

Evaluation of emissions from small cans

Project: CARB – Small can user in mobile air conditioning

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Small can characteristics



Can to be screwed and perforated



Reusable charging kit for small cans to be perforated and screwed



Can equipped with a valve and pressure gauge

Two categories of small cans (SC) are available on the Californian market:

- Cans to be screwed and perforated
- Cans equipped with a valve and an optional pressure gauge

SC brand name	Model	Type	Content	Price Kragen	Price Kragen 2	Price Net www.partsamerica.com/
Quest	Normal	S&P	12 oz		7,99 \$	
Quest	UV	S&P	12 oz		11,99 \$	
Quest	Stop Leak	S&P	12 oz		11,99 \$	
Quest	Sub Zero Polar Bear	S&P + reusable kit	19 oz	28,99 \$	25,99 \$	24,99 \$
Johnsen		S&P	12 oz	7,99 \$	8,99 \$	8,99 \$
Johnsen	UV Dye	S&P	12 oz		14,99 \$	
Interdynamics	EZ Chill	Valve equipped	14 oz	21,99 \$	17,99 \$	
Interdynamics	Arctic Freeze	S&P	13 oz		13,99 \$	12,99 \$
Interdynamics	Arctic Freeze	Valve equipped + P gauge	12oz		39,99 \$	
Interdynamics	Arctic Freeze	Valve equipped	19 oz			32,99 \$
Interdynamics	Arctic Freeze with Reusable Trigger	Valve equipped	14 oz			26,99 \$
Interdynamics	EZ Chill+hose	Valve equipped			28,99 \$	
Interdynamics	EZ Chill Measure/Recharge Kit	Valve equipped + P gauge	19 oz			24,99 \$

Small can leak test results



Type V



Type S&P

Measures are made at the CEP laboratory in order to:

- Evaluate the can emissions before and after a partial use
- 14 different cans of different types have been tested

Cans			Leak Flow Rate [g/yr]								
Net Weight [g]	Type	CEP Reference	new 癩			used 癩			Charging hose		
			30	35	40	30	35	40			
510	V	C1-01	3.17	3.88	5.28	3.41	4.05	4.79	F1-01	F1-01	
396	S&P	C1-03	0.11	0.19	0.32	0.19	0.28	0.55	F1-02		
510	V	C1-02	0.83	1.24	1.95	0.86	1.24	1.65	F1-01	F1-02	
396	V	C1-04	0.62	1.03	1.73	0.55	0.86	1.51	F1-01		
396	S&P	C1-05	0.37	0.60	1.05	441	526	714	F1-09	F1-02	
397	V	C1-06	0.97	1.59	2.27	0.70	2.08	3.34	F1-01		
398	V	C1-07	0.66	1.09	1.64	0.75	1.14	1.84	F1-01	F1-02	
396	S&P	C1-08	0.39	0.62	0.97	1.52	2.23	2.60	F1-12		
398	S&P	C1-10	0.41	0.62	1.09	3.09	4.48	5.86	F1-11	F1-02	
368	S&P	C1-13	0.33	0.49	0.77	0.41	0.62	1.06	F1-04		
340	S&P	C3-01	0.02	0.04	0.03	139	298	604	F1-13	F1-09 F1-13	
340	S&P	C3-02	0.002	0.003	0.08	37.0	50.1	67.8	F1-07		
340	S&P	C3-03	0.002	0.006	0.08	0.02	0.03	0.05	F1-05		
538	S&P	C4-01	0.04	0.05	0.08					F1-09 F1-13	
538	S&P	C4-02	0.05	0.07	0.11	0.06	0.11	0.19	F1-03		



