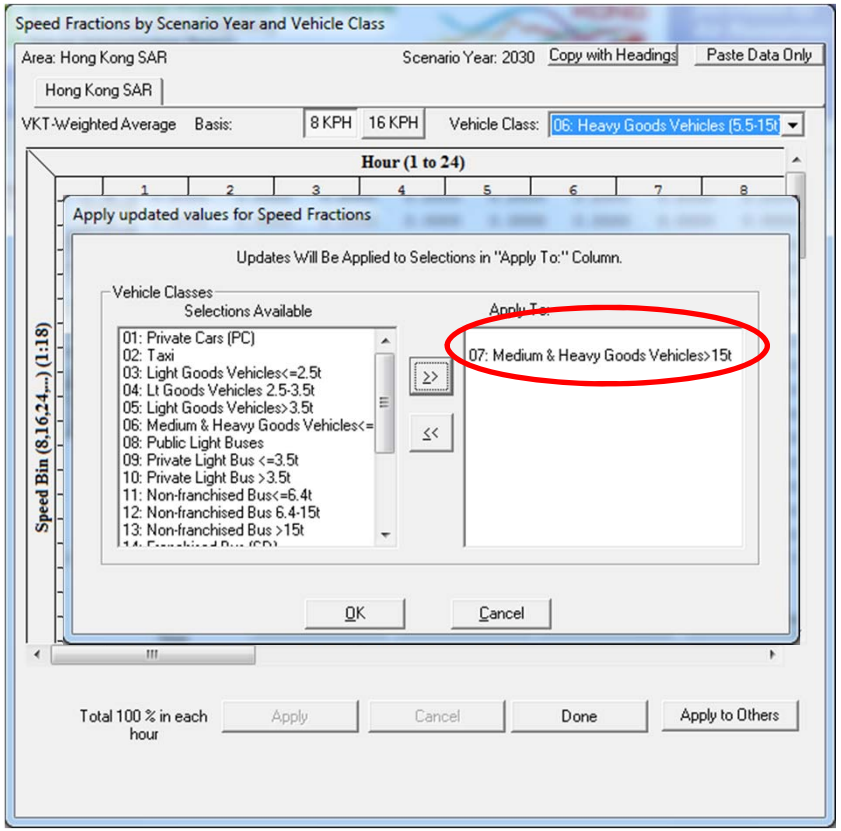


Exercise #7: Apply Speed Fraction Edits to Other Hours

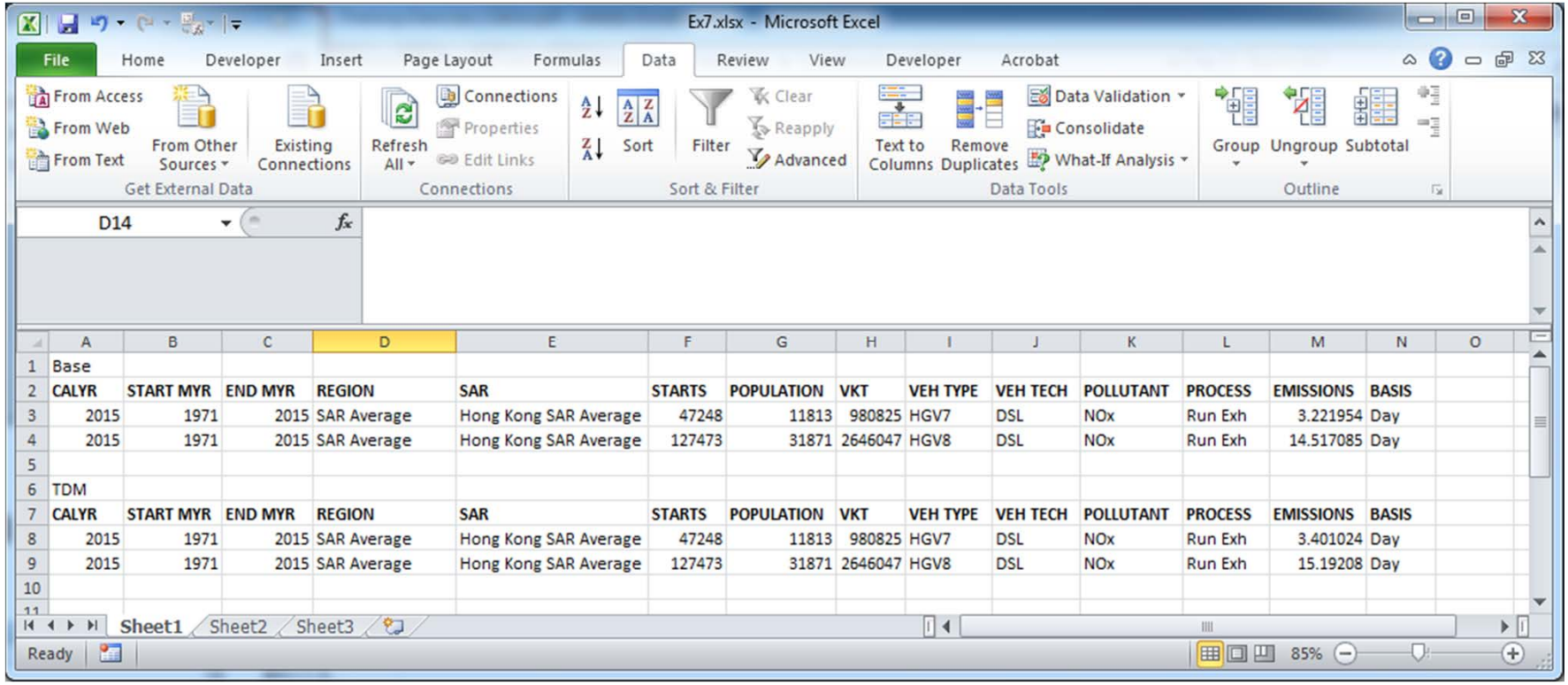
Apply Edit to Another Veh Class



Apply Edit to HGV8



Exercise #7: Solution



Exercise #8: Changing RH

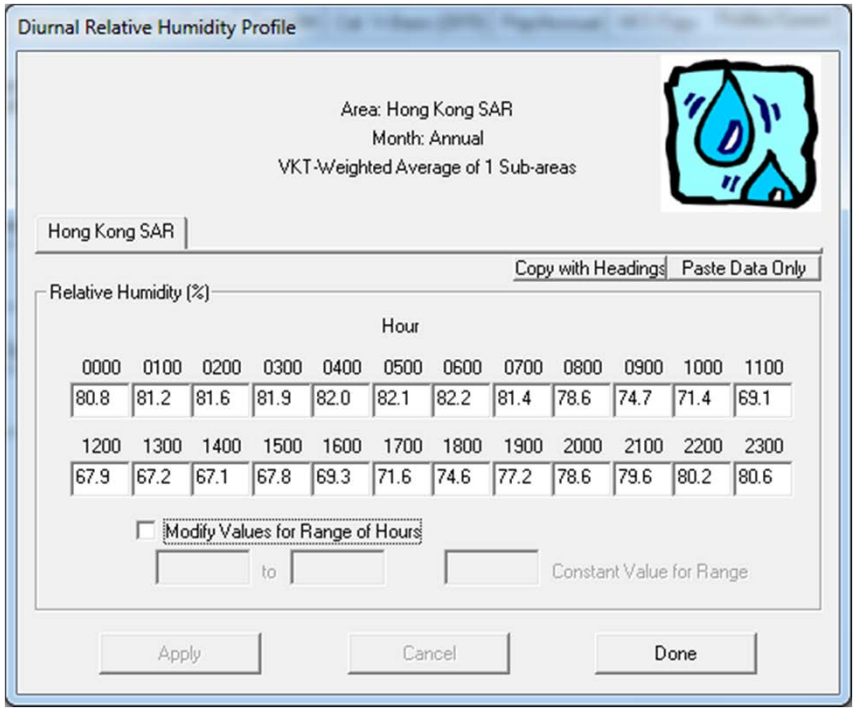
- Context: This exercise shows how the user can change the relative humidity for an area of concern, say, area near a weather station, P, in 2015. It also provides the users
- Problem: Set up a base run for 2015 calendar year for Hong Kong. Include a second scenario, replacing the annual relative humidity values with the annual values provided on RH.XLS.

