



“2017-2019 NORTH AMERICAN ROUND-ROBIN CORRELATION TEST PROJECT FOR OFF- HIGHWAY RECREATIONAL VEHICLES”

Presented By:

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Environment and Climate Change Canada

September 16th 2019

- **Introduction**
- Test Fuel, Test Vehicle, and Participating Laboratories
- Testing Procedures
- Preliminary Findings
- Discussion
- Future Plan for Testing
- Project Contacts

Introduction



- The 2017-2019 North American Round-Robin Correlation Test Project for off-highway recreational vehicles (OHRVs) is a collaborative effort of the U.S. Environmental Protection Agency (U.S. EPA), California Air Resources Board (CARB), and Environment and Climate Change Canada (ECCC).
- OHRVs mainly include off-highway motorcycles (OHMCs), all-terrain vehicles (ATVs), and utility-terrain vehicles (UTVs).
- **The Key Objective**
 - To evaluate the correlation and/or variability among North American OHRV test laboratories for exhaust emissions.

Important Considerations

- Not designed as a lab audit or a durability test of the test vehicles
- There are intentional deviations from the CFR testing procedures
- Lab results are presented in no particular order (to ensure anonymity of participants)
- Results are designed to be used as a high level tool for participating laboratories to gauge where they are in relation to others in the industry and identify opportunities for improvement.

Outline



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Test Fuel and Test Vehicle

- **Test Fuel**
 - Tier 2 Certification Fuel meeting the specifications in Code of Federal Regulations (CFR) Title 40 §86.513.
- **Test Vehicle**

A 2017 Arctic Cat Alterra
550



A 2018 Polaris
Outlaw 110



A 2017 Polaris Ranger XP
1000



Participating Laboratories



Laboratory	OUTLAW	RANGER	ARCTIC CAT
ECCC	X	X	X
BOMBARDIER RECREATIONAL PRODUCTS	X	X	X
CARB	X	X	X
ROUSH	X	X	X
TOVATT ENG.	X	X	X
CALIFORNIA ENVIRONMENTAL ENG.	X	X	
TRANSPORTATION RESEARCH CENTER	X	X	X
MINNESOTA LABS			X
ESW	X		
NVFEL		X	X
S&S CYCLE		X	X
EXCEL			
ATDS			
POLARIS	X	X	
ARCTIC CAT			
NCDL			
OLSON ECOLOGIC			
INTERTEC/CARNOT			
Total	9	10	9

Outline

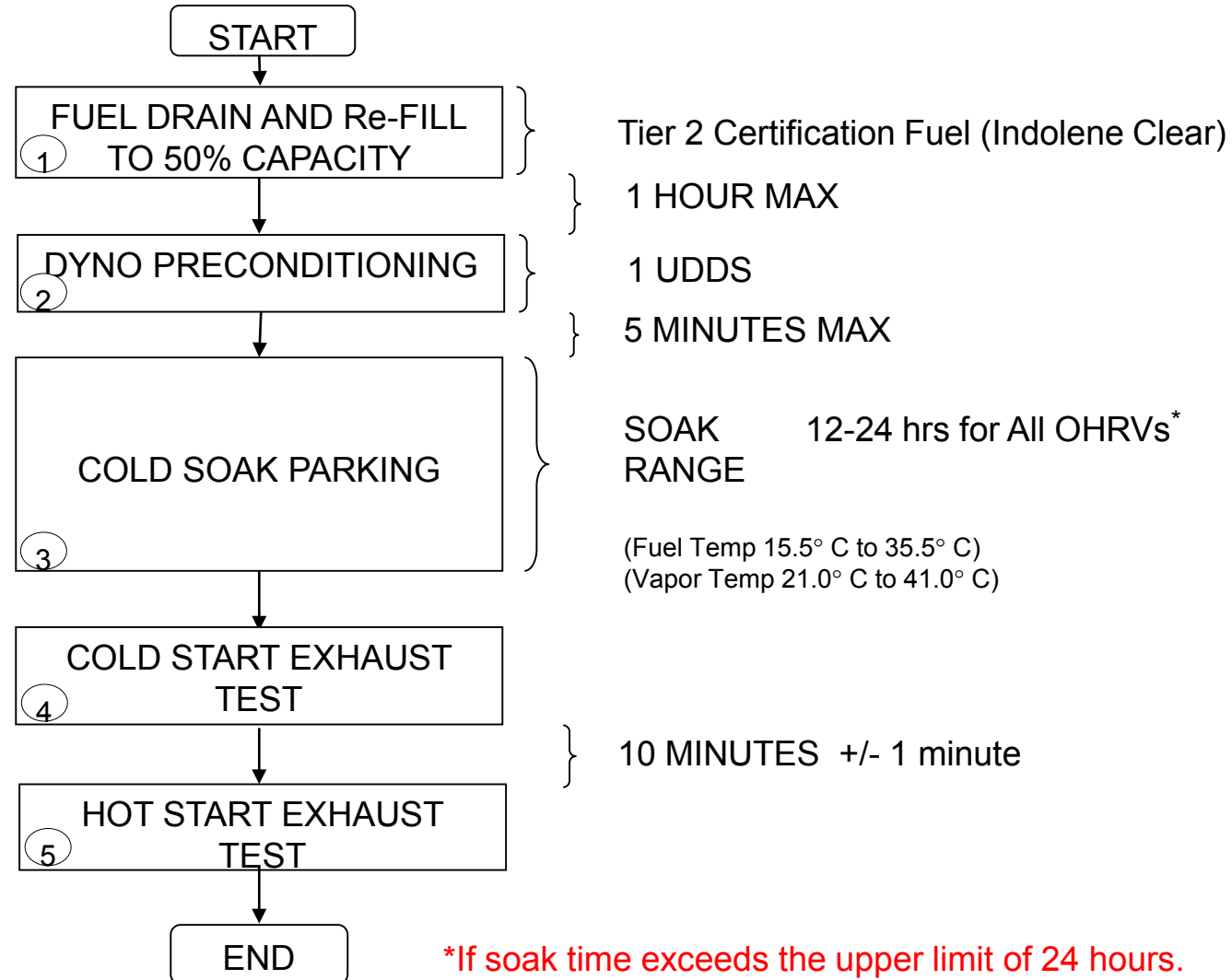


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Testing Procedures

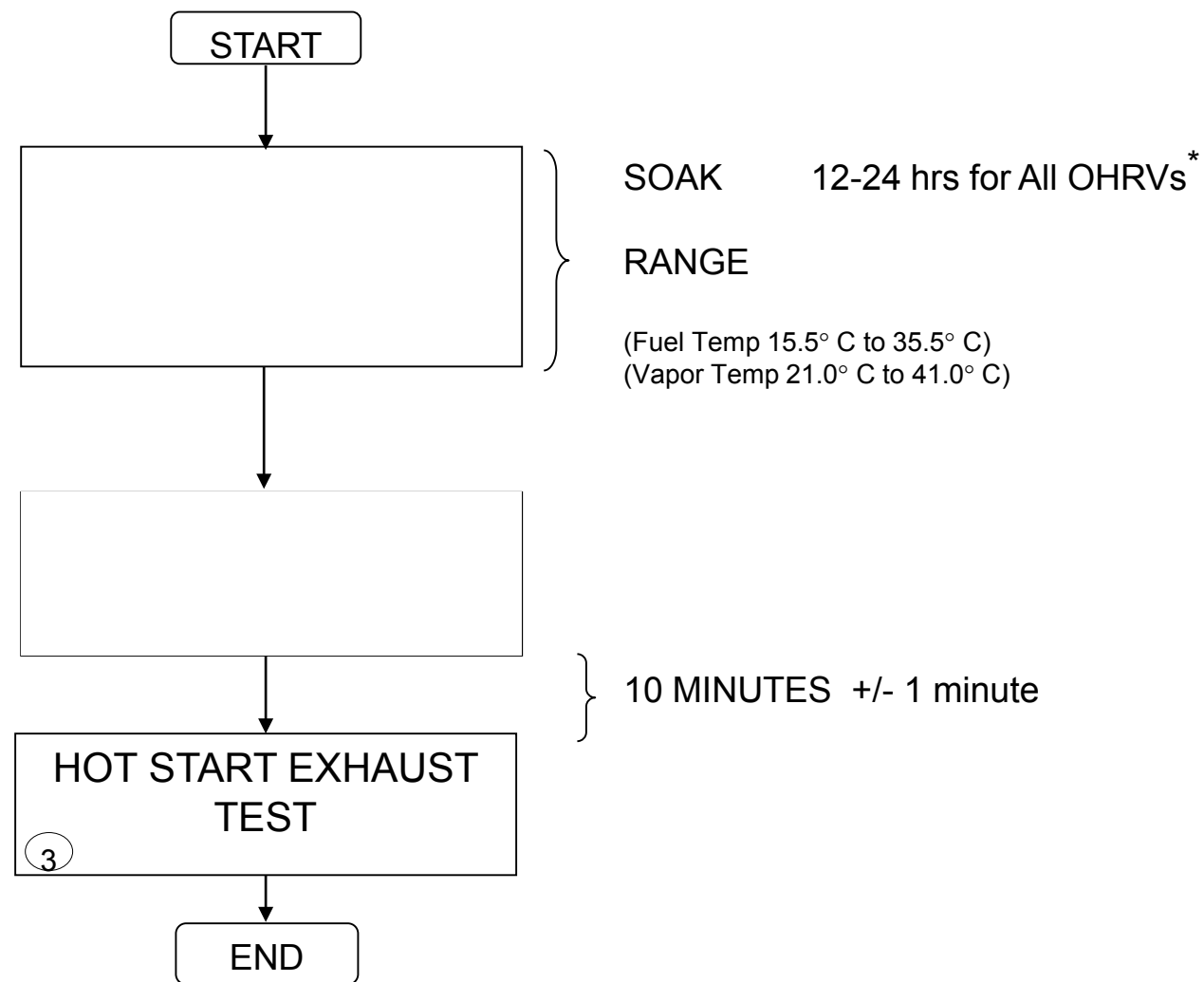


Total Number of Tests: Three complete valid exhaust test series are required per U.S. EPA CFR Title 40 Part 86, Subpart F and California Exhaust Emission Standards and Test Procedures for >1997 OHRVs.



*If soak time exceeds the upper limit of 24 hours.

Testing Procedures



*If soak time is less than the 24 hours.