F1-01

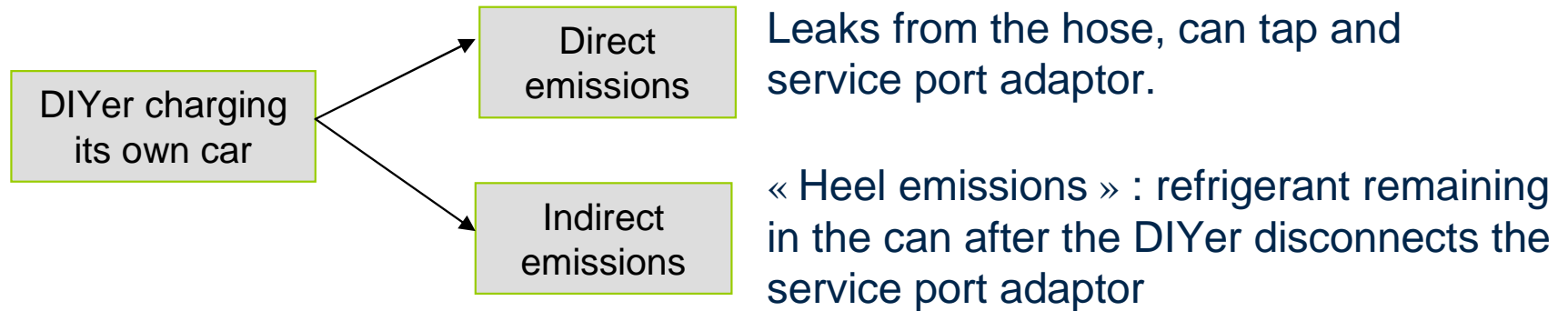


F1-02



F1-09
F1-13

Operating procedure for emission assessment



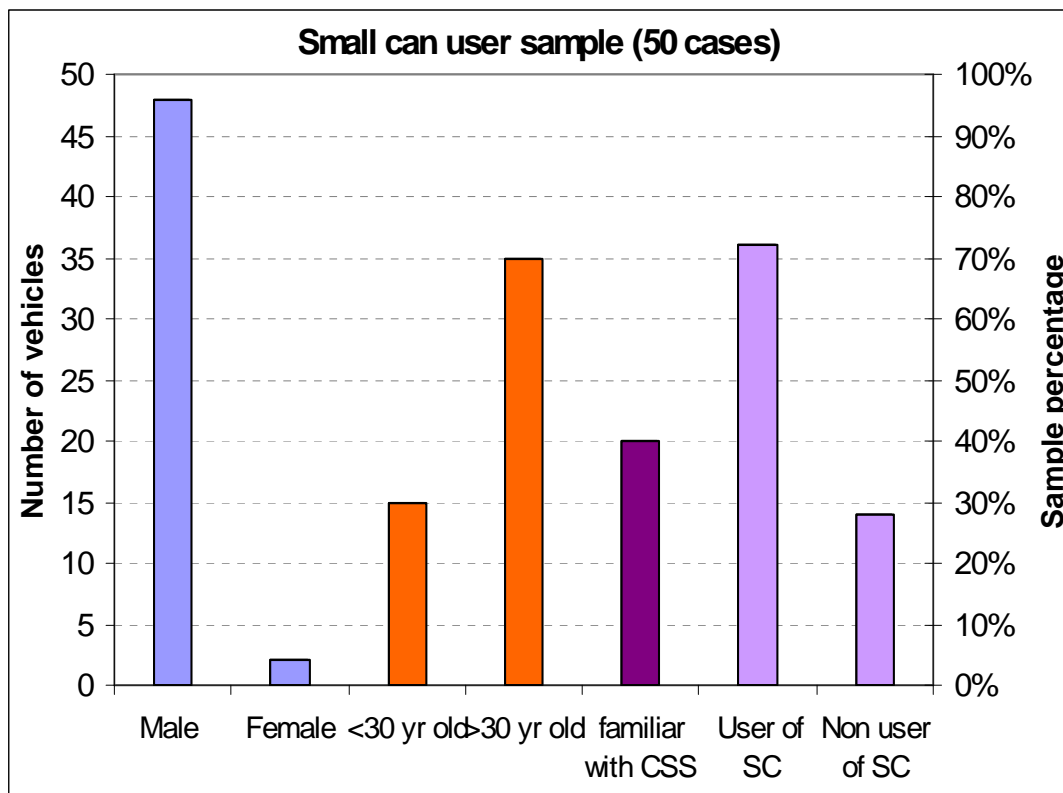
The main steps of the operating procedure are as follows:

- The refrigerant charge of the MAC system is recovered
- An initial and partial charge of the AC loop (typically 1/3 of the original charge),
- The SCU is interviewed on his usual practice with small cans
- The SCU is free to choose the one he wants,
- The SCU proceeds by charging his AC system.
- The refrigerant emissions during the charging process as well as the can heels are evaluated.

Small can user Samples

- 50 DIYers have participated to the survey (45 have done the procedure and 5 have been interviewed)
- Two sample groups