Exercise #8: Entering Different Relative Humidity Values

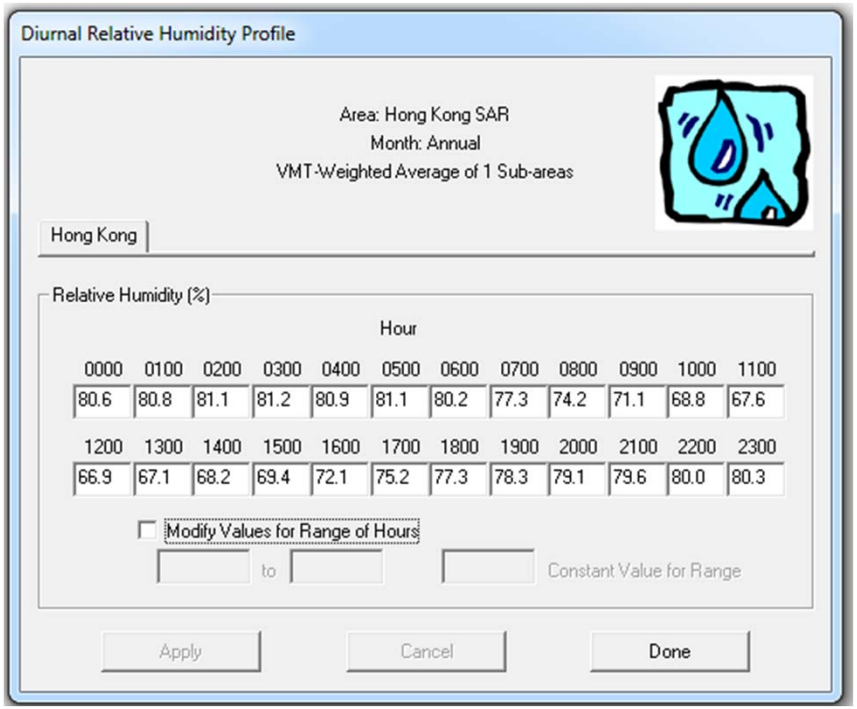
- Scenario data:
  - Scenario #1
    - Geographic Area: Hong Kong SAR
    - Calendar Years: 2015
    - Season: Annual
    - Scenario Type: BURDEN
    - Output File types: Text (CSV), BCD
    - Output Frequency: daily
    - Pollutants: PM_{10}, VOC
  - Scenario #2: Replace annual Relative Humidity Values with values from RH.XLS

Exercise #8: Changing RH

RH Annual (Default)



RH Annual from RH.XLS



Exercise #9: Alternate Base Year

This example shows how to choose and edit an alternate base year and data; then, perform a forecast of these data. The example selects an alternate baseline year (Calendar Year 2014); performs a 5% adjustment to the petrol base population; then forecasts the inventory for Calendar Year 2030.

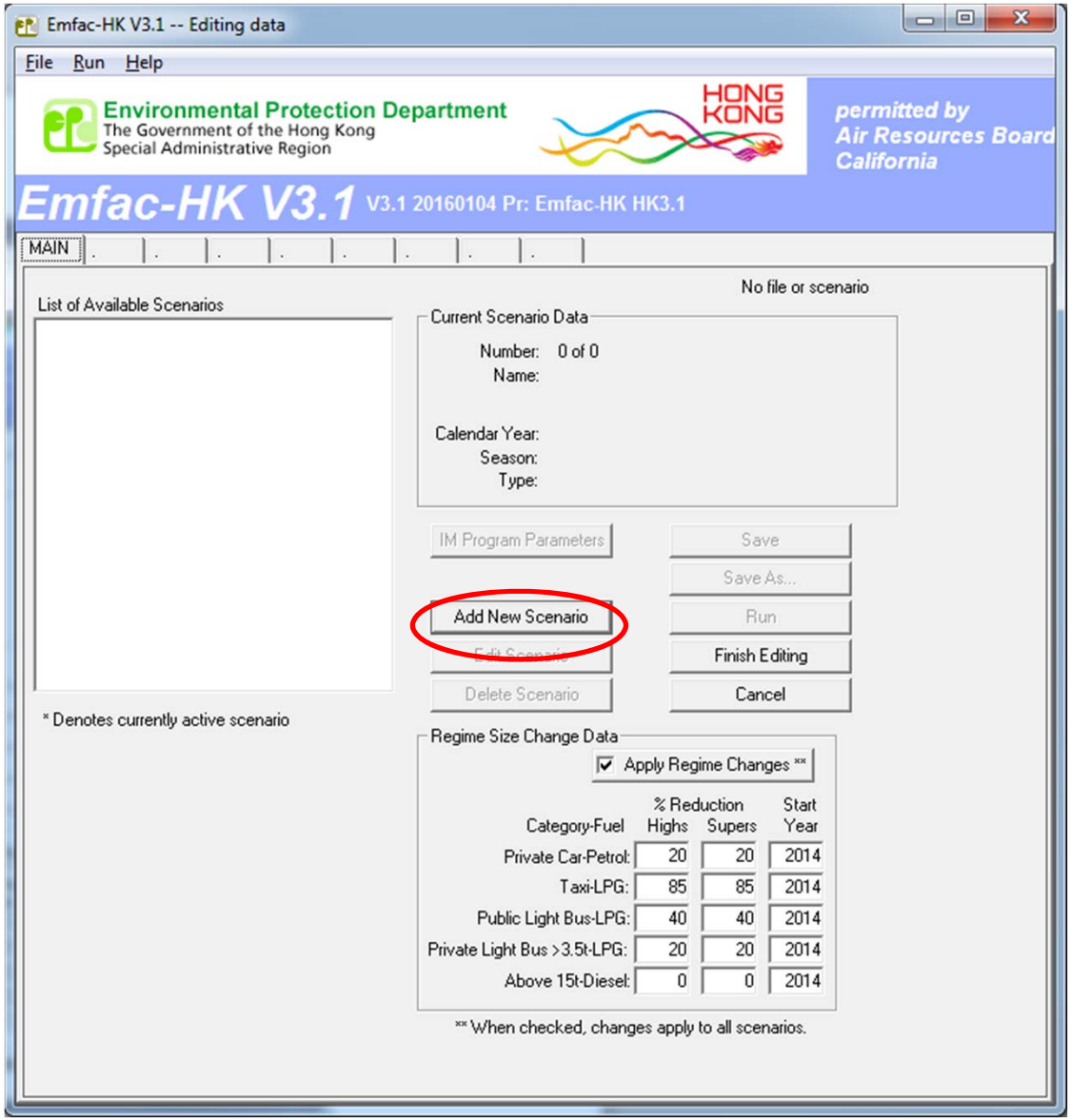
Suggested steps:

1) **Run** EMFAC-HK V3.1

2) Select “**File**” and click “**New**” from the Menu

3) On Tab "MAIN", click “**Add New Scenario**”.