Emission Testing



- Tailpipe exhaust emissions were measured as per the U.S. EPA and CARB protocols. Results were recorded per phase and weighted per test in g/km.
 - Total Hydrocarbon (THC)
 - Carbon Monoxide (CO)
 - Oxides of Nitrogen (NO_x)
 - Methane (CH₄)
 - Non-methane Hydrocarbons (NMHC)
 - THC+NO_x
 - Carbon Dioxide (CO₂)

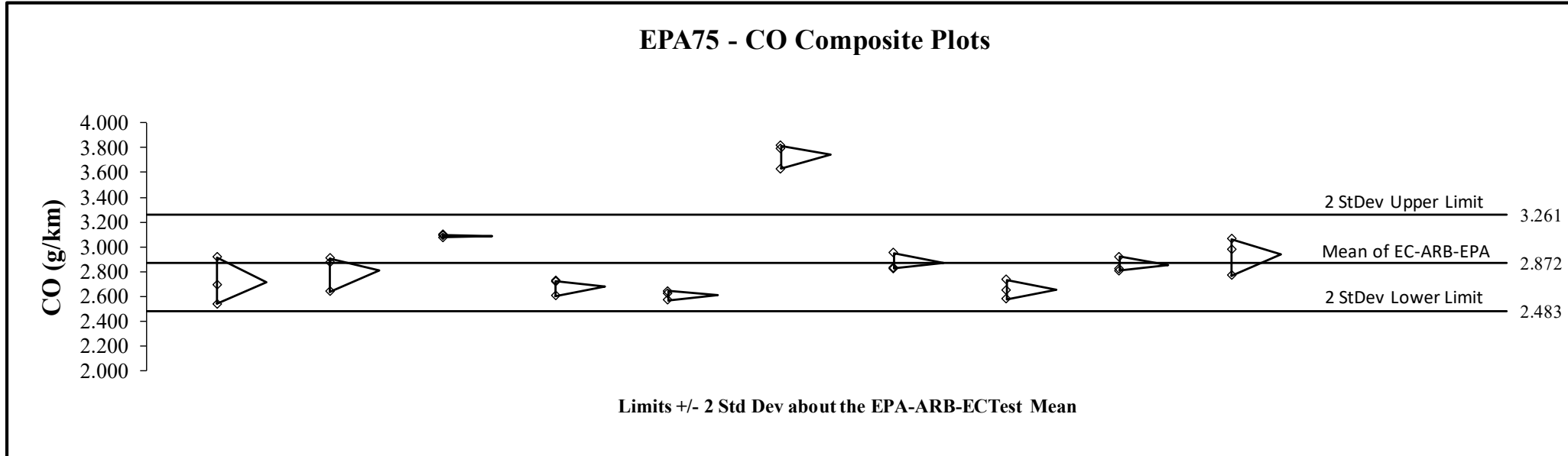
- **Test Cycle Requirement**
 - Under this project, all test vehicles were tested on the Class I dynamometer schedule, Appendix I(b) of the CFR Title 40 Part 86, regardless of the engine displacement.

Outline



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Preliminary Findings – CO (Ranger)

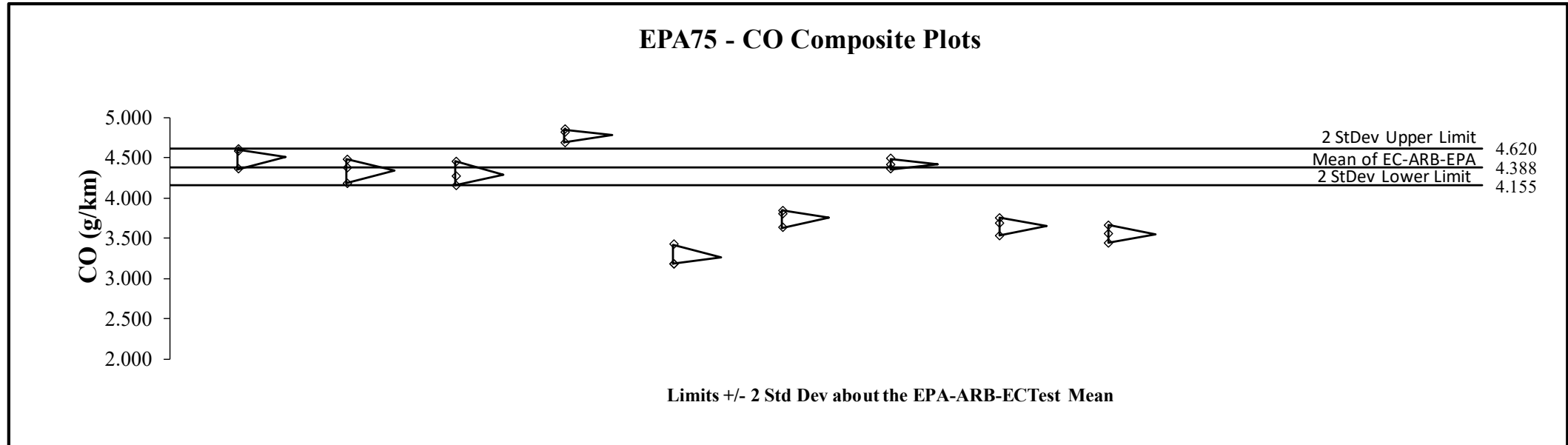


	Lab 1 (EPA)	Lab 2 (ECCC)	Lab 3 (CARB)	Lab 4	Lab 5	Lab 6	Lab 7	Lab 8	Lab 9	Lab 10
MEAN	2.716	2.811	3.090	2.683	2.614	3.747	2.873	2.658	2.851	2.939
STD DEV	0.189	0.146	0.011	0.068	0.039	0.101	0.070	0.077	0.061	0.151
Coeff. of Variation	6.96	5.20	0.34	2.54	1.48	2.69	2.44	2.90	2.14	5.128
% Diff to EC-ARB-EPA Mean	-5.44	-2.14	7.58	-6.59	-8.98	30.47	0.03	-7.47	-0.74	2.33
% Diff to EPA	No Diff	No Diff	13.77	No Diff	No Diff	37.97	No Diff	No Diff	No Diff	No Diff
% Diff to ARB	-12.10	-9.04	No Diff	-13.17	-15.40	21.27	-7.02	-13.99	-7.73	No Diff
% Diff to EC	No Diff	No Diff	9.94	No Diff	No Diff	33.33	No Diff	No Diff	No Diff	No Diff
Number of Tests	3	3	3	3	3	3	3	3	3	3

Note:

- (1) Mean value is the reported laboratory value without a DF applied.
- (2) %Diff is the student "t" distribution analysis at a 95% confidence ratio

Preliminary Findings – CO (Arctic Cat)



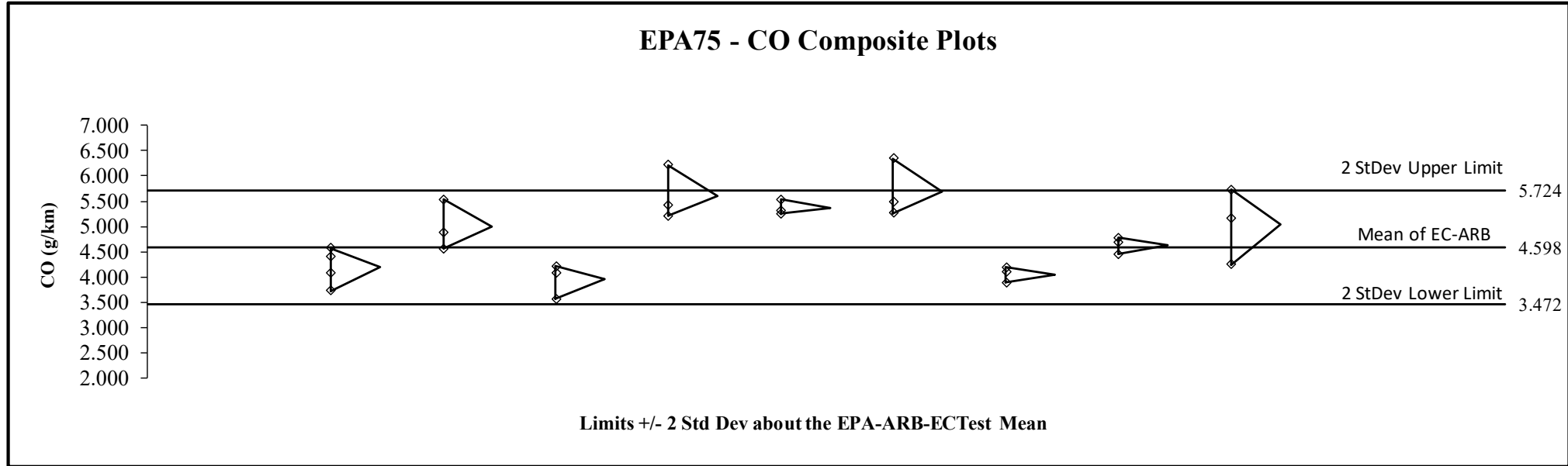
	Lab 1 (EPA)	Lab 2 (ECCC)	Lab 3 (CARB)	Lab 4	Lab 5	Lab 6	Lab 9	Lab 10	Lab 12
MEAN	4.519	4.347	4.297	4.790	3.266	3.761	4.420	3.659	3.555
STD DEV	0.137	0.149	0.152	0.085	0.139	0.111	0.064	0.111	0.109
Coeff. of Variation	3.02	3.43	3.53	1.77	4.27	2.96	1.46	3.04	3.06
% Diff to EC-ARB-EPA Mean	2.99	-0.92	-2.07	9.17	-25.56	-14.28	0.72	-16.62	-18.99
% Diff to EPA	No Diff	No Diff	No Diff	6.01	-27.71	-16.76	No Diff	-19.03	-21.34
% Diff to ARB	No Diff	No Diff	No Diff	11.48	-23.99	-12.47	No Diff	-14.86	-17.28
% Diff to EC	No Diff	No Diff	No Diff	10.19	-24.87	-13.48	No Diff	-15.84	-18.24
Number of Tests	3	3	4	3	3	3	3	3	3

Note:

(1) Mean value is the reported laboratory value without a DF applied.

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Preliminary Findings – CO (Outlaw)