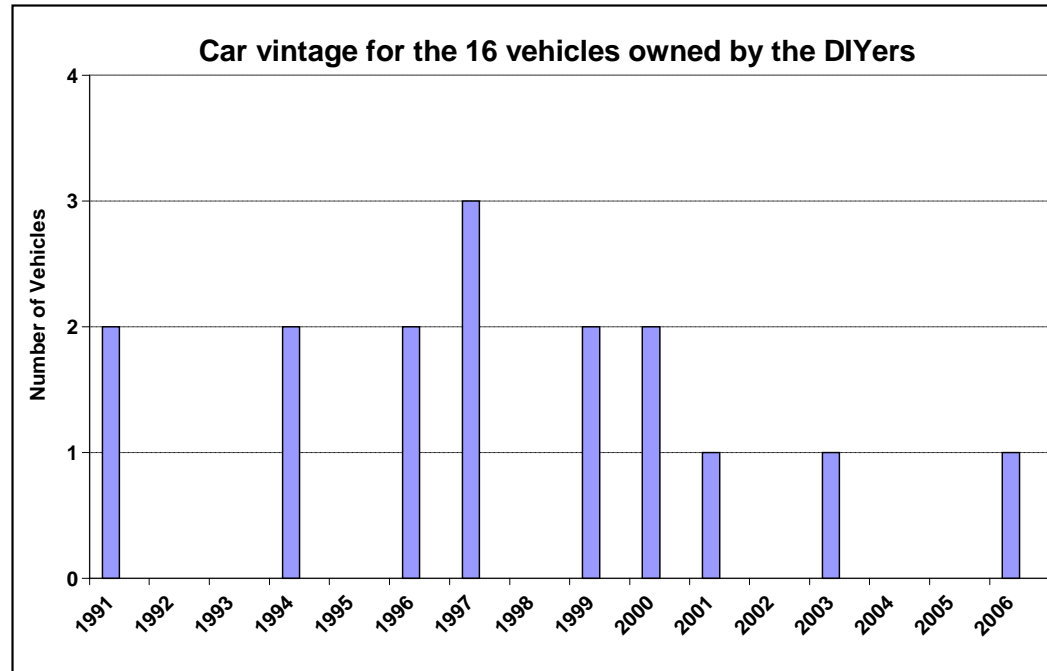
Overall sample



SC: Small Can
CSS: Car Self Servicing
SCU: Small Can User

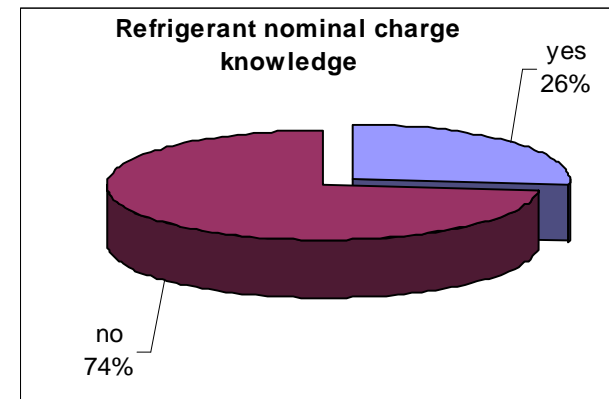
More than 70% of the persons are Small Can users who have previously made refrigerant charge of MVAC

Vehicle analysis



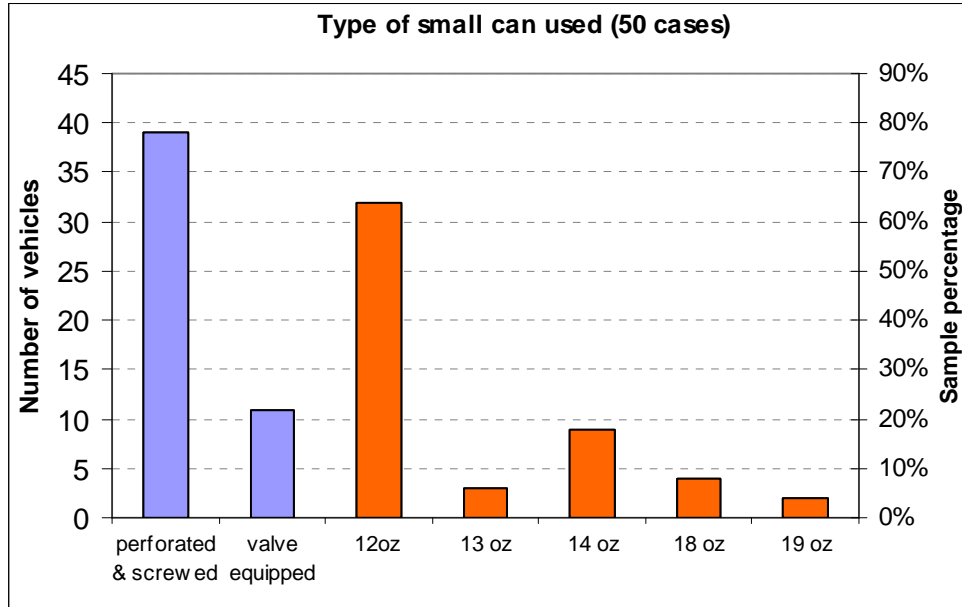
For sample 2, the CEP car used is a Mitsubishi
Montero, sample number: 20

Knowledge of the AC nominal charge
for persons who made the procedure on
their own vehicle