Exercise #9: Alternate Base Year

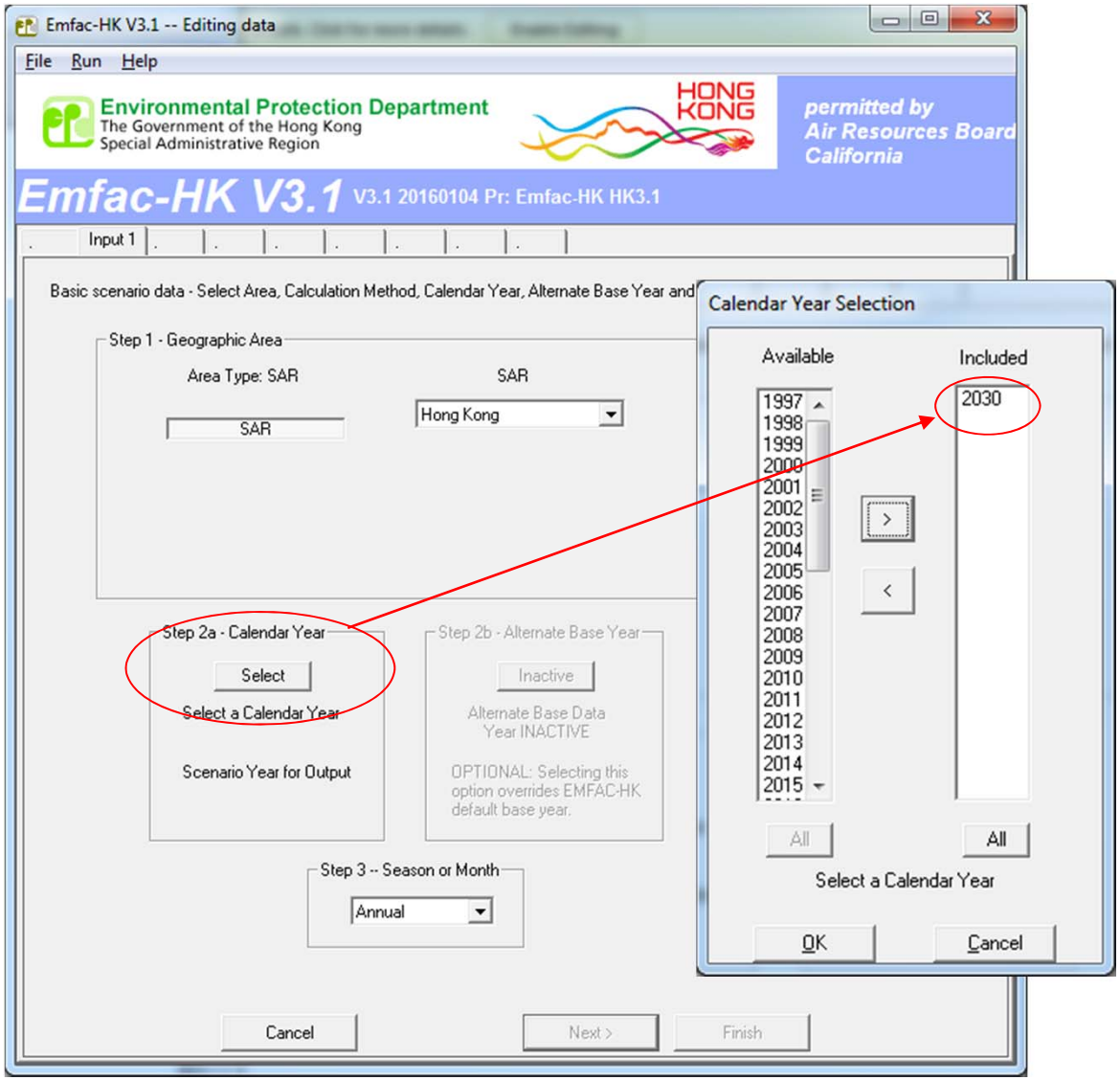


Exercise #9: Alternate Base Year

4) On Tab "INPUT1", under *Step 2a - Target Years*, click **“Select”**

5) On the "Target Year Selection" screen, click "**2030**" in the *Available* column; then, click ">". The target year 2030 should appear in the "Included" column. Click “**OK**”.

Exercise #9: Alternate Base Year

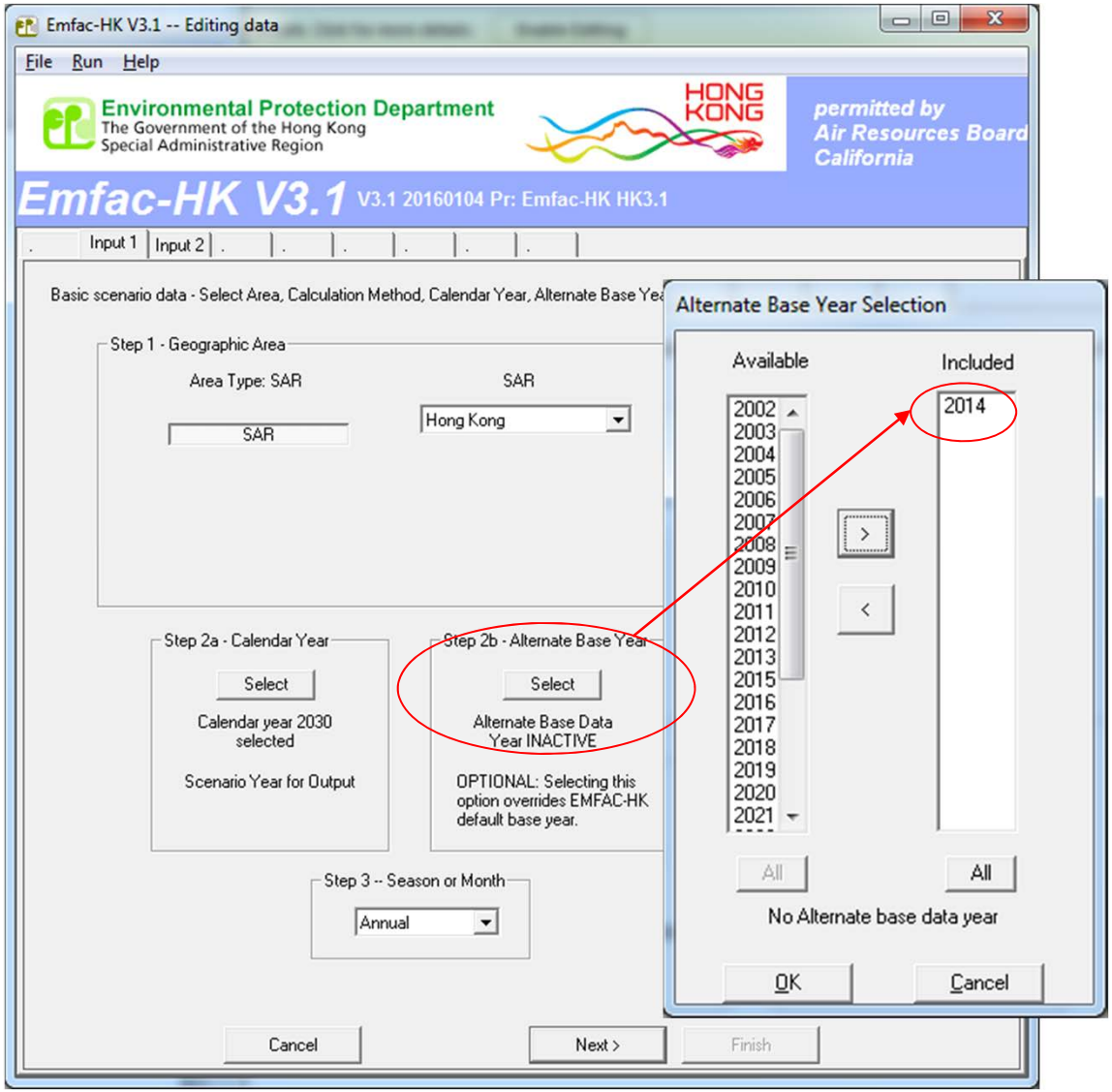


Exercise #9: Alternate Base Year

6) On Tab “INPUT 1”, under *Step 2b – Alternate Baseline Yr”* is no longer “grayed out”. Click “**Select”** and proceed to selecting an alternate baseline year.

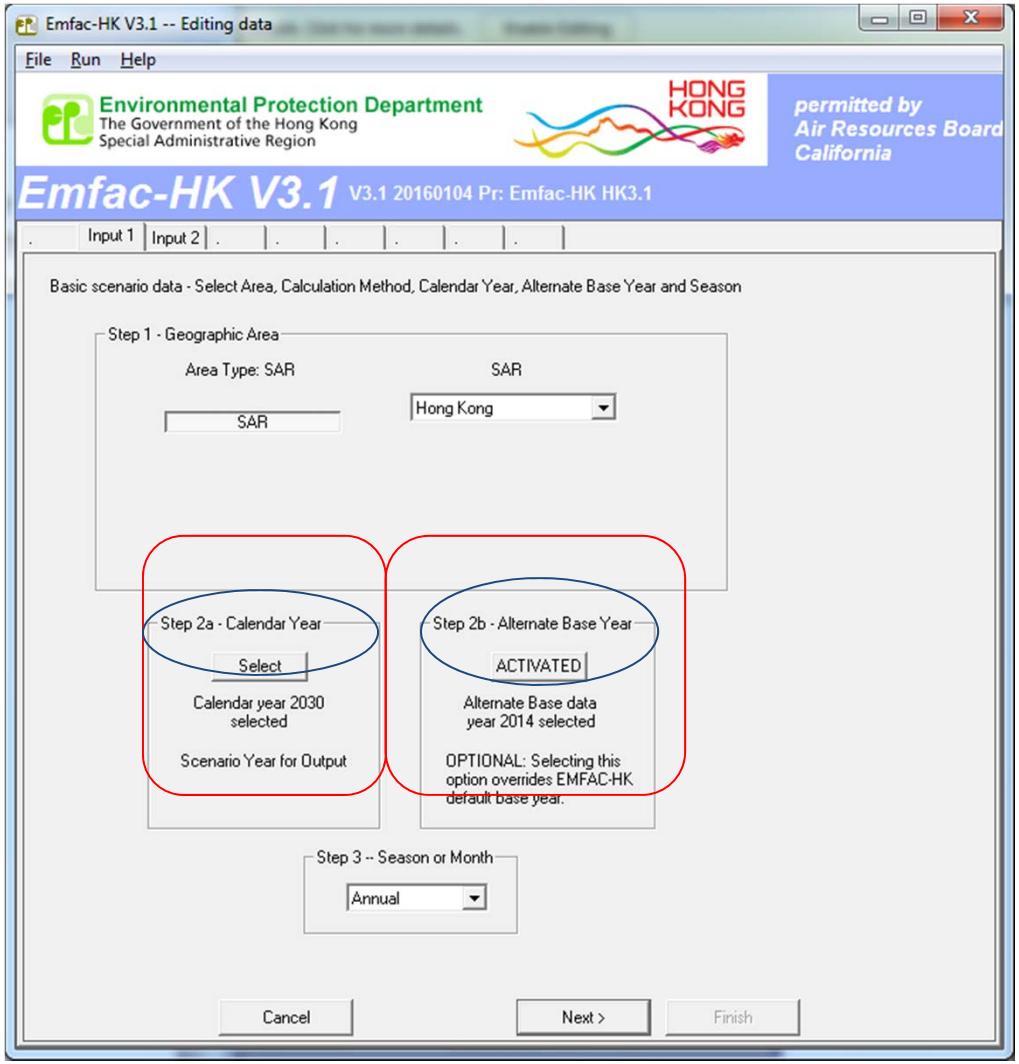
7) On the “Alternate Baseline Yr Selection" screen, click "**2014**" in the *Available* column; then, click "**>**". The alternate baseline year of “2014” should appear in the "Included" column. Click “**OK**”.