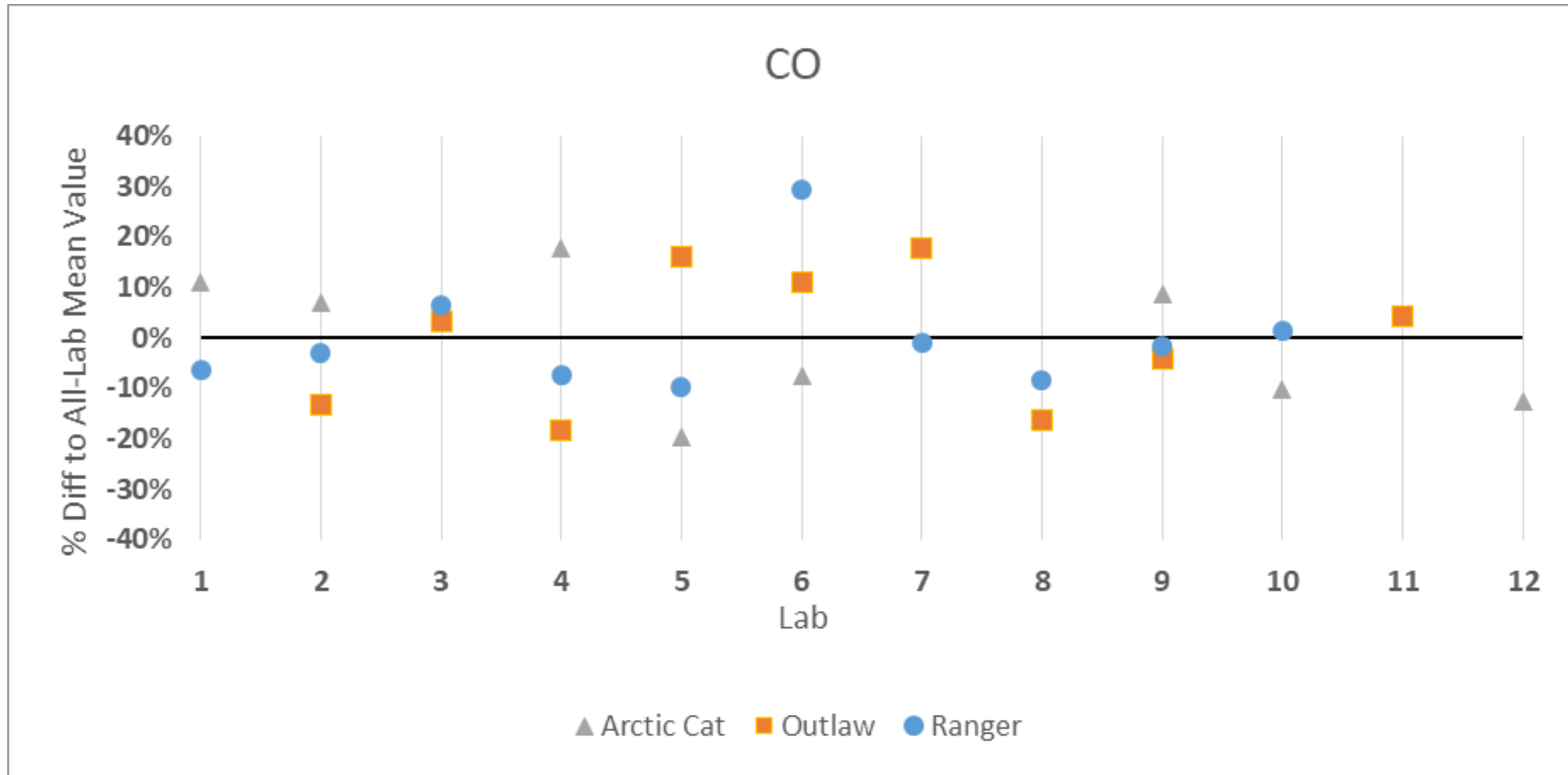


	Lab 1 (EPA)	Lab 2 (ECCC)	Lab 3 (CARB)	Lab 4	Lab 5	Lab 6	Lab 7	Lab 8	Lab 9	Lab 11
MEAN	---	4.200	4.996	3.955	5.618	5.373	5.705	4.061	4.644	5.049
STD DEV	---	0.373	0.494	0.341	0.537	0.150	0.567	0.157	0.167	0.747
Coeff. of Variation	---	8.89	9.88	8.62	9.56	2.79	9.94	3.87	3.59	14.795
% Diff to EC-ARB- EPA Mean	---	-8.66	8.66	-13.99	22.17	16.86	24.07	-11.67	0.99	9.80
% Diff to EPA	---	---	---	---	---	---	---	---	---	---
% Diff to ARB	---	No Diff	No Diff	-20.85	No Diff	No Diff	No Diff	-18.71	No Diff	No Diff
% Diff to EC	---	No Diff	No Diff	No Diff	33.75	27.93	35.83	No Diff	No Diff	No Diff
Number of Tests	3	4	3	3	3	3	3	3	3	3

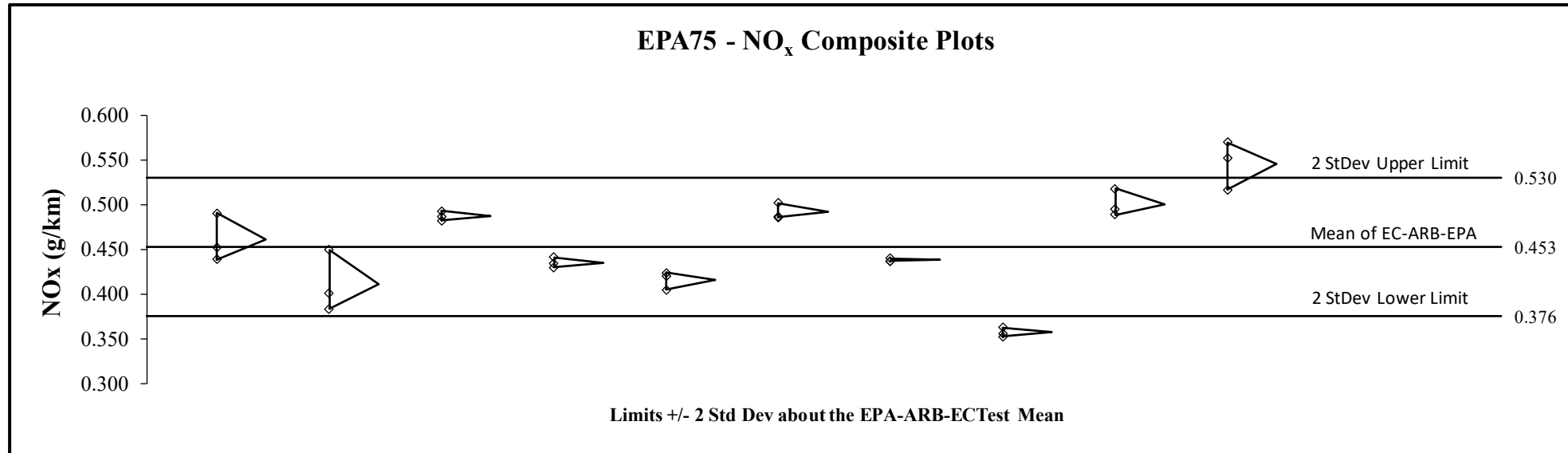
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Preliminary Findings – CO



Preliminary Findings – NO_x (Ranger)

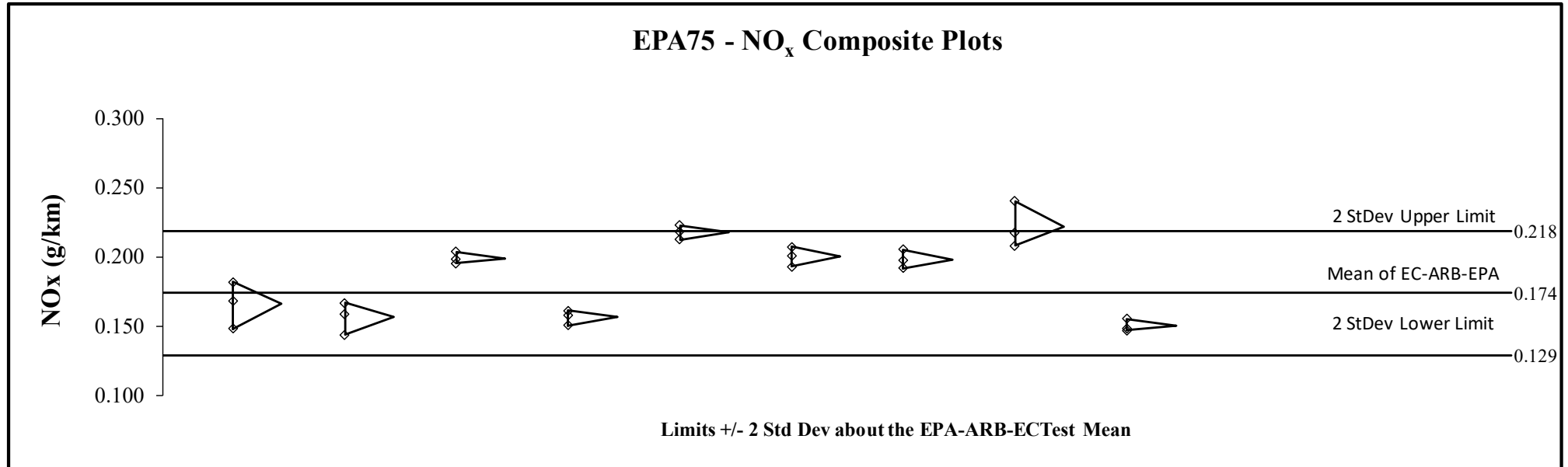


	Lab 1 (EPA)	Lab 2 (ECCC)	Lab 3 (CARB)	Lab 4	Lab 5	Lab 6	Lab 7	Lab 8	Lab 9	Lab 10
MEAN	0.4606	0.4112	0.4873	0.4350	0.4162	0.4917	0.4380	0.3573	0.5003	0.5460
STD DEV	0.0267	0.0342	0.0055	0.0058	0.0102	0.0090	0.0017	0.0051	0.0156	0.0272
Coeff. of Variation	5.80	8.32	1.13	1.34	2.44	1.82	0.40	1.44	3.12	4.9742
% Diff to EC-ARB-EPA Mean	1.67	-9.23	7.56	-3.99	-8.15	8.52	-3.33	-21.13	10.43	20.50
% Diff to EPA	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	-22.43	No Diff	18.5231
% Diff to ARB	No Diff	-15.61	No Diff	-10.74	-14.60	No Diff	-10.12	-26.68	No Diff	12.0315
% Diff to EC	No Diff	No Diff	18.50	No Diff	No Diff	19.56	No Diff	No Diff	21.66	32.7589
Number of Tests	3	3	3	3	3	3	3	3	3	3

Note:

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Preliminary Findings – NO_x (Arctic Cat)

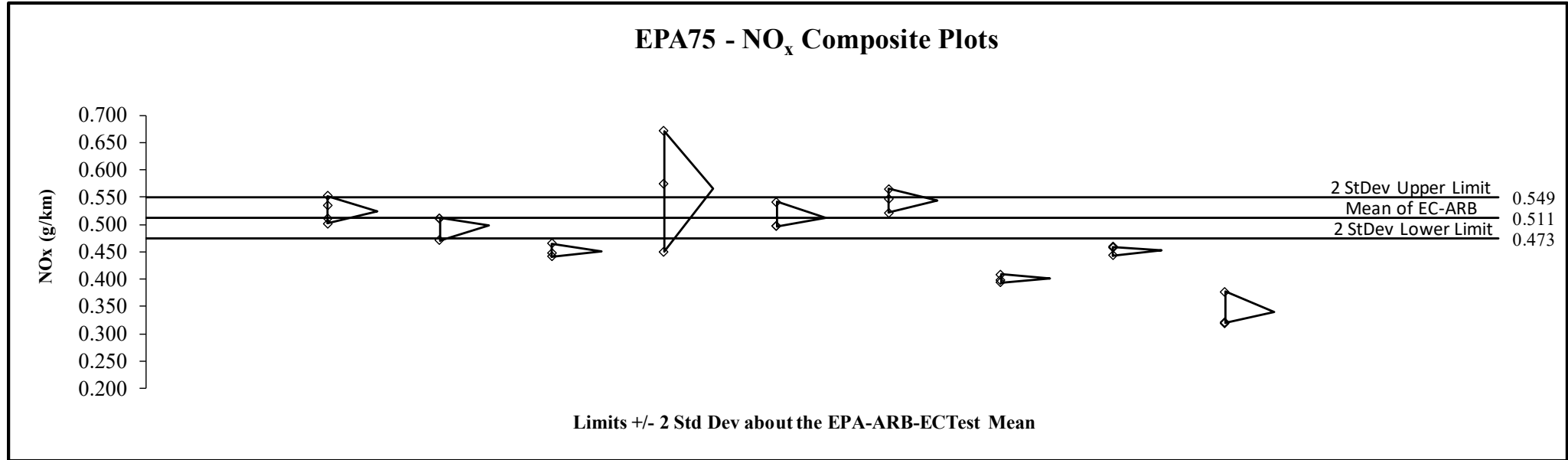


	Lab 1 (EPA)	Lab 2 (ECCC)	Lab 3 (CARB)	Lab 4	Lab 5	Lab 6	Lab 9	Lab 10	Lab 12
MEAN	0.1661	0.1564	0.1990	0.1564	0.2175	0.2003	0.1980	0.2217	0.1503
STD DEV	0.0169	0.0116	0.0042	0.0055	0.0053	0.0072	0.0069	0.0165	0.0045
Coeff. of Variation	10.19	7.44	2.13	3.50	2.42	3.58	3.47	7.46	3.00
% Diff to EC-ARB- EPA Mean	-4.48	-10.01	14.49	-10.01	25.14	15.22	13.93	27.55	-13.55
% Diff to EPA	No Diff	No Diff	19.85	No Diff	31.00	20.62	19.27	33.53	No Diff
% Diff to ARB	-16.56	-21.40	No Diff	-21.40	9.30	No Diff	No Diff	No Diff	-24.49
% Diff to EC	No Diff	No Diff	27.22	No Diff	39.05	28.04	26.60	41.74	No Diff
Number of Tests	3	3	4	3	3	3	3	3	3