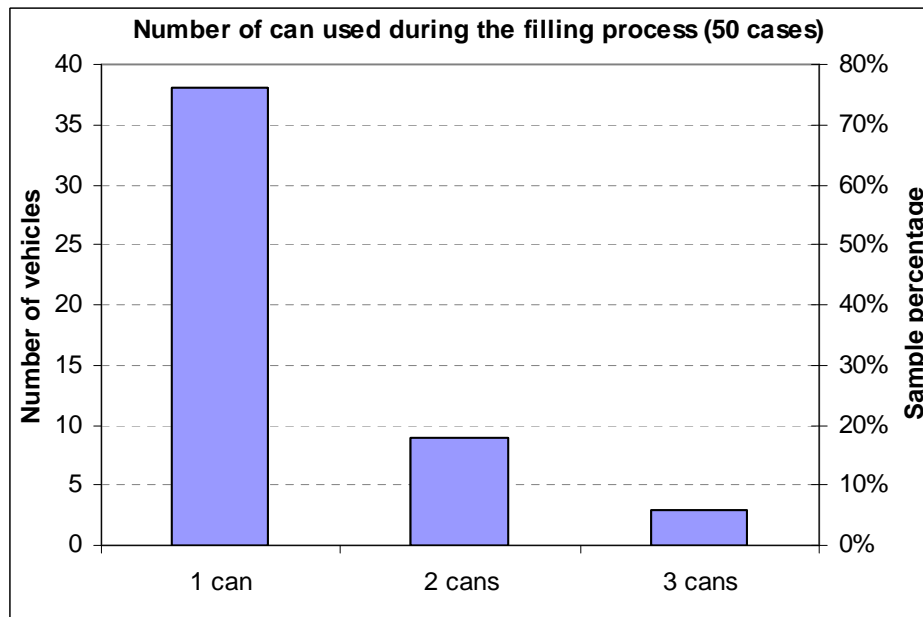
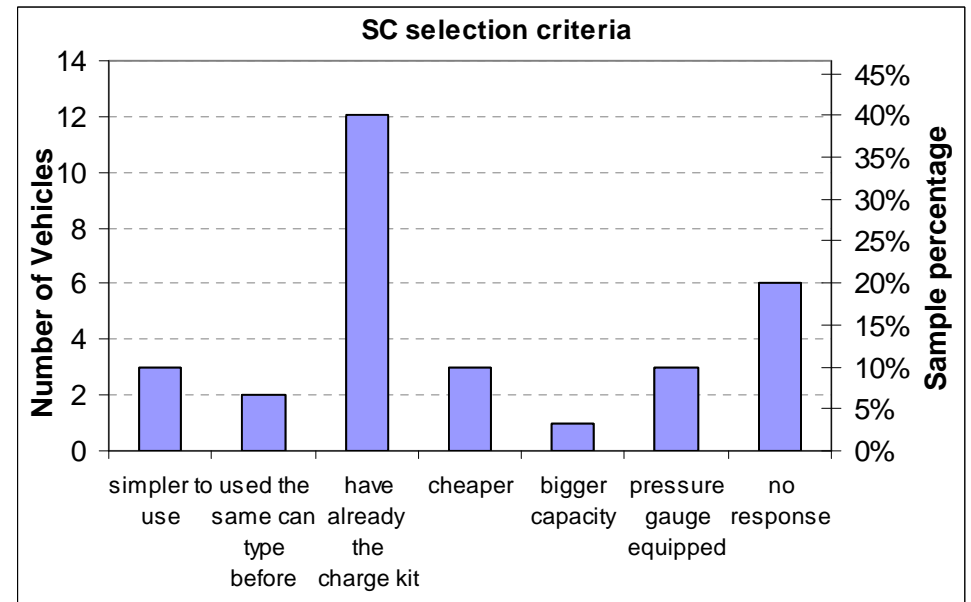