Exercise #9: Alternate Base Year



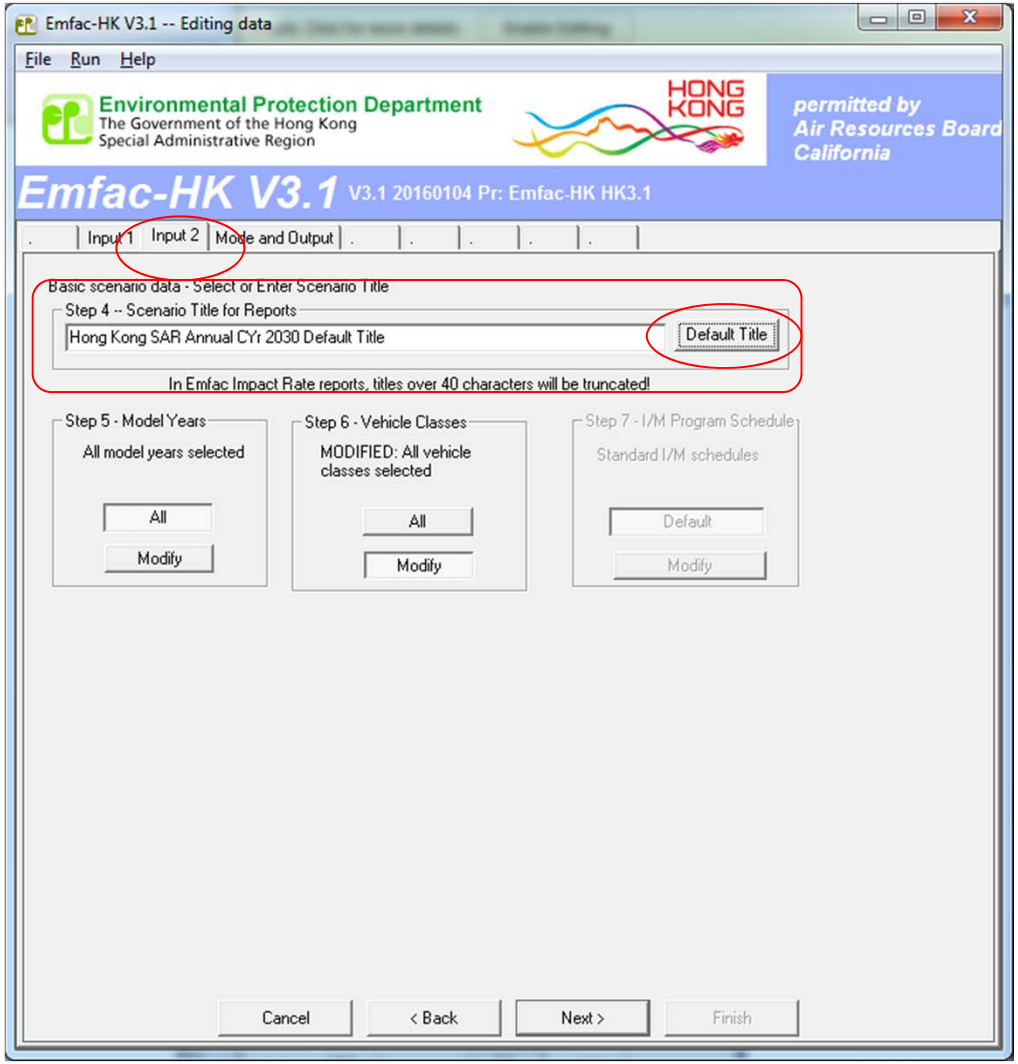
Exercise #9: Alternate Base Year

8) The updated *Step 2a – Target Years* and *Step 2b – Alternate Baseline Yr* boxes should now both be updated, as indicated below. At Step 3, keep the *Season or Month* selection as "**Annual**". Click "**Next**" to proceed to the screen titled *Input 2*.



Exercise #9: Alternate Base Year

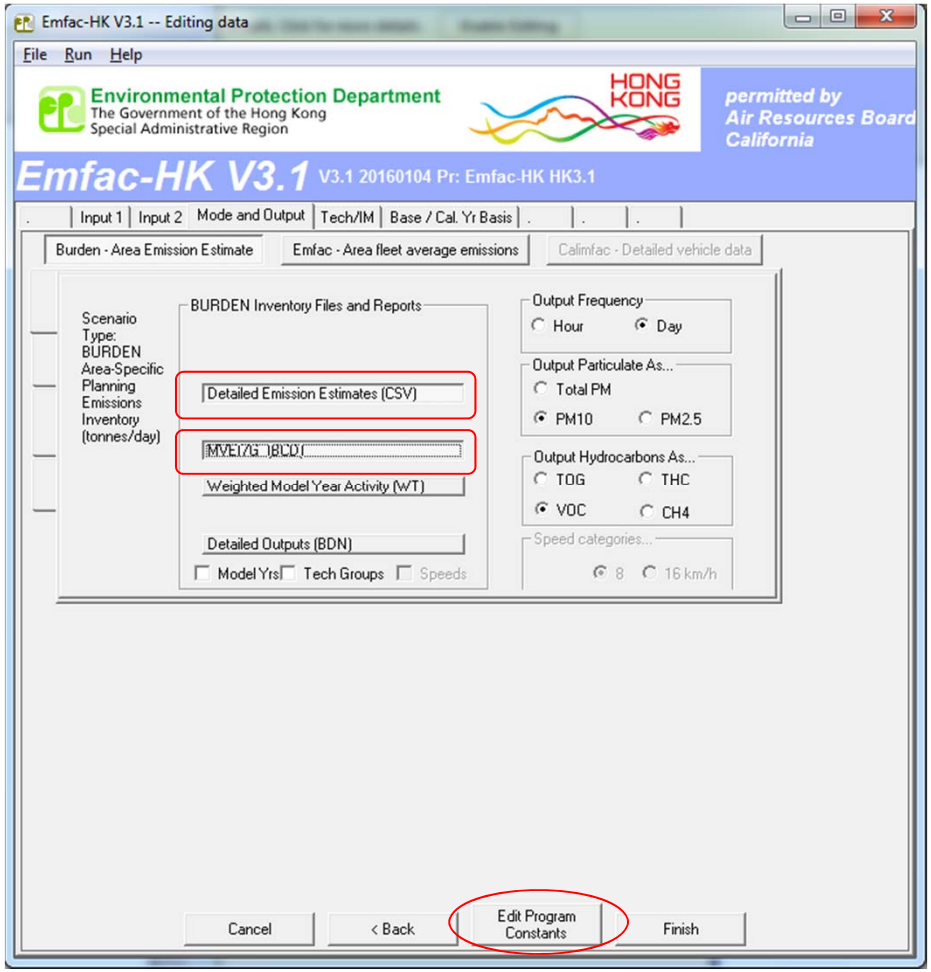
9) In *Input 2* screen, click "**Default Title**" to change the *Step 4 - Scenario Title for Reports* to reflect the concerned scenario.



Exercise #9: Alternate Base Year

15) Click "**Next**" and proceed to the *Mode and Output* screen.