Note:

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Preliminary Findings – NO_x (Outlaw)

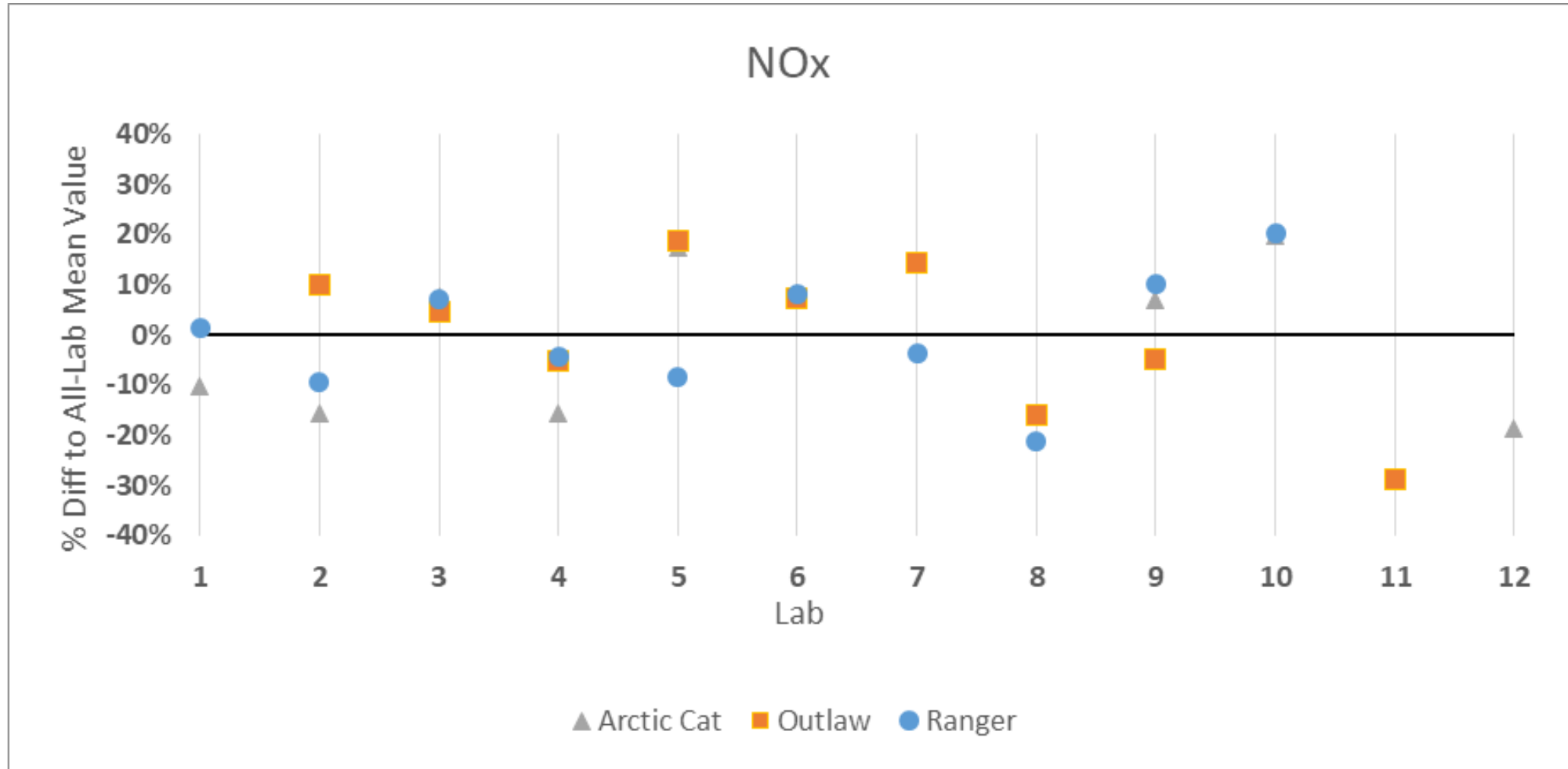


	Lab 1 (EPA)	Lab 2 (ECCC)	Lab 3 (CARB)	Lab 4	Lab 5	Lab 6	Lab 7	Lab 8	Lab 9	Lab 11
MEAN	---	0.5248	0.4980	0.4510	0.5652	0.5120	0.5443	0.4004	0.4532	0.3393
STD DEV	---	0.0228	0.0234	0.0121	0.1106	0.0251	0.0221	0.0073	0.0089	0.0326
Coeff. of Variation	---	4.34	4.70	2.69	19.57	4.91	4.06	1.81	1.97	9.6142
% Diff to EC-ARB- EPA Mean	---	2.62	-2.62	-11.82	10.52	0.11	6.44	-21.71	-11.39	-33.65
% Diff to EPA	---	---	---	---	---	---	---	---	---	---
% Diff to ARB	---	No Diff	No Diff	-9.44	No Diff	No Diff	No Diff	-19.60	-9.00	-31.8608
% Diff to EC	---	No Diff	No Diff	-14.07	No Diff	No Diff	No Diff	-23.71	-13.65	-35.3440
Number of Tests	3	4	3	3	3	3	3	3	3	3

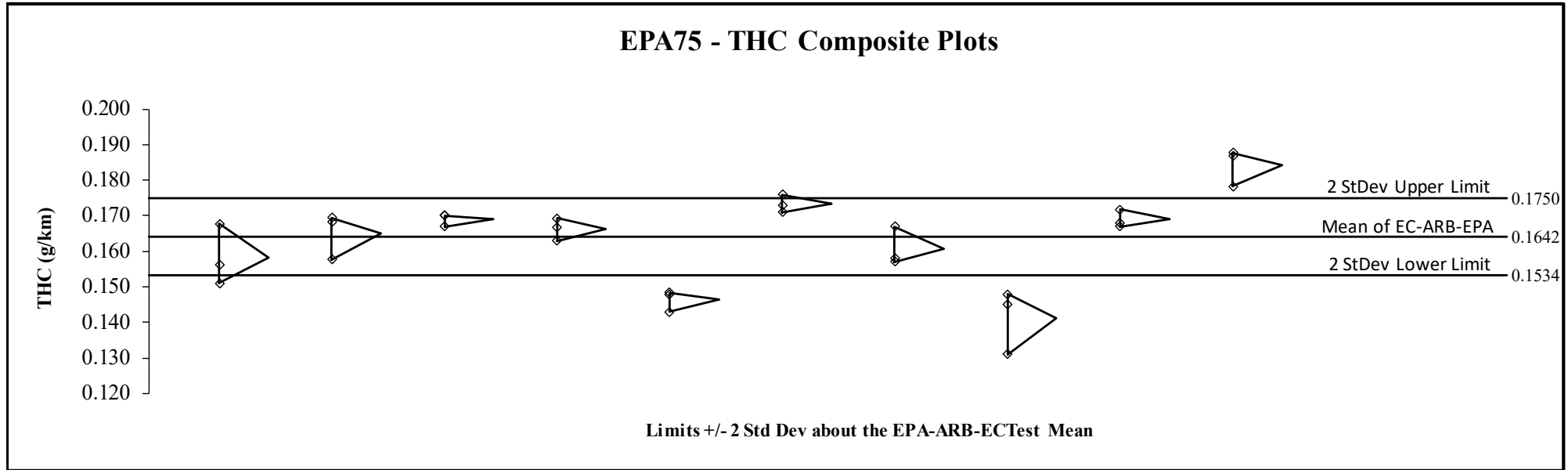
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Preliminary Findings – NOx



Preliminary Findings – THC (Ranger)

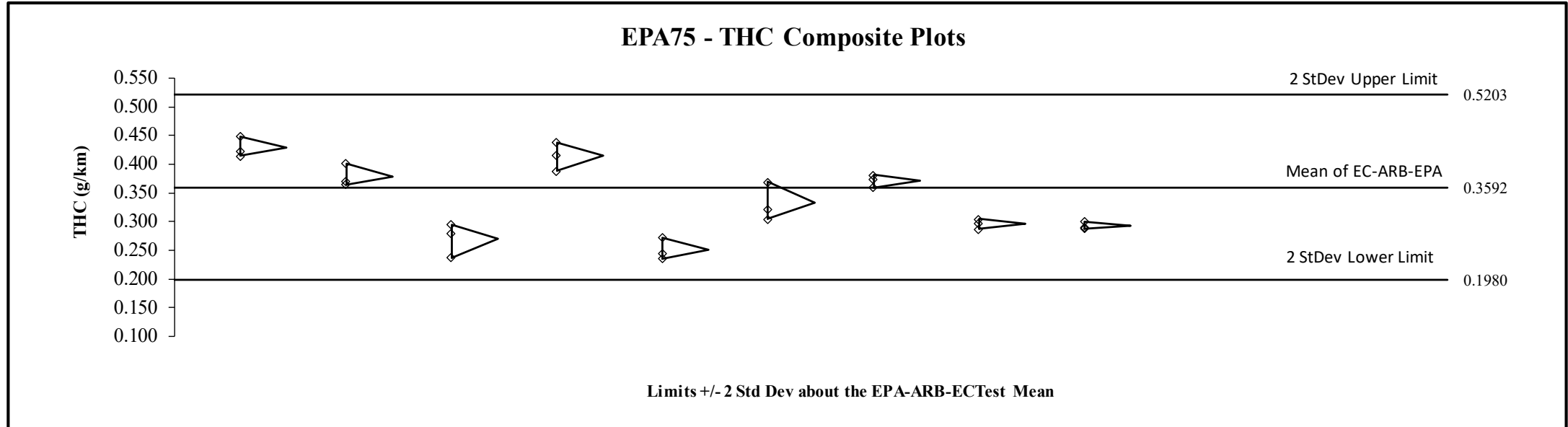


	Lab 1 (EPA)	Lab 2 (ECCC)	Lab 3 (CARB)	Lab 4	Lab 5	Lab 6	Lab 7	Lab 8	Lab 9	Lab 10
MEAN	0.1584	0.1652	0.1690	0.1663	0.1464	0.1733	0.1607	0.1413	0.1689	0.1843
STD DEV	0.0086	0.0065	0.0017	0.0031	0.0030	0.0025	0.0055	0.0091	0.0026	0.0052
Coeff. of Variation	5.41	3.92	1.02	1.89	2.05	1.45	3.43	6.42	1.51	2.83
% Diff to EC-ARB-EPA Mean	-3.54	0.60	2.94	1.32	-10.80	5.58	-2.13	-13.91	2.90	12.26
% Diff to EPA	No Diff	No Diff	No Diff	No Diff	No Diff	9.46	No Diff	No Diff	No Diff	16.39
% Diff to ARB	No Diff	No Diff	No Diff	No Diff	-13.35	No Diff	No Diff	-16.37	No Diff	9.05
% Diff to EC	No Diff	No Diff	No Diff	No Diff	-11.34	No Diff	No Diff	-14.43	No Diff	11.59
Number of Tests	3	3	3	3	3	3	3	3	3	3