Choice of small cans

Type and capacity of small cans



Criteria for small can type choice

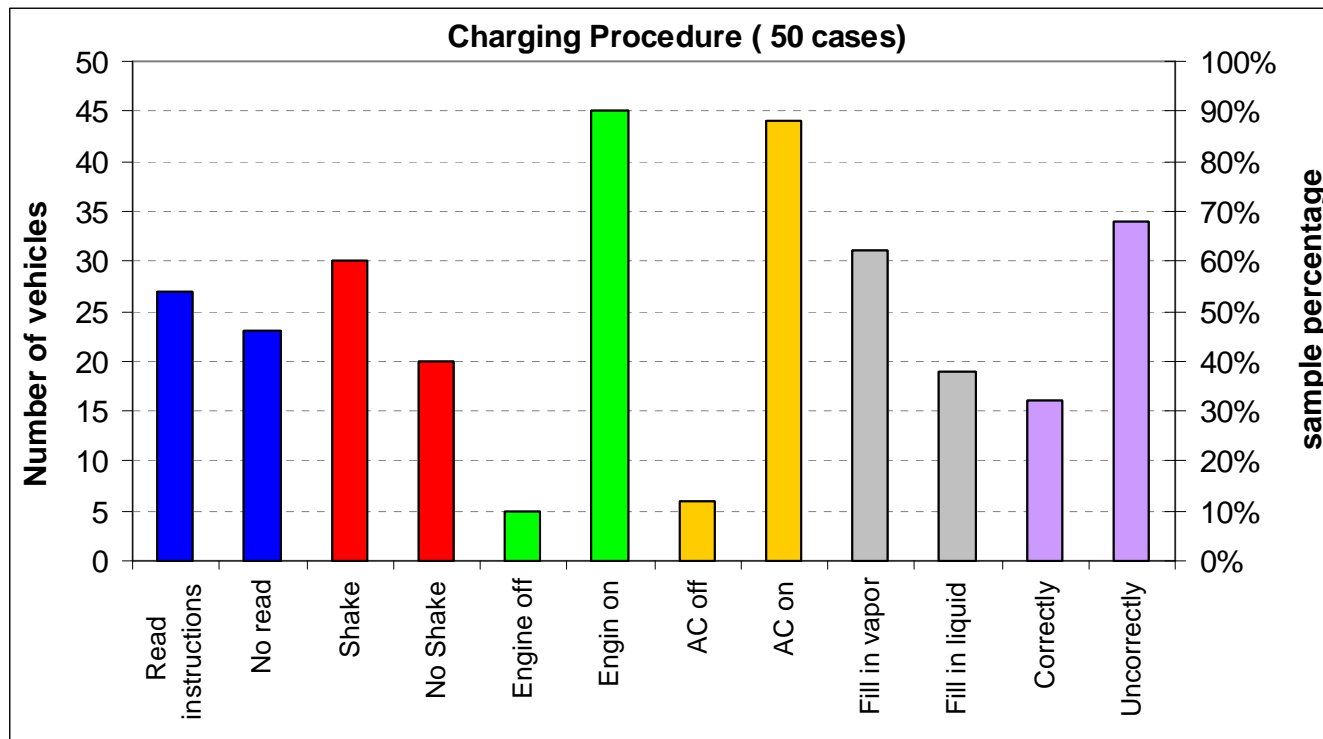


Number of cans used

Charging procedure

A procedure is considered correct if all of the instructions are correctly done