•16) In the *Mode and Output* screen, click on "**Burden – Area Emission Estimate**". Under *Burden Inventory Files and Reports* click on "**Detailed Emission Estimates (CSV)"** and **"MVEI7G (BCD)**".



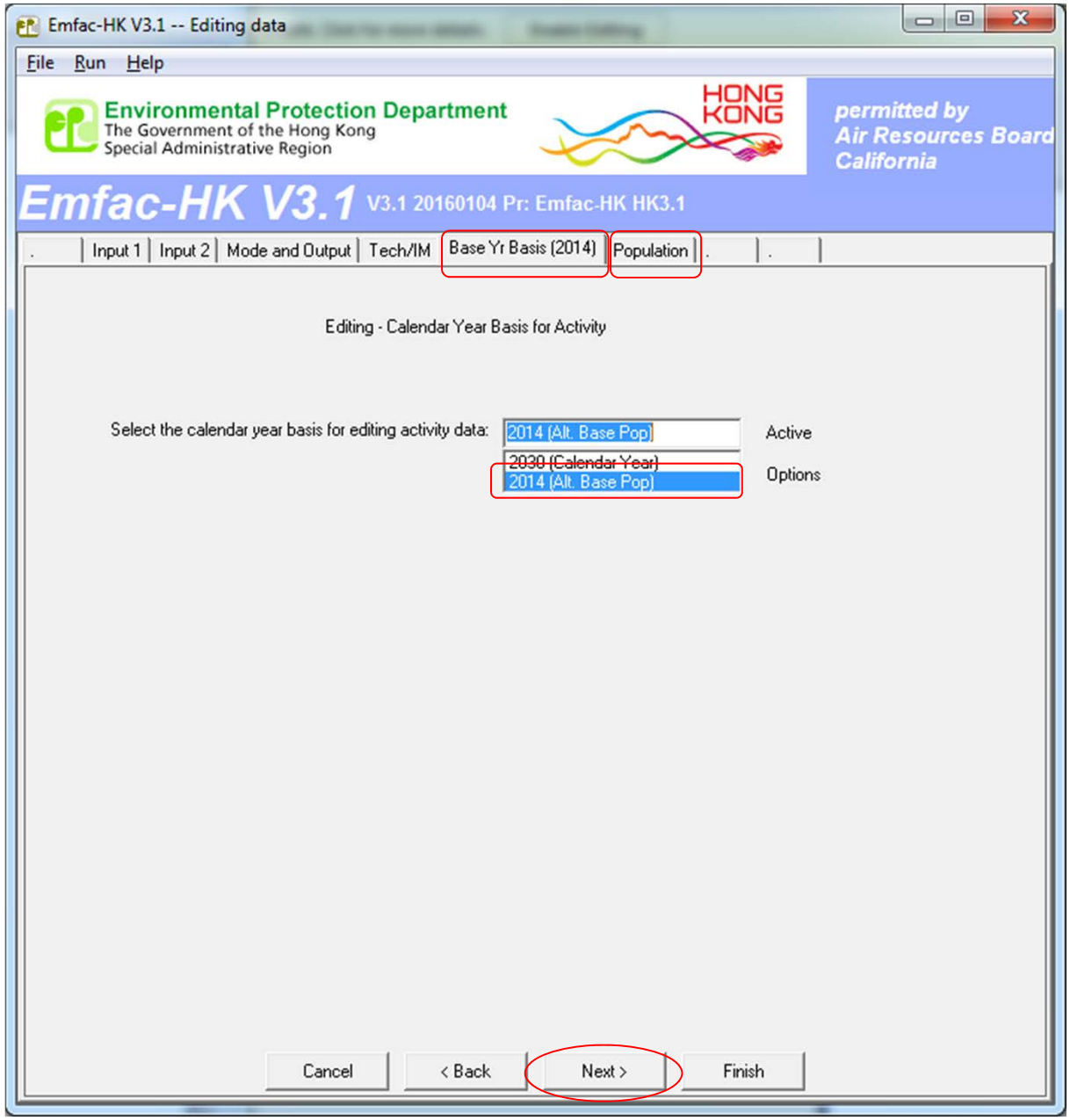
Exercise #9: Alternate Base Year

17) Click "**Edit Program Constants**" to advance to the next screen, which is the Tech/IM screen.

18) Click "**Next**" at the *Tech/IM Screen* to advance to the *Base/Targ Yr* screen.

19) We will now perform edits to the Alternate Baseline Data: on the *Base/Targ Yr* Screen click on "**2014 (Alt Baseline Pop)**" to select the alternate baseline data for editing. Once the selection is made, notice that the tab has been relabeled to *Base Yr Basis (2014)*, and the *Population* tab appears on the Tab Strip.

Exercise #9: Alternate Base Year



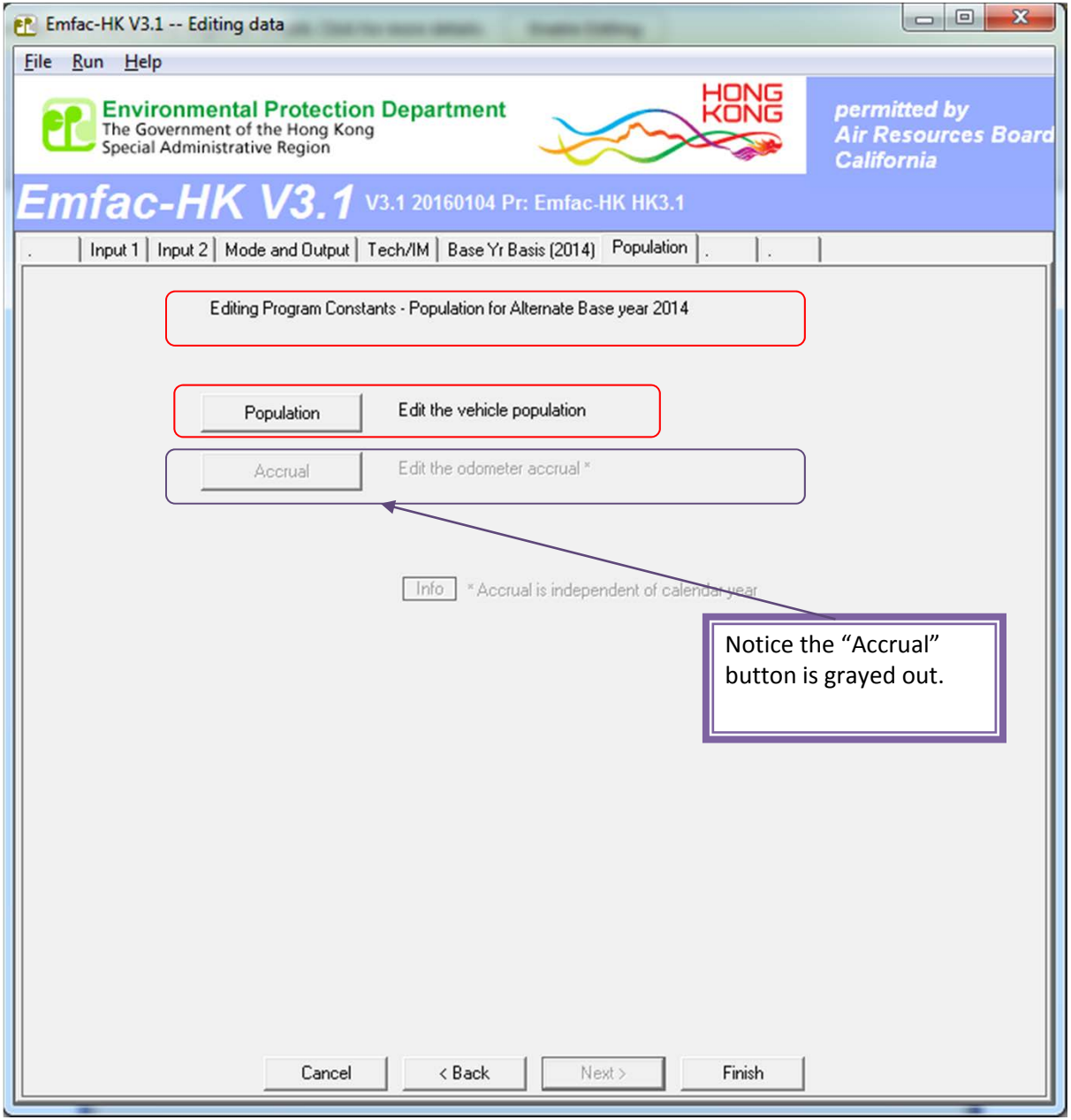
Exercise #9: Alternate Base Year

20) Click “**Next**” to advance to the *Population* edits screen.