Note:

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Preliminary Findings – THC (Arctic Cat)

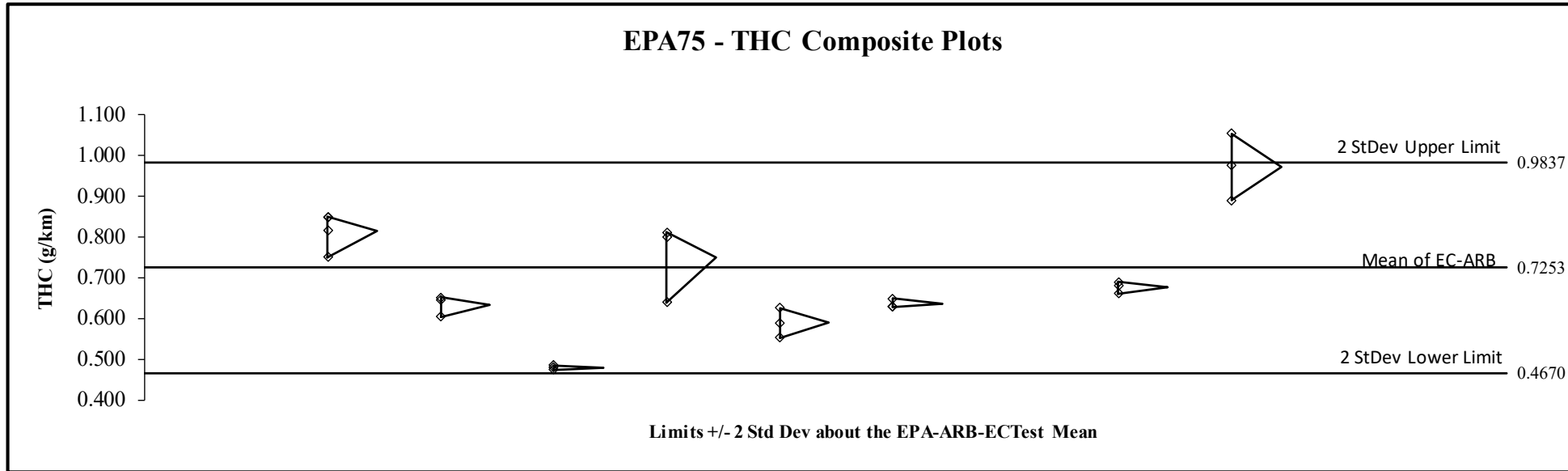


	Lab 1 (EPA)	Lab 2 (ECCC)	Lab 3 (CARB)	Lab 4	Lab 5	Lab 6	Lab 9	Lab 10	Lab 12
MEAN	0.4281	0.3788	0.2706	0.4140	0.2512	0.3319	0.3715	0.2964	0.2929
STD DEV	0.0175	0.0194	0.0295	0.0250	0.0188	0.0332	0.0114	0.0086	0.0060
Coeff. of Variation	4.08	5.13	10.91	6.04	7.48	10.00	3.06	2.8912	2.0543
% Diff to EC-ARB-EPA Mean	19.20	5.47	-24.67	15.27	-30.07	-7.58	3.4371	-17.4681	-18.4398
% Diff to EPA	No Diff	-11.52	-36.80	No Diff	-41.33	-22.47	-13.22	-30.7600	-31.5753
% Diff to ARB	58.22	40.00	No Diff	53.02	No Diff	No Diff	37.3044	No Diff	No Diff
% Diff to EC	13.02	No Diff	-28.57	No Diff	-33.70	No Diff	No Diff	-21.7476	-22.6689
Number of Tests	3	3	4	3	3	3	3.0000	3.0000	3.0000

Note:

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Preliminary Findings – THC (Outlaw)

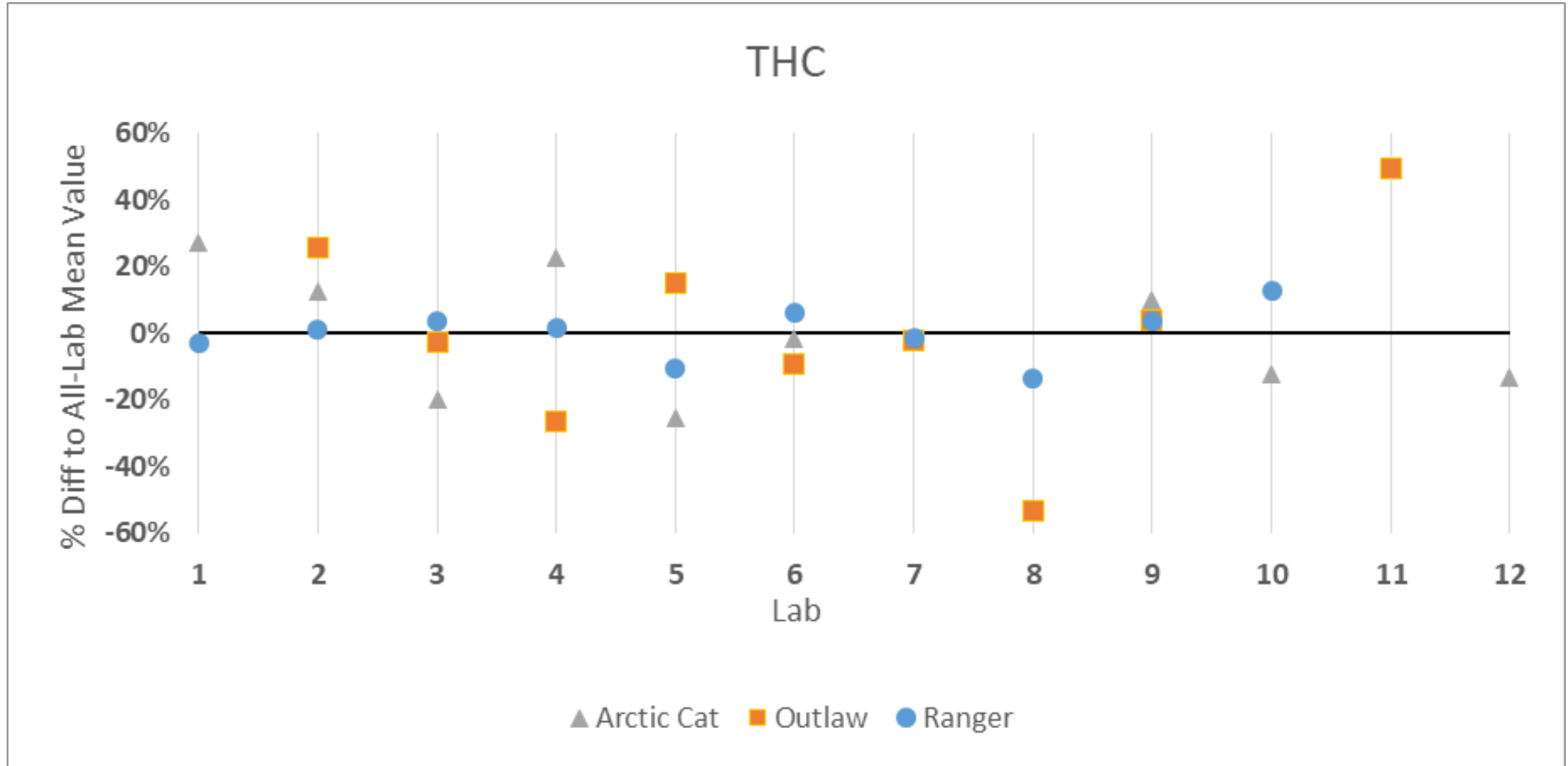


	Lab 1 (EPA)	Lab 2 (ECCC)	Lab 3 (CARB)	Lab 4	Lab 5	Lab 6	Lab 7	Lab 8	Lab 9	Lab 11
MEAN	---	0.8167	0.6340	0.4802	0.7505	0.5893	0.6363	0.3041	0.6777	0.9733
STD DEV	---	0.0465	0.0254	0.0055	0.0962	0.0365	0.0118	0.0208	0.0144	0.0820
Coeff. of Variation	---	5.69	4.00	1.14	12.82	6.19	1.86	6.85	2.12	8.43
% Diff to EC-ARB- EPA Mean	---	12.59	-12.59	-33.80	3.46	-18.75	-12.27	-58.08	-6.57	34.19
% Diff to EPA	---	---	---	---	---	---	---	---	---	---
% Diff to ARB	---	28.81	No Diff	-24.27	No Diff	No Diff	No Diff	-52.04	No Diff	53.52
% Diff to EC	---	No Diff	-22.37	-41.21	No Diff	-27.84	-22.08	-62.77	-17.02	19.18
Number of Tests	3	4	3	3	3	3	3	3	3	3