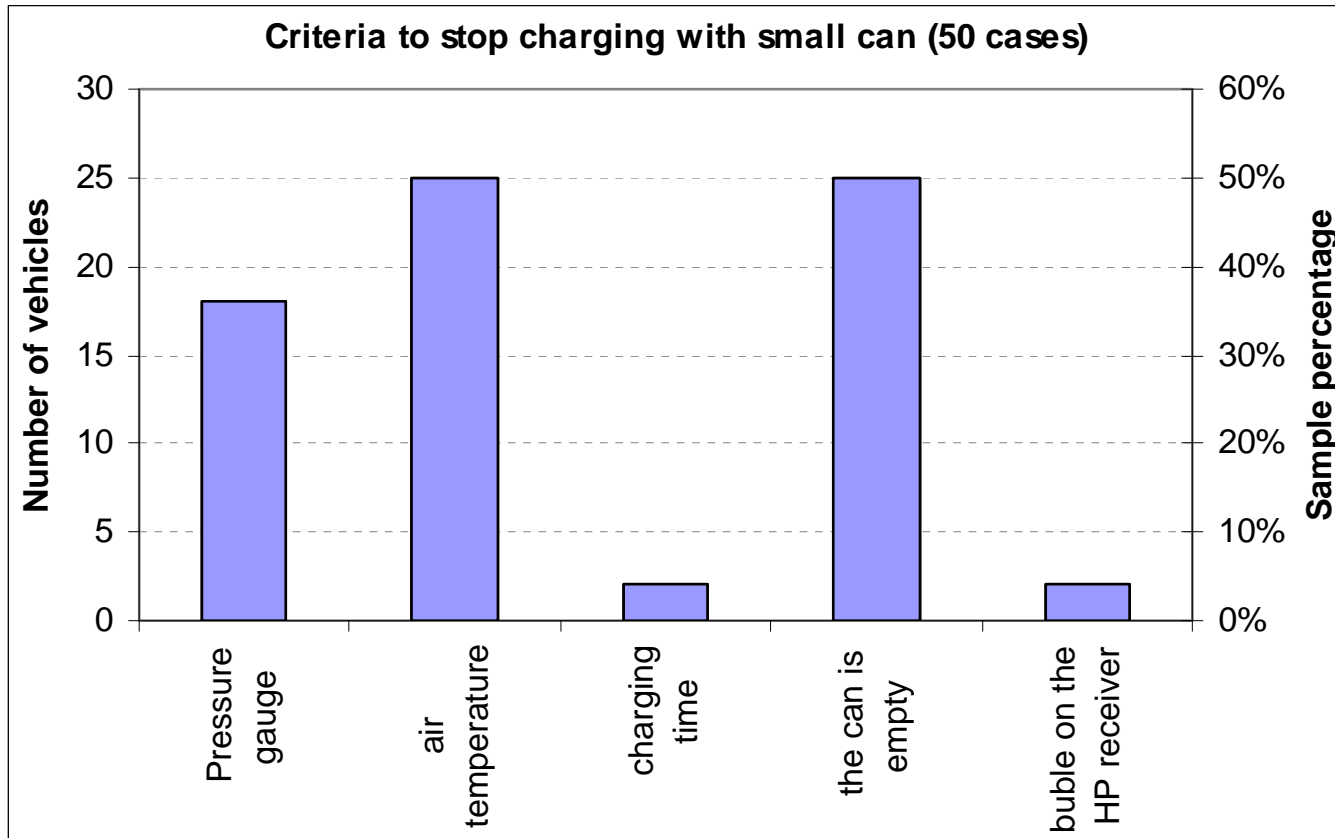
OverallSample



Report of facts and actions during the charging process of small can users

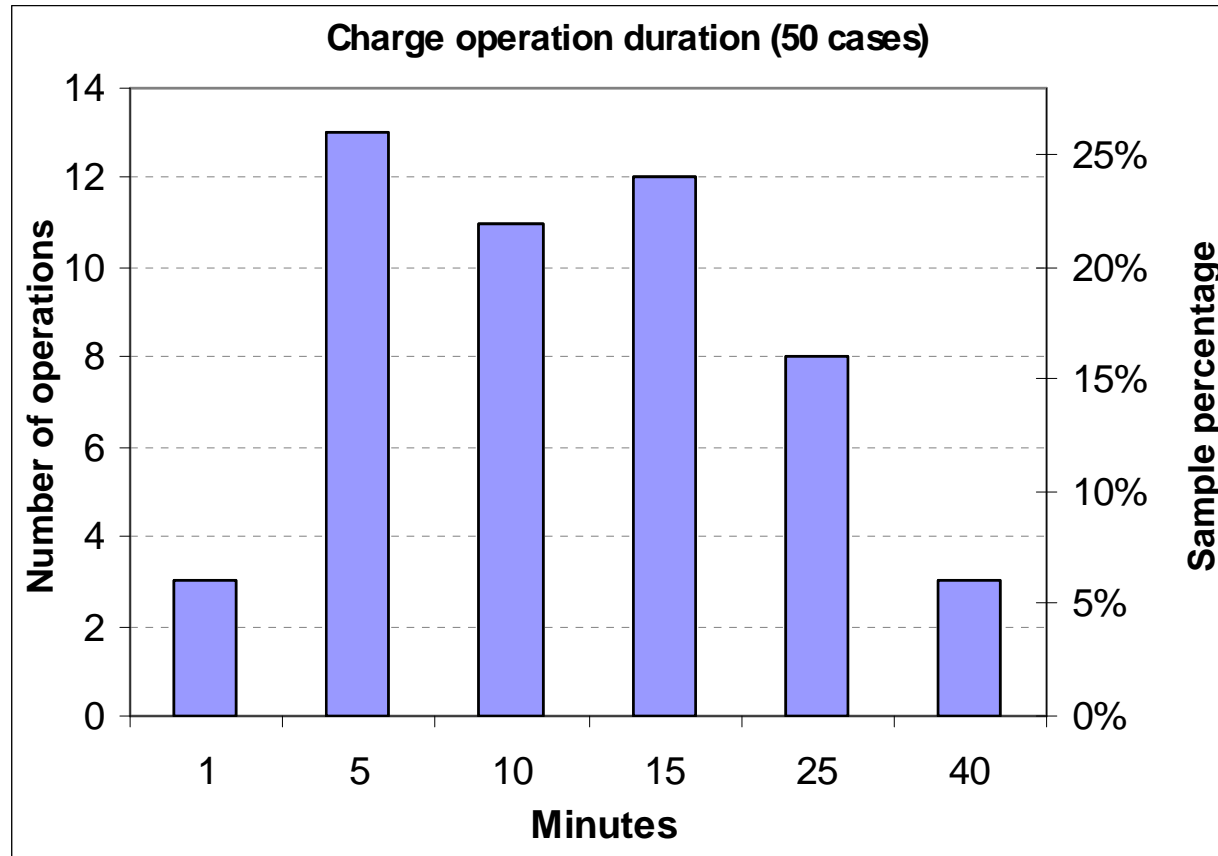
Criteria to stop charging

Overall sample

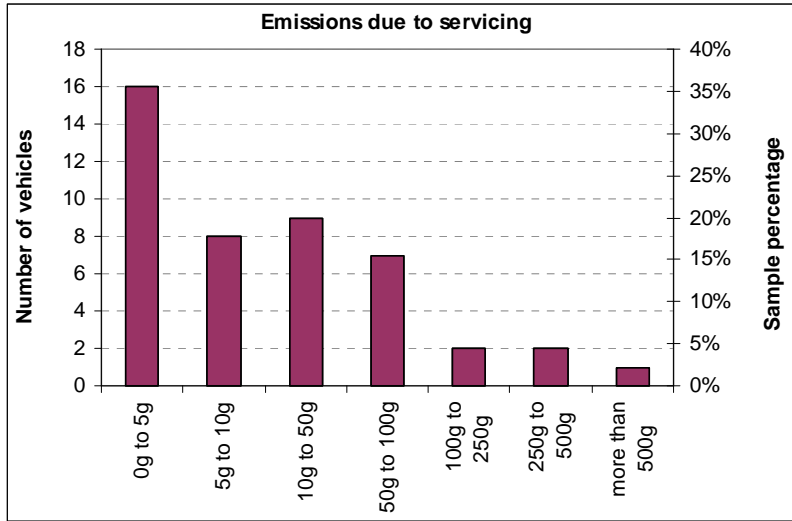