21) Population/Accrual edit screen: notice the Accrual button is “grayed out”, as it is neither applicable nor editable for the baseline year).

22) Click on the “**Population**” button to advance to the editing screen.

Exercise #9: Alternate Base Year



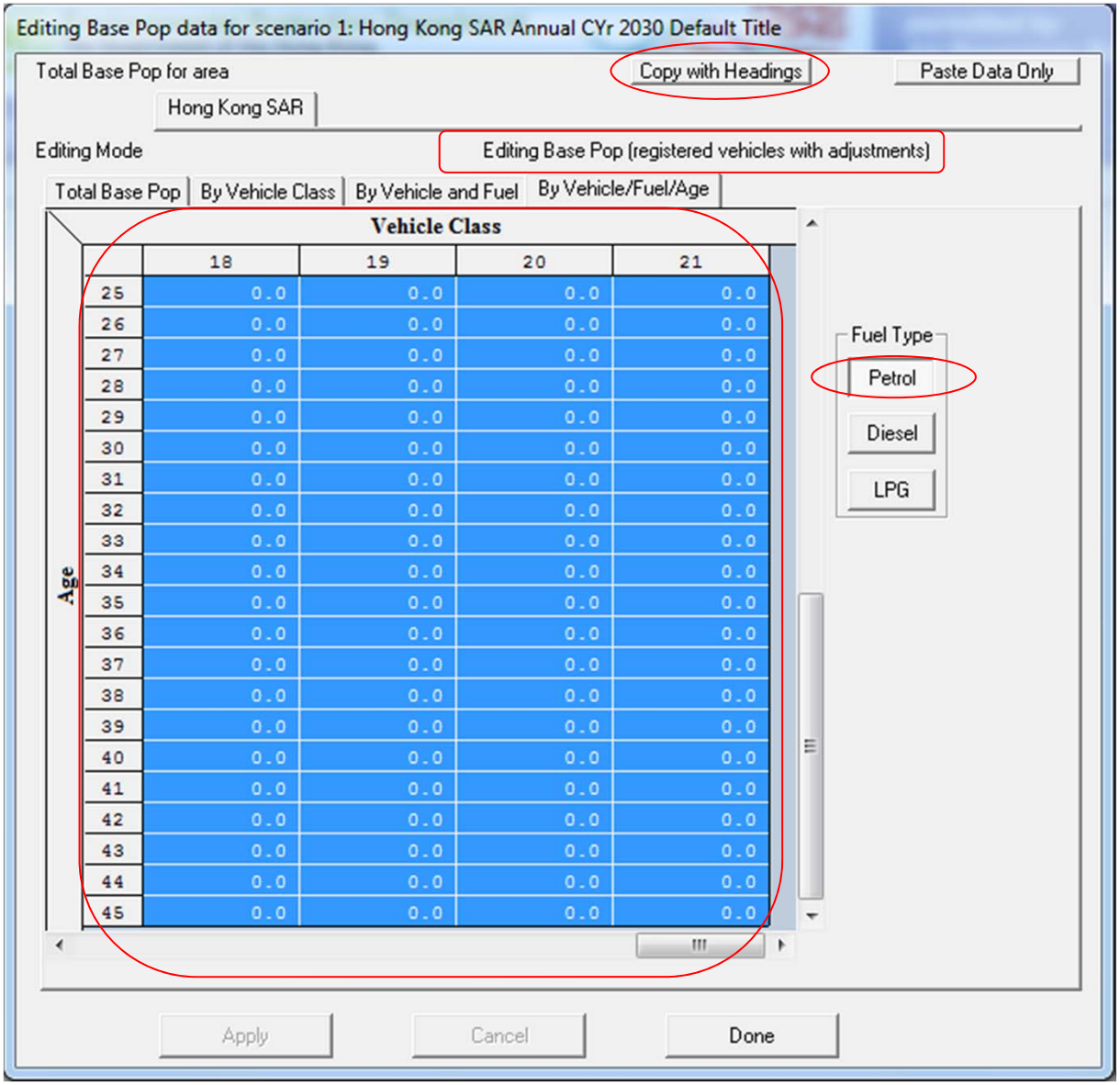
Exercise #9: Alternate Base Year

23) Editing Baseline Population screen for Petrol (By Vehicle/Fuel/Age). The default data for 2014 are displayed.

24) Click on "**Vehicle Class 1"**, "**Age 1"** cell (i.e., Row 1, Column 1). Hold mouse down while dragging mouse downward and across to the right until all 45 ages and 21 vehicle classes are highlighted.

25) Select "**Copy with Headings**".

Exercise #9: Alternate Base Year



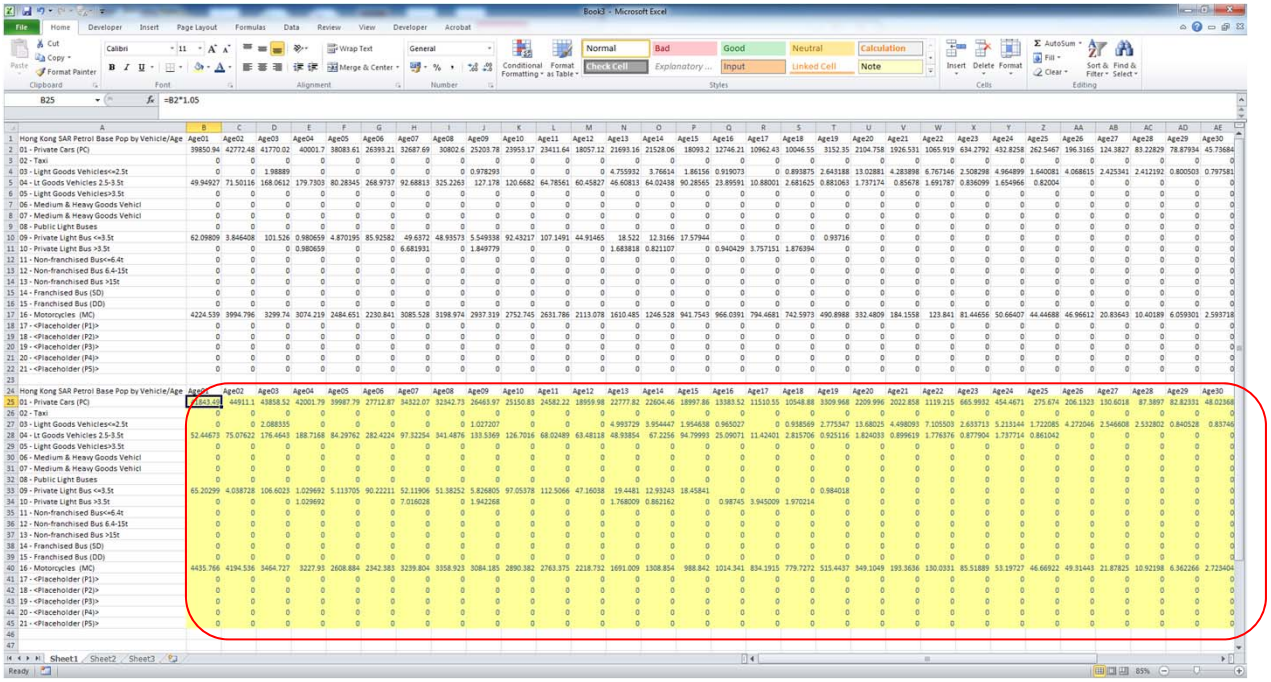
Exercise #9: Alternate Base Year

26) Open a Microsoft Excel blank spreadsheet. Paste data into Cell A1. Paste data again at Cell C24 (a formula will be used to edit this portion of the data)

27) Adjust column width of “A”, so vehicle class label can be seen.

28) At Cell B25, enter the formula “=**B2*1.05**”. Copy this formula to the data range (C25:AT45). Values highlighted below in yellow with “blue” text illustrate the formula cells.