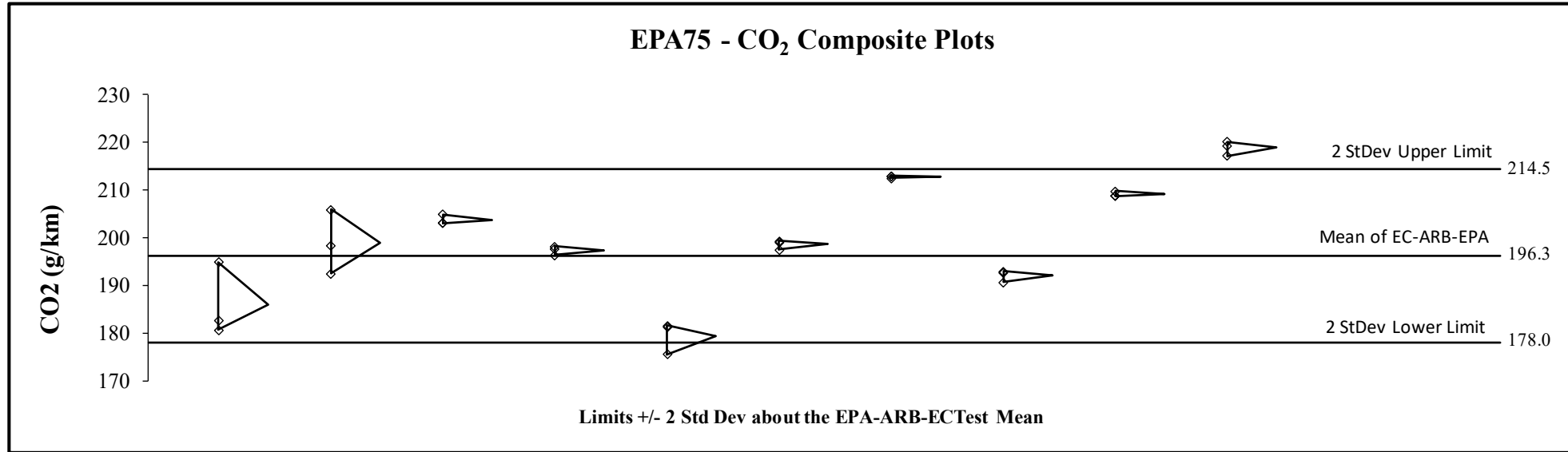
Note:

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Preliminary Findings – THC



Preliminary Findings – CO₂ (Ranger)

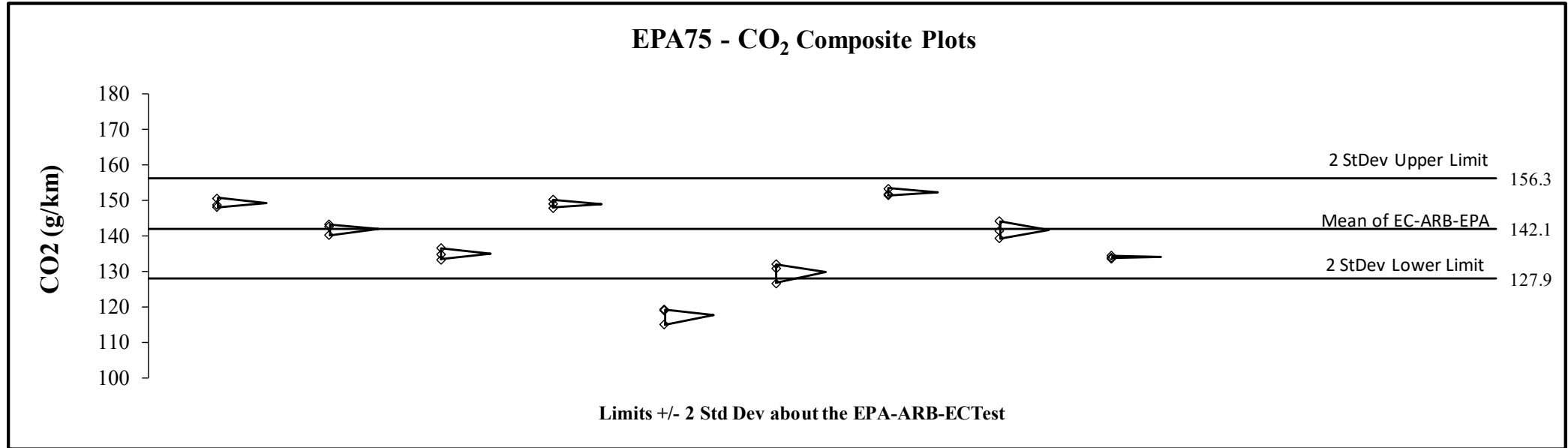


	Lab 1 (EPA)	Lab 2 (ECCC)	Lab 3 (CARB)	Lab 4	Lab 5	Lab 6	Lab 7	Lab 8	Lab 9	Lab 10
MEAN	186.1	199.0	203.7	197.4	179.5	198.7	212.8	192.2	209.2	218.9
STD DEV	7.75	6.74	1.02	0.89	3.37	1.02	0.24	1.30	0.60	1.58
Coeff. of Variation	4.17	3.39	0.50	0.45	1.88	0.51	0.11	0.67	0.29	0.72
% Diff to EC-ARB-EPA Mean	-5.18	1.37	3.81	0.59	-8.54	1.23	8.45	-2.08	6.59	11.55
% Diff to EPA	No Diff	No Diff	9.48	No Diff	No Diff	6.76	14.37	No Diff	12.41	17.64
% Diff to ARB	-8.66	No Diff	No Diff	-3.10	-11.90	-2.48	4.47	-5.67	2.68	7.46
% Diff to EC	No Diff	No Diff	No Diff	No Diff	-9.78	No Diff	6.98	No Diff	No Diff	10.05
Number of Tests	3	3	3	3	3	3	3	3	3	3

Note:

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Preliminary Findings – CO₂ (Arctic Cat)

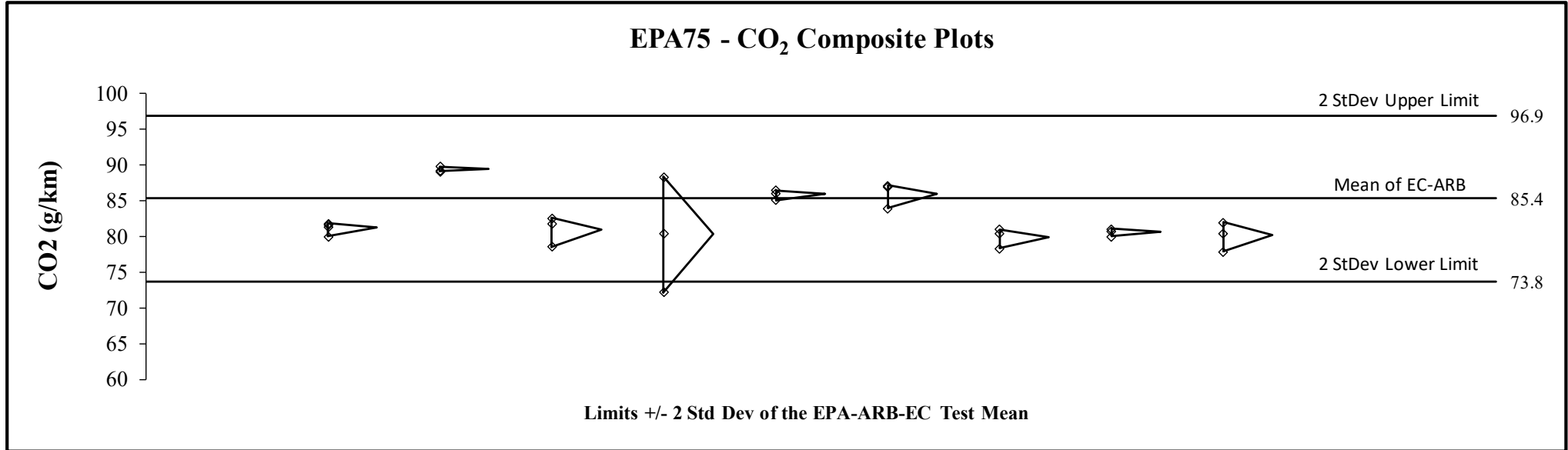


	Lab 1 (EPA)	Lab 2 (ECCC)	Lab 3 (CARB)	Lab 4	Lab 5	Lab 6	Lab 9	Lab 10	Lab 12
MEAN	149.2	142.1	135.0	149.1	117.8	129.9	152.3	141.7	134.1
STD DEV	1.31	1.65	1.61	1.20	2.40	2.84	1.09	2.40	0.37
Coeff. of Variation	0.88	1.16	1.19	0.80	2.04	2.18	0.72	1.69	0.28
% Diff to EC-ARB-EPA									
Mean	5.01	-0.01	-5.00	4.94	-17.12	-8.55	7.16	-0.30	-5.64
% Diff to EPA	No Diff	-4.78	-9.53	No Diff	-21.07	-12.92	2.05	-5.06	-10.15
% Diff to ARB	10.53	5.24	No Diff	10.46	-12.76	No Diff	12.79	4.94	No Diff
% Diff to EC	5.03	No Diff	-4.98	4.95	-17.11	-8.54	7.17	No Diff	-5.63
Number of Tests	3	3	4	3	3	3	3	3	3

Note:

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Preliminary Findings – CO₂ (Outlaw)