Charging operation duration

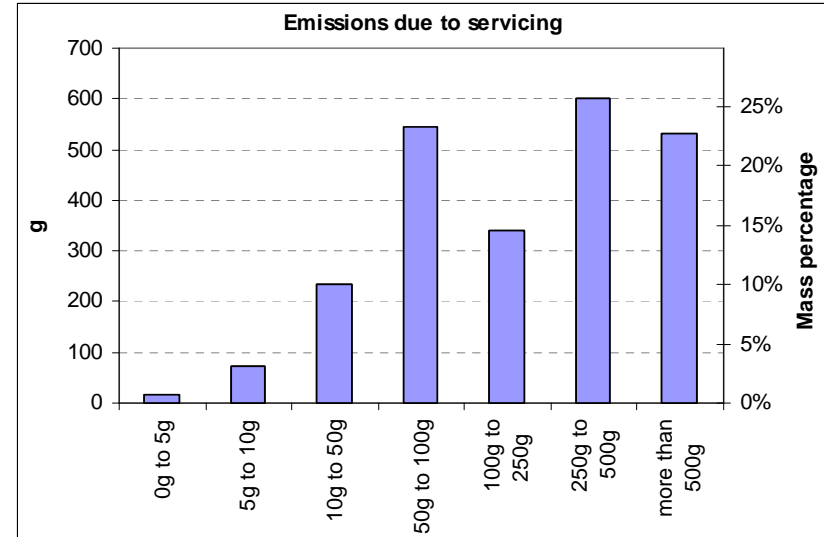
Overall sample



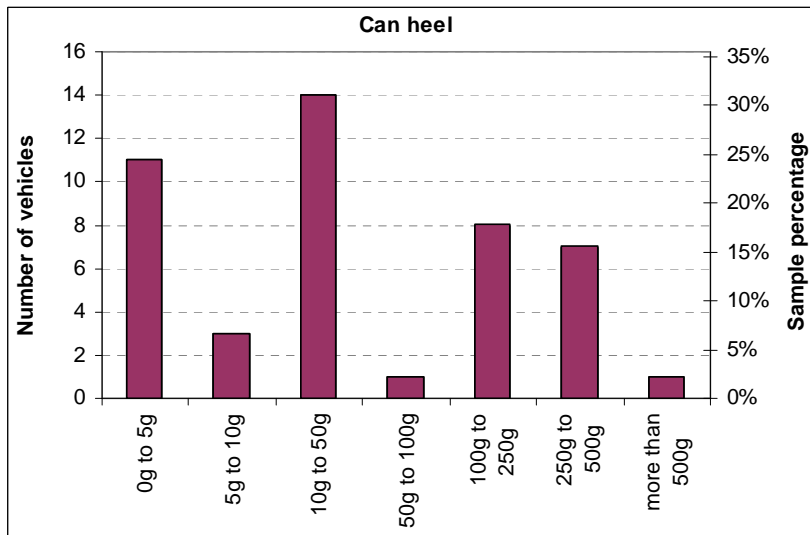
heels (50 cases)



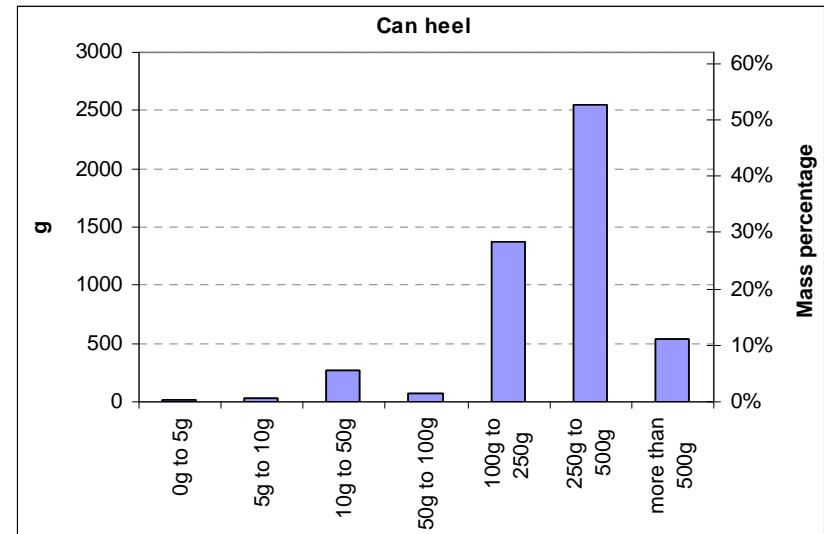
Number of vehicles as a function of emission range due to servicing