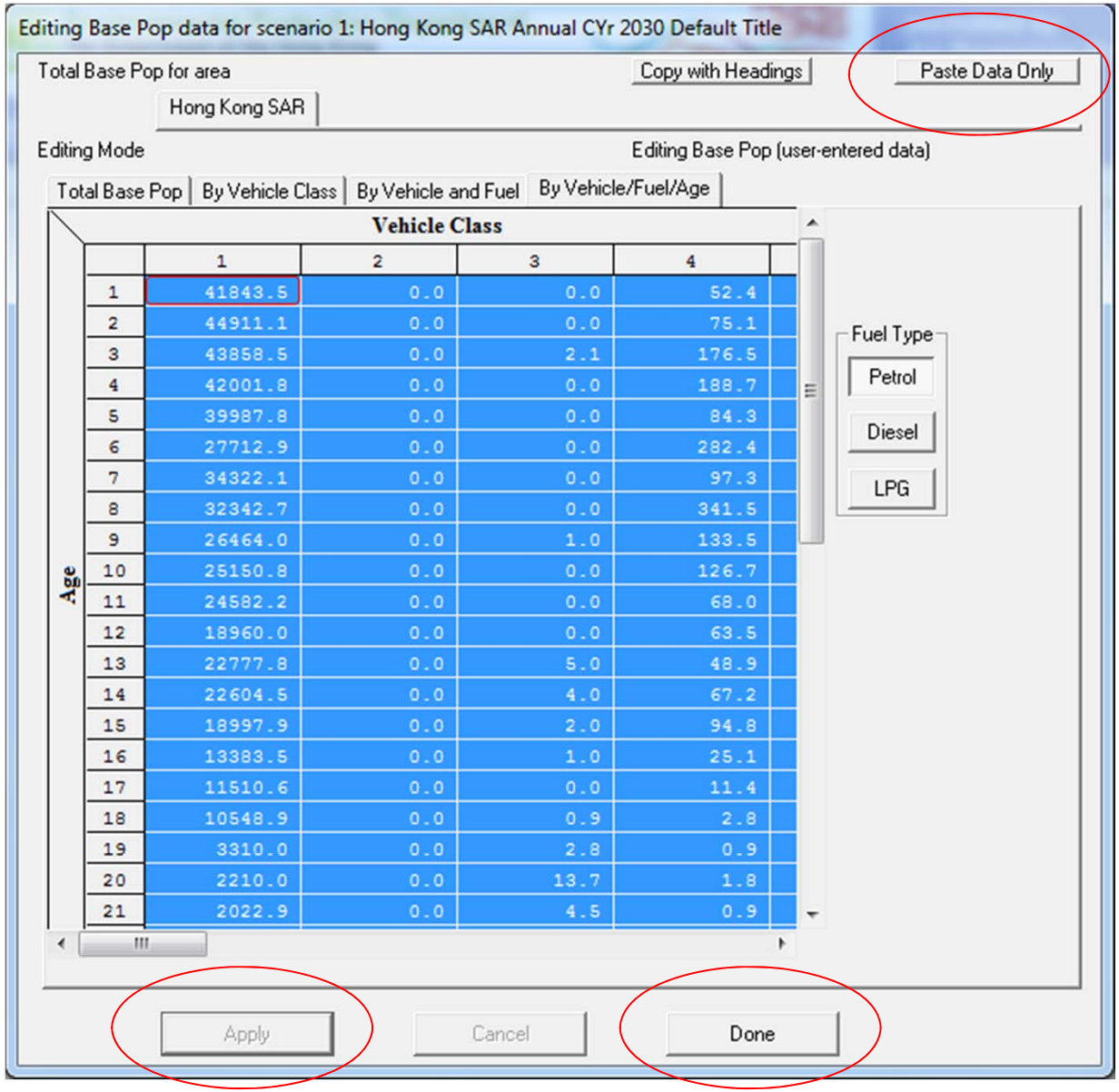
Exercise #9: Alternate Base Year



29) Highlight C25:AT25 with the mouse (i.e, the “yellow” portion above entending to Age 45), then type “**Ctrl-C**” to copy to the buffer.

30) Return to EMFAC-HK and click “**Paste Data Only**”. Then “**Apply**”. Then “**Done**”

Exercise #9: Alternate Base Year



Age	1	2	3	4
1	41843.5	0.0	0.0	52.4
2	44911.1	0.0	0.0	75.1
3	43858.5	0.0	2.1	176.5
4	42001.8	0.0	0.0	188.7
5	39987.8	0.0	0.0	84.3
6	27712.9	0.0	0.0	282.4
7	34322.1	0.0	0.0	97.3
8	32342.7	0.0	0.0	341.5
9	26464.0	0.0	1.0	133.5
10	25150.8	0.0	0.0	126.7
11	24582.2	0.0	0.0	68.0
12	18960.0	0.0	0.0	63.5
13	22777.8	0.0	5.0	48.9
14	22604.5	0.0	4.0	67.2
15	18997.9	0.0	2.0	94.8
16	13383.5	0.0	1.0	25.1
17	11510.6	0.0	0.0	11.4
18	10548.9	0.0	0.9	2.8
19	3310.0	0.0	2.8	0.9
20	2210.0	0.0	13.7	1.8
21	2022.9	0.0	4.5	0.9

Exercise #9: Alternate Base Year

17) Click “Finish”

18) At the MAIN screen, click “Save As” to save and name the input file to an appropriate folder. In this example, the input file was named as “Ex09.inp”.

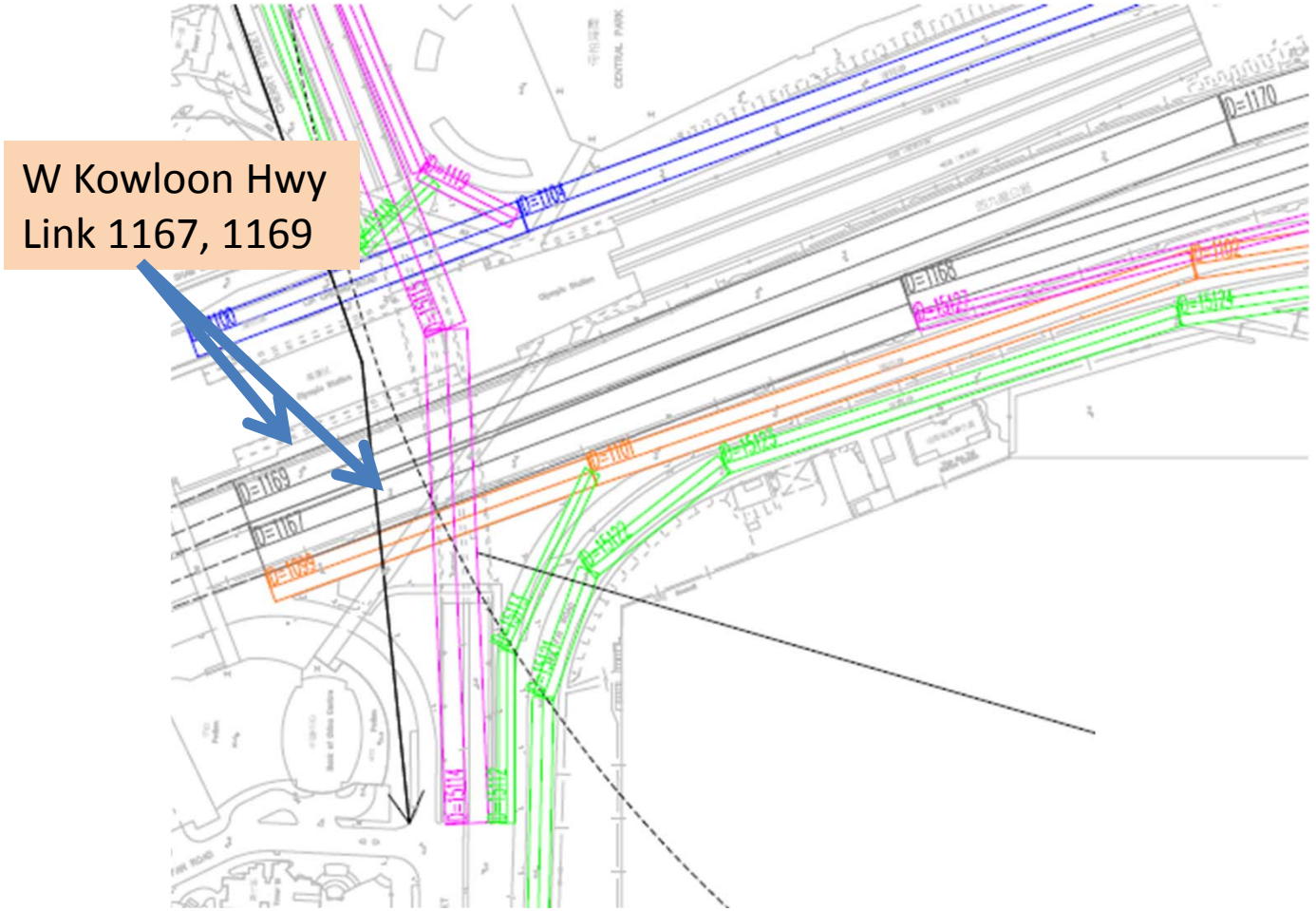
Exercise #10: Future Projections (Accelerated Retirement)

- Context: This example evaluates emission changes if franchised double-deck buses older than 15 years old are retired from the fleet (replaced with newer ones). Compare results in Calendar Year 2013 vs 2020.
- Replacement options:
  - 1: All buses 15+ yrs old replaced with brand new
  - 2: All buses 15+ yrs old replaced with 1-5 yr-old buses.