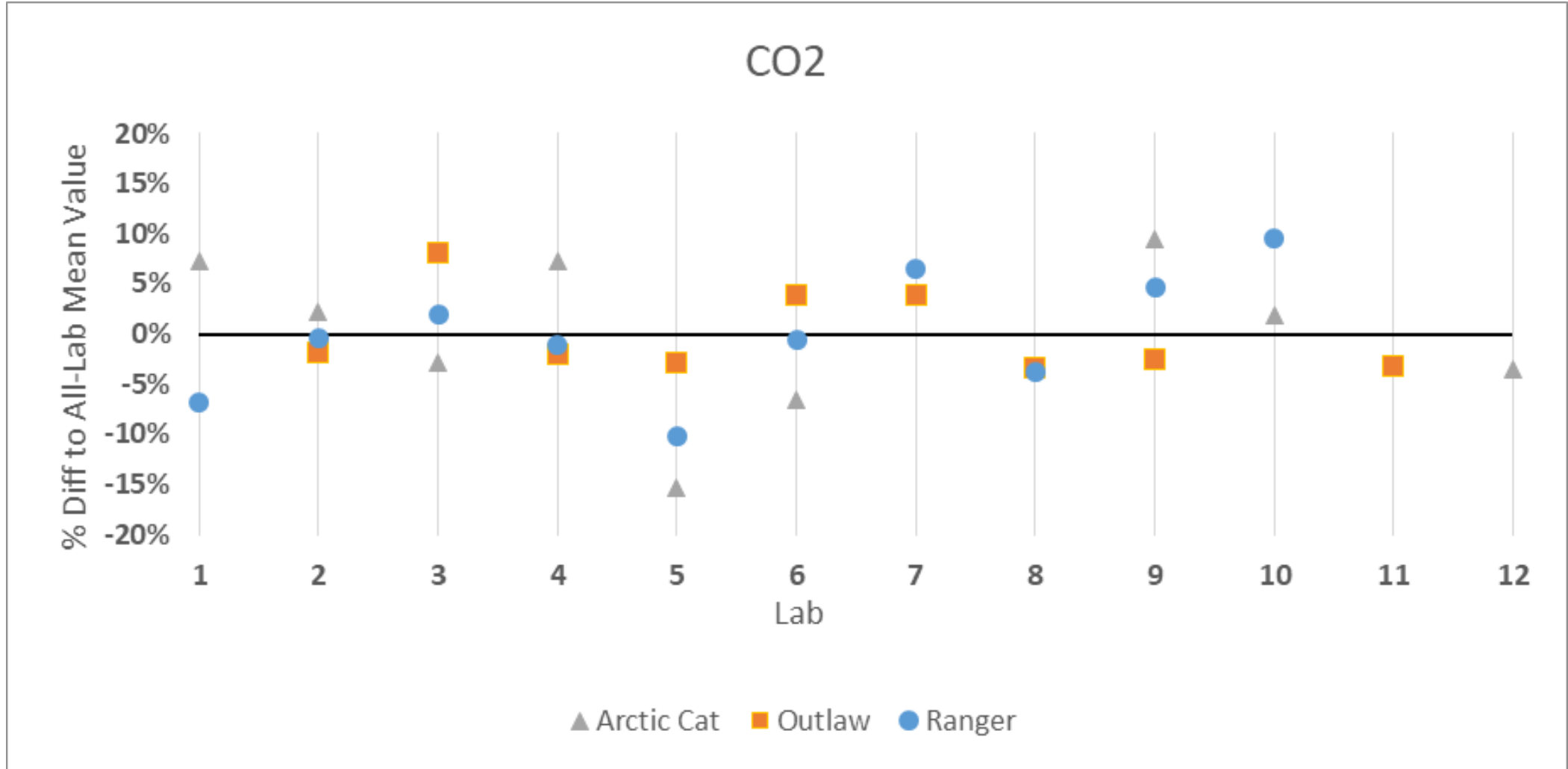


	Lab 1 (EPA)	Lab 2 (ECCC)	Lab 3 (CARB)	Lab 4	Lab 5	Lab 6	Lab 7	Lab 8	Lab 9	Lab 11
MEAN	---	81.3	89.5	81.0	80.4	85.9	86.0	79.9	80.6	80.2
STD DEV	---	0.84	0.35	2.13	8.10	0.72	1.78	1.41	0.55	2.09
Coeff. of Variation	---	1.03	0.39	2.63	10.08	0.83	2.07	1.76	0.69	2.61
% Diff to EC-ARB- EPA Mean	---	-4.80	4.80	-5.08	-5.86	0.67	0.79	-6.33	-5.54	-6.09
% Diff to EPA	---	---	---	---	---	---	---	---	---	---
% Diff to ARB	---	-9.17	No Diff	-9.43	No Diff	-3.94	-3.83	-10.62	-9.87	-10.39
% Diff to EC	---	No Diff	10.09	No Diff	No Diff	5.75	5.88	No Diff	No Diff	No Diff
Number of Tests	3	4	3	3	3	3	3	3	3	3

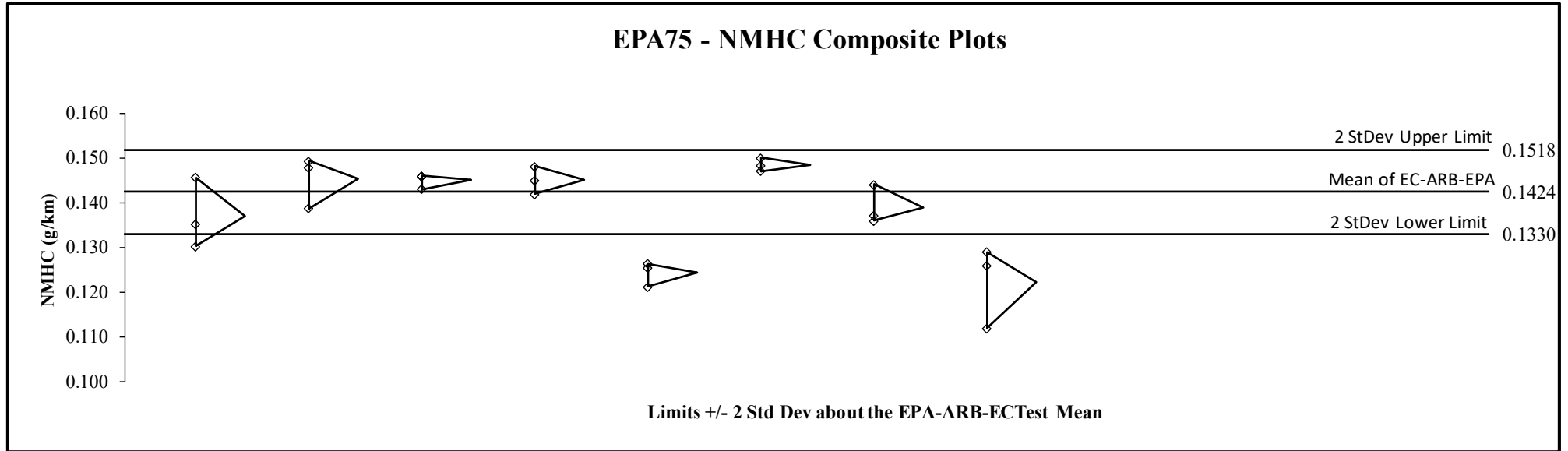
Note:

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Preliminary Findings – CO2



Preliminary Findings – NMHC (Ranger)

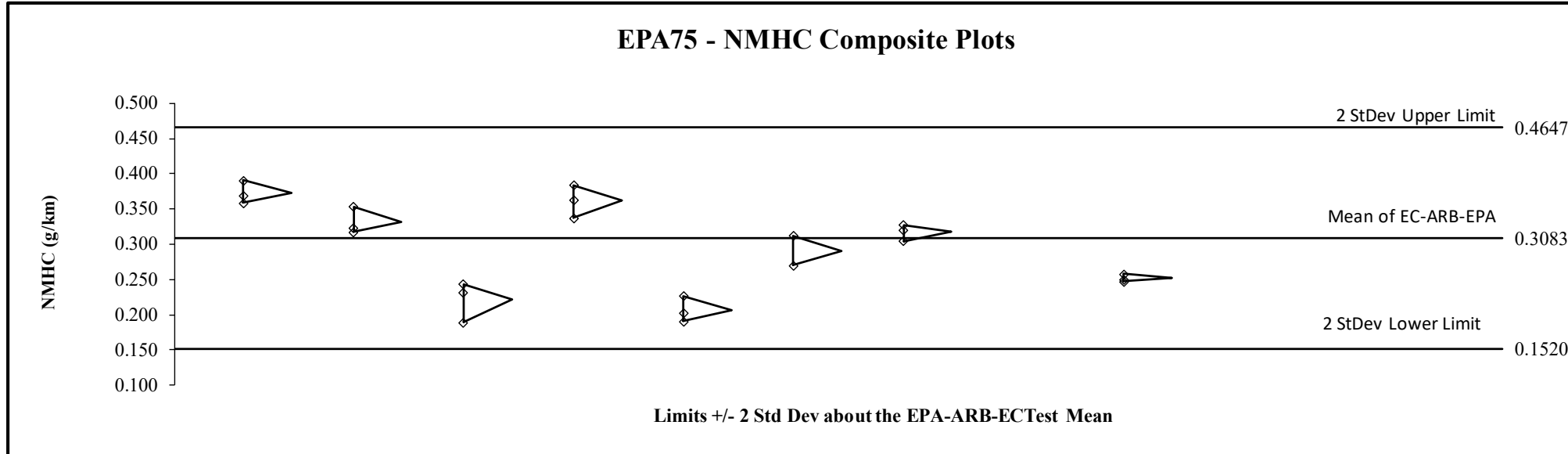


	Lab 1 (EPA)	Lab 2 (ECCC)	Lab 3 (CARB)	Lab 4	Lab 5	Lab 6	Lab 7	Lab 8	Lab 9	Lab 10
MEAN	0.1370	0.1453	0.1450	0.1450	0.1243	0.1484	0.1390	0.1223	---	---
STD DEV	0.0078	0.0057	0.0017	0.0030	0.0027	0.0015	0.0044	0.0091	---	---
Coeff. of Variation	5.73	3.94	1.19	2.10	2.18	1.01	3.14	7.42	---	---
% Diff to EC-ARB- EPA Mean	-3.80	1.99	1.81	1.79	-12.71	4.22	-2.40	-14.10	---	---
% Diff to EPA	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	---	---
% Diff to ARB	No Diff	No Diff	No Diff	No Diff	-14.26	No Diff	No Diff	-15.63	---	---
% Diff to EC	No Diff	No Diff	No Diff	No Diff	-14.41	No Diff	No Diff	-15.78	---	---
Number of Tests	3	3	3	3	3	3	3	3	3	3

Note:

- (1) Mean value is the reported laboratory value without a DF applied.
- (2) %Diff is the student "t" distribution analysis at a 95% confidence ratio

Preliminary Findings – NMHC (Arctic Cat)



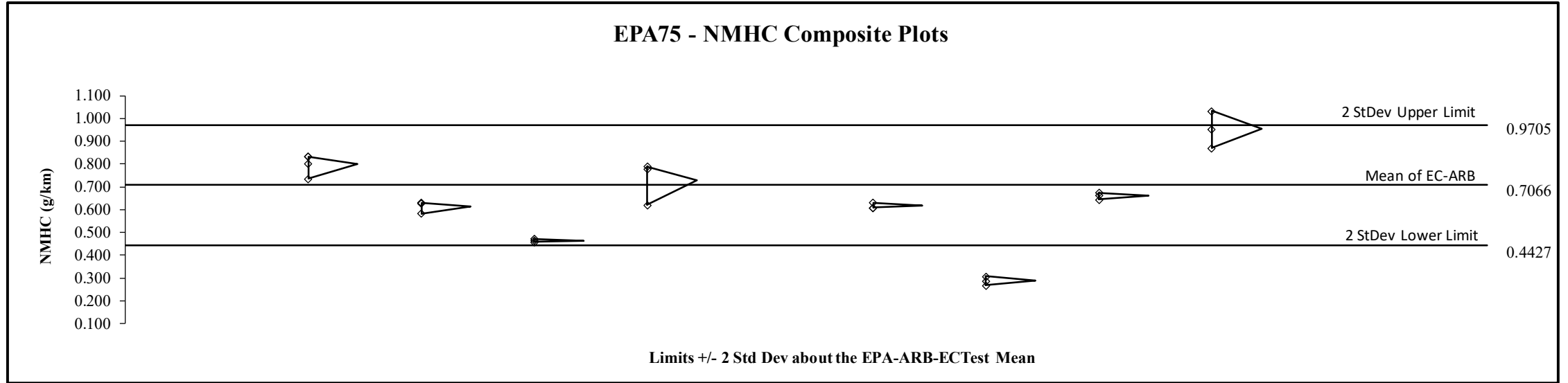
	Lab 1 (EPA)	Lab 2 (ECCC)	Lab 3 (CARB)	Lab 4	Lab 5	Lab 6	Lab 9	Lab 10	Lab 12
MEAN	0.3725	0.3313	0.2213	0.3611	0.2069	0.2908	0.3170	---	0.2516
STD DEV	0.0164	0.0192	0.0283	0.0234	0.0182	0.0298	0.0117	---	0.0057
Coeff. of Variation	4.40	5.79	12.77	6.49	8.80	10.24	3.68	---	2.26
% Diff to EC-ARB- EPA Mean	20.81	7.44	-28.25	17.10	-32.90	-5.71	2.82	---	-18.40
% Diff to EPA	No Diff	-11.07	-40.60	No Diff	-44.46	-21.95	-14.89	---	-32.46
% Diff to ARB	68.36	49.73	No Diff	63.19	No Diff	No Diff	43.29	---	No Diff
% Diff to EC	12.44	No Diff	-33.21	No Diff	-37.55	No Diff	No Diff	---	-24.05
Number of Tests	3	3	4	3	3	3	3	3	3

Note:

(1) Mean value is the reported laboratory value without a DF applied.

