

MOVES2014 Model Preparation & Testing

for Use in Regional Air Quality Conformity Analysis

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NATIONAL CAPITAL REGION TRANSPORTATION PLANNING BOARD

Briefing Outline

- Background
- New Model Features
- Model Preparation Process
- Model Testing Framework
- Test Result Summary
- Test Result Details
- Findings
- Conclusion

Background

- This MPO is in EPA's designated non-attainment area
- US DOT and EPA require regional Air Quality Conformity Analysis for CLRP and TIP
- Conformity Regulations: Use of latest planning assumptions and tools
- Currently using EPA's MOVES2010a model for Conformity Analysis
- On July 2014 EPA released MOVES2014 model
 - Use in Conformity 'as expeditiously as possible' (no later than 2 years)
- MOVES2014 Model preparation & testing

Select New Features of MOVES2014

- **Federal Programs:**
 - ✓ Tier 3 in 2017 for cars and light/medium/heavy duty vehicles
 - ✓ New CAFE fuel economy standards effective for passenger car/light truck for 2017, and medium/heavy trucks for 2018
 - Heavy duty vehicle GHG regulation for MY 2014-2018
 - Phase 2 light duty vehicle GHG regulation for MY 2017-2025
 - **New Science** based on new test programs & studies:
 - ✓ Improved emission rates for gasoline sulfur and ethanol
 - ✓ Improved temperature effects on emissions
 - ✓ Improved Evaporative & PM emissions calculations methods
 - **Methodological Changes (examples but not limited to):**
 - E85 inclusion in fuel data
 - ✓ Combination long-haul truck 'hoteling' (auxiliary power unit)
 - ✓ Combination long-haul truck start emissions eliminated
- ✓ Applicable for Conformity Analysis;
 - Not applicable for Conformity Analysis

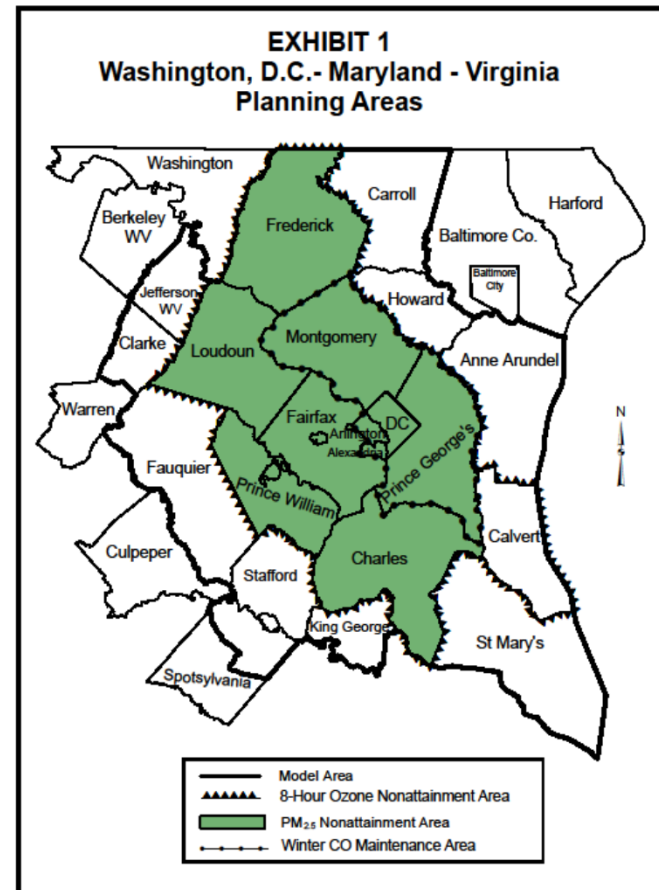
TPB MOVES2014 Model Preparation

- Training
- Coordination & Consultation with EPA and state air and transportation agencies
- Input Data Conversion (MOVES2010a to MOVES2014)
- New Data Compilation
- Test model runs and debugging
(Representative jurisdictions for 2015, 2017 and 2040)
- Development of customized input & output processing tools
- Full regional test runs (2015 & 2040)
- QA/QC; Interagency consultation

Full Regional Test Runs - Framework

Purpose: To determine preparedness of MOVES2014 application for regional Air Quality Conformity Analysis

- **Inputs:**
 - Travel Data:
 - Travel demand modeling results for 2014 CLRP/FY2015-2020 TIP
 - 2011 Vehicle Registration Data
 - 8.3 Cooperative Land Use Forecasts
 - Non-Travel Data: Fuel, I/M & meteorological data for 2014 CLRP/FY2015-2020 TIP
- **Geographical Coverage:** Non-attainment areas (vary by pollutant)
- **Models:** MOVES2014 (October 2014 Release)
- **Analysis Year:** 2015 and 2040