Exercise #10: Future Projections

- Scenario data:
  - Geographic Area: Hong Kong SAR
  - Calendar Years: 2013, 2020
  - Season: Annual
  - Scenario Type: BURDEN
  - Output File types: CSV, BCD
  - Pollutants: PM10, VOC
  - Hint: Copy FBDD populations by age from GUI and implement desired program.

Exercise #11 – HK Expressway



Exercise #11 – HK Expressway Emission Factor

- Problem: Determine the "composite" NOx running exhaust emission factor (grams/km) for the expressway links below. Additional information for exercise on EX11 spreadsheet.

Road Link	Link ID	Fleet Profile*	Link Length (km)	Peak Traffic Flow (veh/hr)
W Kowloon Hwy NB	1167	EX	0.260	4,117
W Kowloon Hwy SB	1169	EX	0.395	4,842

Exercise #11 –
Expressway Fleet Profile

PC	Taxi	LGV3	LGV4	LGV6	HGV7	HGV8	PLB
45.77%	19.46%	0.24%	9.60%	5.69%	1.17%	3.33%	2.50%

PV4	PV5	NFB6	NFB7	NFB8	FBSD	FBDD	MC
0.41%	0.34%	1.34%	0.97%	0.97%	0.05%	3.5%	4.66%

Exercise #11 – Expressway Link (cont.)

- Scenario data:
  - Geographic Area: Hong Kong SAR
  - Calendar Years: 2015
  - Season: Annual
  - Scenario Type: EMFAC
  - Output File types: RTL
  - Pollutants: PM10, VOC
  - Temperature: 1 = 20 deg C
  - Relative Humidity: 1 = 70%
  - Speeds: 100kph, except 70kph for GV > 5.5t, FB, NFB

Exercise #11 – Expressway Link (cont.)

- Number of Runs: only 1 EMFAC-HK run is necessary as the fleet and speed distributions are the same for each link.

Exercise #11 (cont.)

- Steps
  - Setup EMFAC-HK model run
  - Look up emission factors for each vehicle class
  - Fill out Speed Fractions Table
    - NOTE: speeds differ by vehicle class
  - Compute “composite” (i.e., fleet-average) emission factor
  - Develop CALINE4 input parameters

Exercise #12: Build/No-Build

- Context: This example evaluates emission changes if a roadway construction project is not implemented (i.e, build/no-build). Projections are made what traffic will be like on the road if the project is not done.
- Roadway (2015)
  - Assume expressway fleet distribution from Exercise #11
    - 4% reduction in vehicle population
    - Reduce speeds by 10kph to simulate present congestion

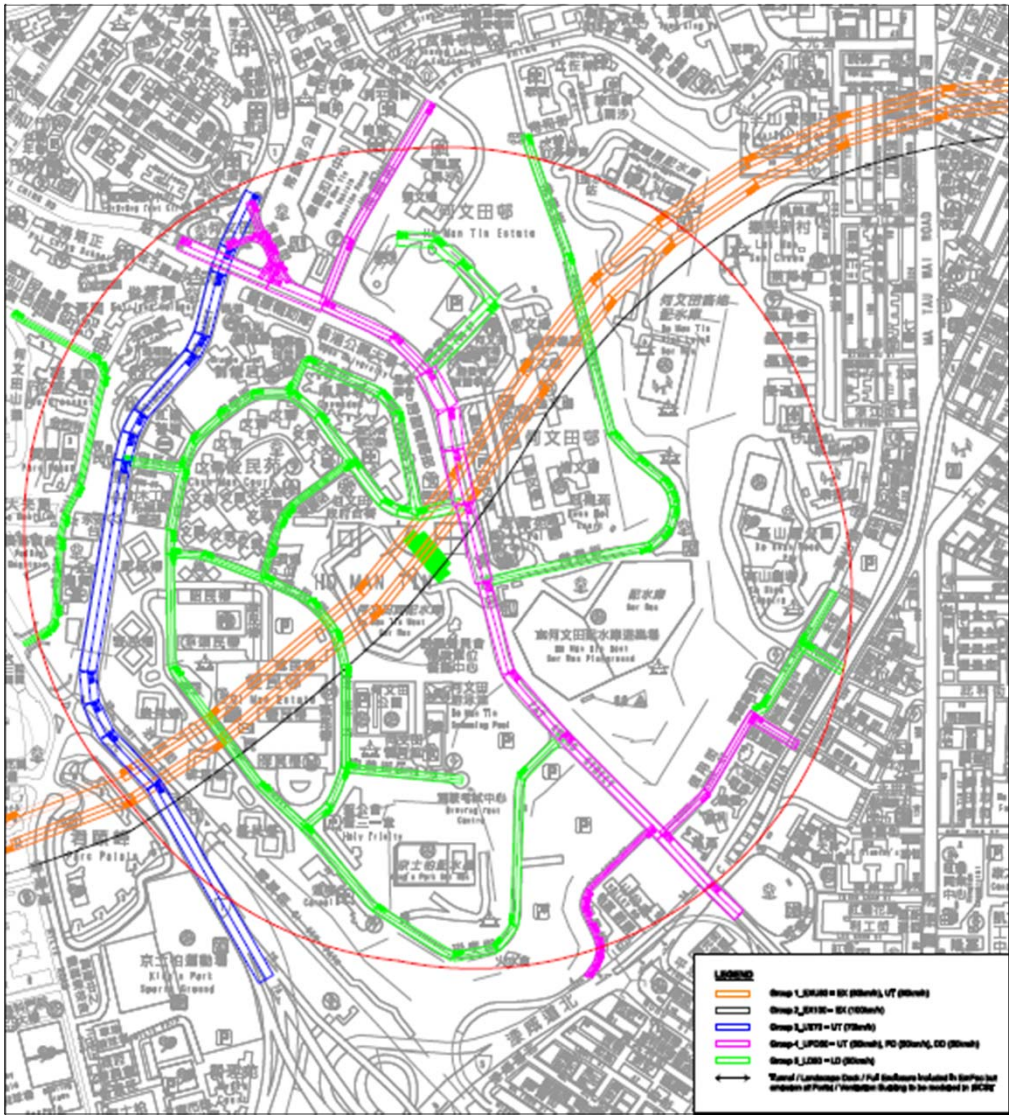
Exercise #12: Build/No-Build

- Scenario data:
  - Geographic Area: Hong Kong SAR
  - Calendar Year: 2015
  - Season: Annual
  - Scenario Type: EMFAC
  - Output File types: RTL
  - Pollutants: NOx

Exercise #13: EIA Example

- Project: Extensive new roadway to be built
- Sensitivity Analysis reveals 3 scenario years to evaluate:
  - 2021: commission year
  - 2026: interim year
  - 2036: 15 years after (peak VKT)
- 3 Roadway Groups:
  - EX (100 kph), UT (80 kph), PD (50 kph)
  - no starting emissions assumed

Exercise #13: Road Extent Example



Source: Agreement No. CE 43/2010 (HY) Central Kowloon Route – Design and Construction Estimation of Vehicular Emission for the Study Area and Determination of Worst Assessment Year by EMFAC, Appendix 4.5

Exercise #13 – EIA Example

- Scenario data:
  - Geographic Area: Hong Kong SAR
  - Calendar Years: 2021, 2026, 2036
  - Season: Annual
  - Scenario Type: EMFAC
  - Output File types: RTL
  - Pollutants: NOx
  - Temperature: 1 = 20 deg C
  - Relative Humidity: 1 = 70%
  - Speed Fractions:
  - Roads w/ posted speeds >= 70kph
    - 100% at 70kph for GV > 5.5t, FB, NFB

Exercise #13: Simplifications

- For simplicity
  - default technology fractions
  - we'll evaluate calendar year 2021 only.
  - Fleet mix distributions for each roadway type provided on spreadsheet

Exercise #13: EIA Example

- Setup EMFAC-HK model runs
- Look up emission factors for each vehicle class for appropriate speed
- Compute “composite” (i.e., fleet-average) NOx running exhaust emission factor for each roadway type
- Develop CALINE4 input parameters