(2) %Diff is the student "t" distribution analysis at a 95% confidence ratio

Preliminary Findings – NMHC (Outlaw)

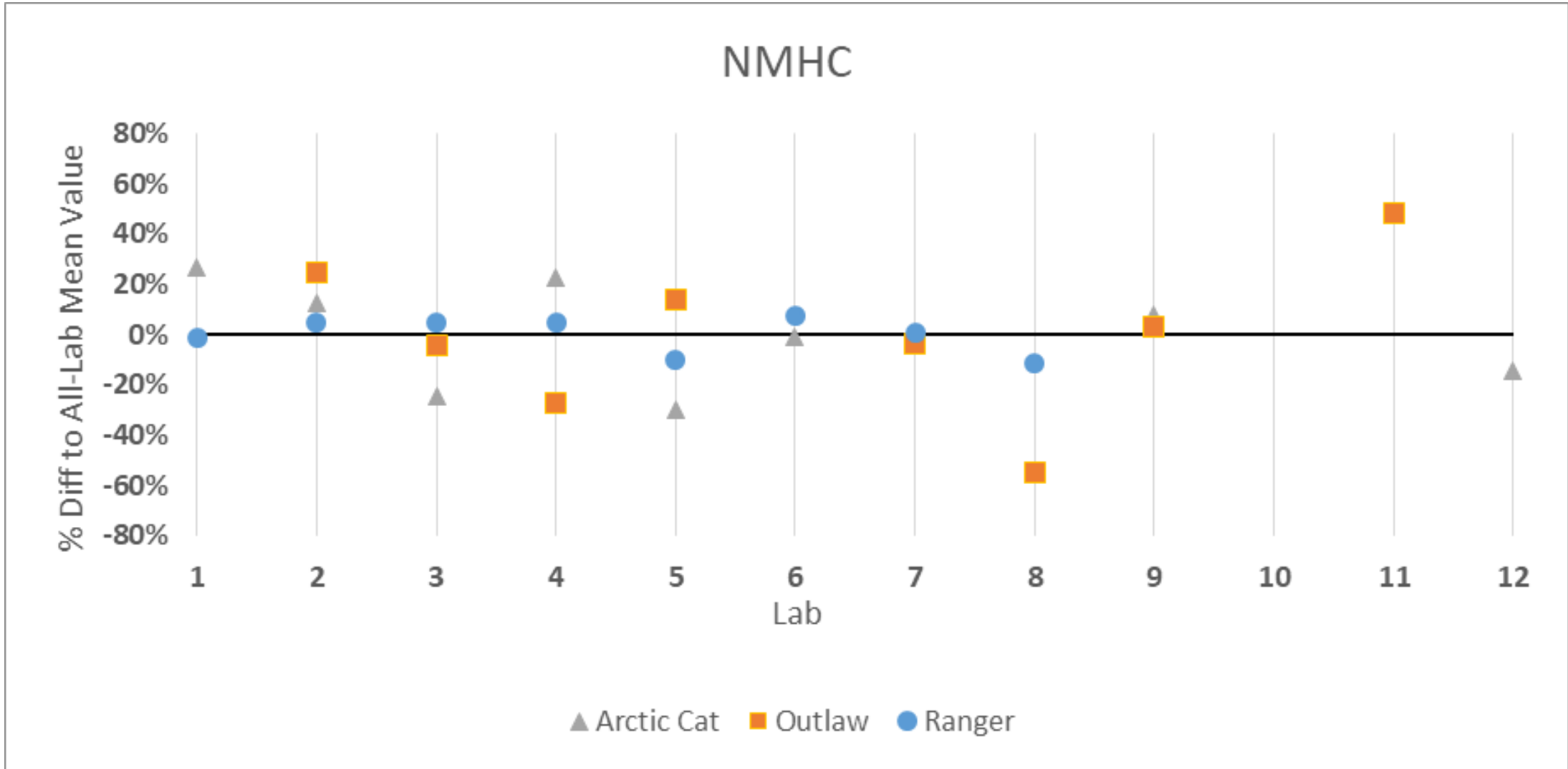


	Lab 1 (EPA)	Lab 2 (ECCC)	Lab 3 (CARB)	Lab 4	Lab 5	Lab 6	Lab 7	Lab 8	Lab 9	Lab 11
MEAN	---	0.7999	0.6133	0.4646	0.7298	---	0.6160	0.2883	0.6601	0.9520
STD DEV	---	0.0455	0.0263	0.0068	0.0943	---	0.0121	0.0193	0.0151	0.0815
Coeff. of Variation	---	5.69	4.29	1.45	12.93	---	1.97	6.68	2.28	8.5614
% Diff to EC-ARB- EPA Mean	---	13.20	-13.20	-34.25	3.28	---	-12.83	-59.20	-6.58	34.72
% Diff to EPA	---	---	---	---	---	---	---	---	---	---
% Diff to ARB	---	30.42	No Diff	-24.25	No Diff	---	No Diff	-52.99	No Diff	55.2174
% Diff to EC	---	No Diff	-23.33	-41.92	No Diff	---	-22.99	-63.96	-17.48	19.0109
Number of Tests	3	4	3	3	3	3	3	3	3	3

Note:

- (1) Mean value is the reported laboratory value without a DF applied.
- (2) %Diff is the student "t" distribution analysis at a 95% confidence ratio

Preliminary Findings – NMHC



Outline



- Introduction
- Test Fuel, Test Vehicle, and Participating Laboratories
- Testing Procedures
- Preliminary Findings
- **Discussion**
- Future Plan for Testing
- Project Contacts

- Sources of Variability for Tailpipe exhaust emissions
 - *A Chassis dynamometer exhaust emission test cell is a complex system consisting of:*
 - Chassis dynamometer
 - Exhaust sampling system
 - Analysis bench
 - Test vehicle
 - Driver (human or robotic)

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Future Plans



- Continue to offer the opportunity for participation at testing facilities across North America and expand to include facilities overseas
- Bring vehicles back to ECCC (or other regulatory lab) to track if emissions have changed with time/mileage accumulation
- Draw conclusions based on test results (including potential action items)
- Develop improved test procedures for subsequent correlation programs
 - *Monitor and log driver-metrics (e.g. engine speed) to promote consistent driving behaviours*
 - *Monitor intake air temperature of vehicle to assist with optimal fan placement*
 - *Specify a recommended CVS flowrate for each test vehicle*
 - *Develop program for interested participants involving the 'sharing' of a professional driver and/or test fuel*

Outline



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Project Contacts



- For further questions/inquiries, please contact:
 - **Maryam Delavarrafiee**, CARB, Emission Test Procedure Developer Coordinator (Maryam.Delavarrafiee@arb.ca.gov) (626) 575-6877
 - **David Swain**, EPA, Project Coordinator (734) 214-4377 (swain.david@epa.gov)
 - **Jonathan Stokes**, ECCC, Data Analysis and Project Report (jonathan.stokes@canada.ca) (613)949-0708

Thank you!



Back-up Slide (Vehicle Information)

Test Vehicle & Test Parameters			
Vehicle (Year/Make/Model):	2017 Arctic Cat Alterra 550	2018 Polaris Outlaw 110	2017 Polaris Ranger XP 1000 EPS
Test Vehicle VIN or other ID:	4VF17ATV1HT201163	RF3YAK112JT021725	4XARTA996H8558638
Engine Displacement (cc):	550	112	999
Motorcycle Class:	I	I	I
Transmission:	Continuous Variable Transmission	Continuous Variable Transmission	Continuous Variable Transmission
Idle Speed (rpm)	NA	NA	1,250
Motorcycle Top Speed (km/h):	93.3	NA	NA
Tire Make & Model:	Carlisle Trail Pro	Duro	Maxxis Ceros
Front Tire Size:	25X8.0 - 12 NHS 78D	NA	NA
Rear Tire Size:	25X10 - 12 NHS 78D	NA	NA
Front and Rear Tire Pressure (psi):	10	3	10 and 12, respectively
GVWR (kg):	652	NA	NA
Dry Mass (kg):	328.9	126.0	689.6
Curb Mass (kg):	378	NA	NA
Loaded Vehicle Mass (kg):	458	NA	NA
Equivalent Inertia Mass (kg):	460	230	810
Force Coefficient A (N):	31.41	11.31	62
Force Coefficient C (N/(km/h) ²)	0.0319	0.0260	0.0340
Force (Road Load) at 65 km/h (N):	166.0	121.2	206.7
70 to 60 km/h Coast down Target			
Time (s):	7.73	5.30	10.99
Allowable Tolerances			
Longest Time (s):	8.0	5.5	11.3
Shortest Time (s):	7.5	5.1	10.7
Fuel Tank Capacity (L):	20.1	5.9	37.9
50% Fuel Tank Capacity (L):	10.5	2.95	18.95

Back-up Slide (Vehicle Information)

Test Vehicle & Test Parameters	
Vehicle (Year/Make/Model):	2018 Polaris Outlaw 110
Engine Displacement (cc):	112
Motorcycle Class:	I
Transmission:	Continuous Variable
Front and Rear Tire Pressure (psi):	3
Equivalent Inertia Mass (kg):	230
Force Coefficients:	
A (N):	11.31
C (N/(km/h) ²)	0.026
Force (Road Load) at 65 km/h (N):	121.2
70 to 60 km/h Coast down Target:	
Time (s):	5.3
Fuel Tank Capacity (L):	5.9
50% Fuel Tank Capacity (L):	2.95



Back-up Slide (Vehicle Information)

Test Vehicle & Test Parameters	
Vehicle (Year/Make/Model):	2017 Arctic Cat Alterra 550
Engine Displacement (cc):	550
Motorcycle Class:	I
Transmission:	Continuous Variable
Front and Rear Tire Pressure (psi):	10
Equivalent Inertia Mass (kg):	460
Force Coefficients:	
A (N):	31.41
C (N/(km/h) ²)	0.0319
Force (Road Load) at 65 km/h (N):	166
70 to 60 km/h Coast down Target:	
Time (s):	7.73
Fuel Tank Capacity (L):	20.1
50% Fuel Tank Capacity (L):	10.5



Back-up Slide (Vehicle Information)

Test Vehicle & Test Parameters	
Vehicle (Year/Make/Model):	2017 Polaris Ranger XP 1000 EPS
Engine Displacement (cc):	999
Motorcycle Class:	I
Transmission:	Continuous Variable
Front and Rear Tire Pressure (psi):	10 and 12, respectively
Equivalent Inertia Mass (kg):	810
Force Coefficients:	
A (N):	62
C (N/(km/h) ²)	0.034
Force (Road Load) at 65 km/h (N):	206.7
70 to 60 km/h Coast down Target:	
Time (s):	10.99
Fuel Tank Capacity (L):	10
50% Fuel Tank Capacity (L):	5