Mass emission due to servicing

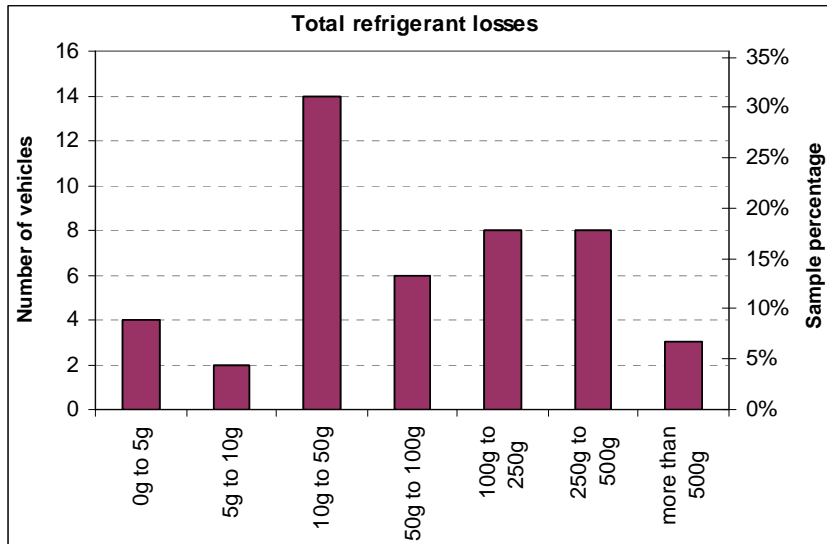


Number of vehicles as a function of can heel range

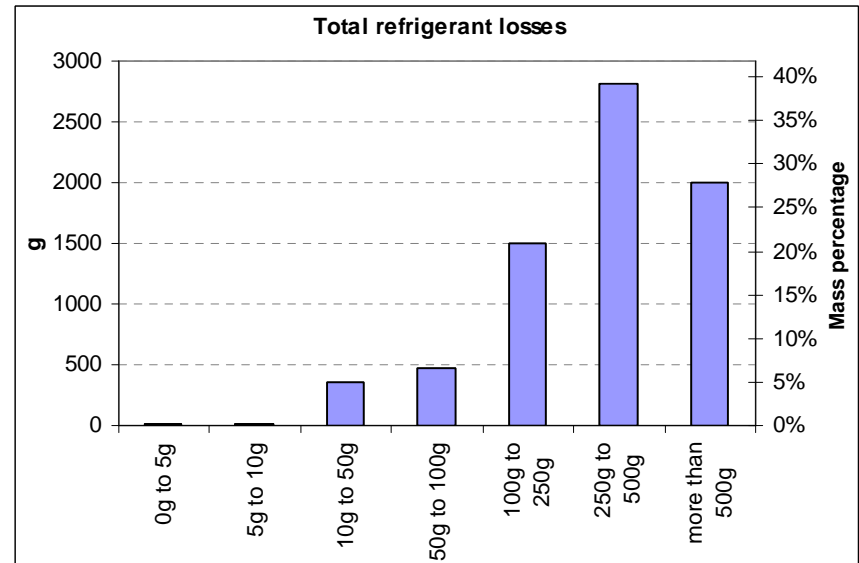


Mass emission as a function of can heel range

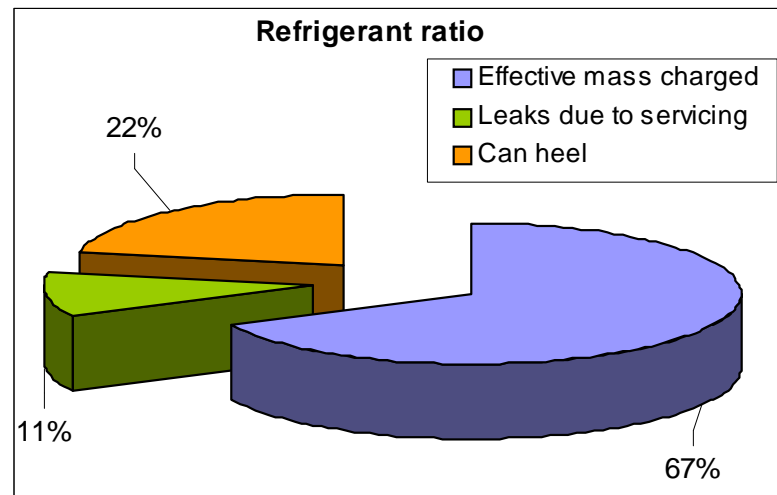
Overall refrigerant emissions



Number of vehicles per refrigerant emissions



Mass emission range



Charge and losses of refrigerant (Overall sample)

Conclusions

Conclusions are drawn from field tests carefully done with a sample of DIYers : 70% had previously made the refrigerant charging operation.

- 1 / 3 of the refrigerant contained in the can is emitted during operation and after (emission of the refrigerant heel)
- The indications given by the pressure gauge are not physically based and are misleading
- The indications given on small can tags are incomplete: no indication on the practical interest to shake the can, no indication to verify when the can is empty
- After use (when the charging hose is kept connected to the small can or for cans equipped with a valve) some cans are leak tight while others are huge emitters
- The small can users should have an indication on significant leak sites before charging.