Regional Total Emissions - Summary

Analysis Year: 2015

Year 2015 Emissions Comparison: MOVES2010a Vs. MOVES2014					
Based on the 2014 CLRP & FY2015-2020 TIP Air Quality Conformity					
Season	Pollutant	MOVES2014	MOVES2010a	Δ	%Δ
ANNUAL (t/y)	PM2.5	1,656	1,926	-271	-14%
	NOX	41,226	46,115	-4,889	-11%
OZONE (t/d)	VOC	56.1	58.5	-2.4	-4%
	NOX	114.5	131.9	-17.4	-13%
WINTER (t/d)	CO	351	494	-143	-29%
GHG (t/y)	CO2 Equivalent	24,914,703	25,476,533	-561,831	-2%

Regional Total Emissions - Summary

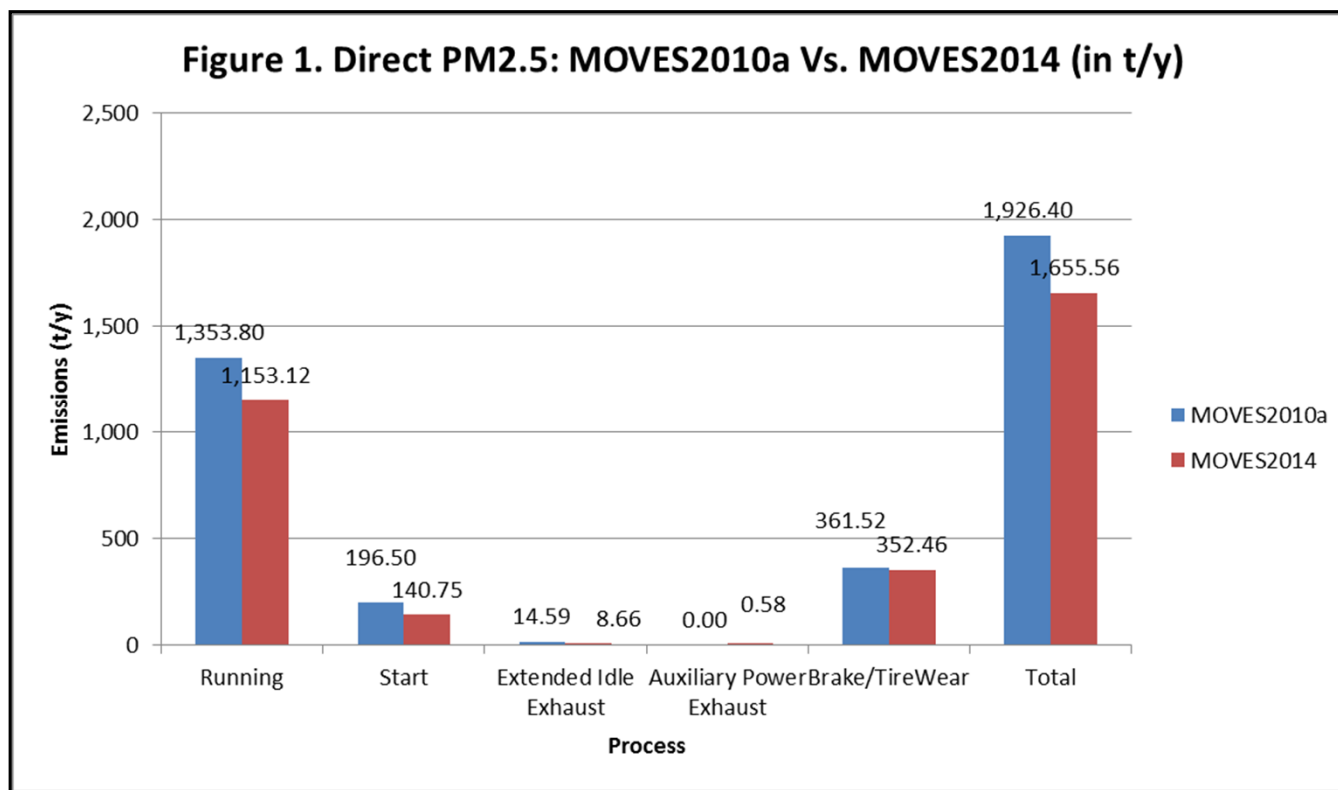
Analysis Year: 2040

Year 2040 Emissions Comparison: MOVES2010a Vs. MOVES2014					
Based on the 2014 CLRP & FY2015-2020 TIP Air Quality Conformity					
Season	Pollutant	MOVES2014	MOVES2010a	Δ	%Δ
ANNUAL (t/y)	PM2.5	734	1,299	-565	-43%
	NOX	8,277	21,944	-13,667	-62%
OZONE (t/d)	VOC	18.2	39.9	-21.7	-54%
	NOX	20.7	61.1	-40.4	-66%
WINTER (t/d)	CO	121	381	-261	-68%
GHG (t/y)	CO2 Equivalent	19,549,207	26,722,145	-7,172,938	-27%

Regional Total Emissions - Components: 2015 Fine Particles (Direct PM2.5)

Table 1. Direct PM2.5: MOVES2010a Vs. MOVES2014 (in t/y)

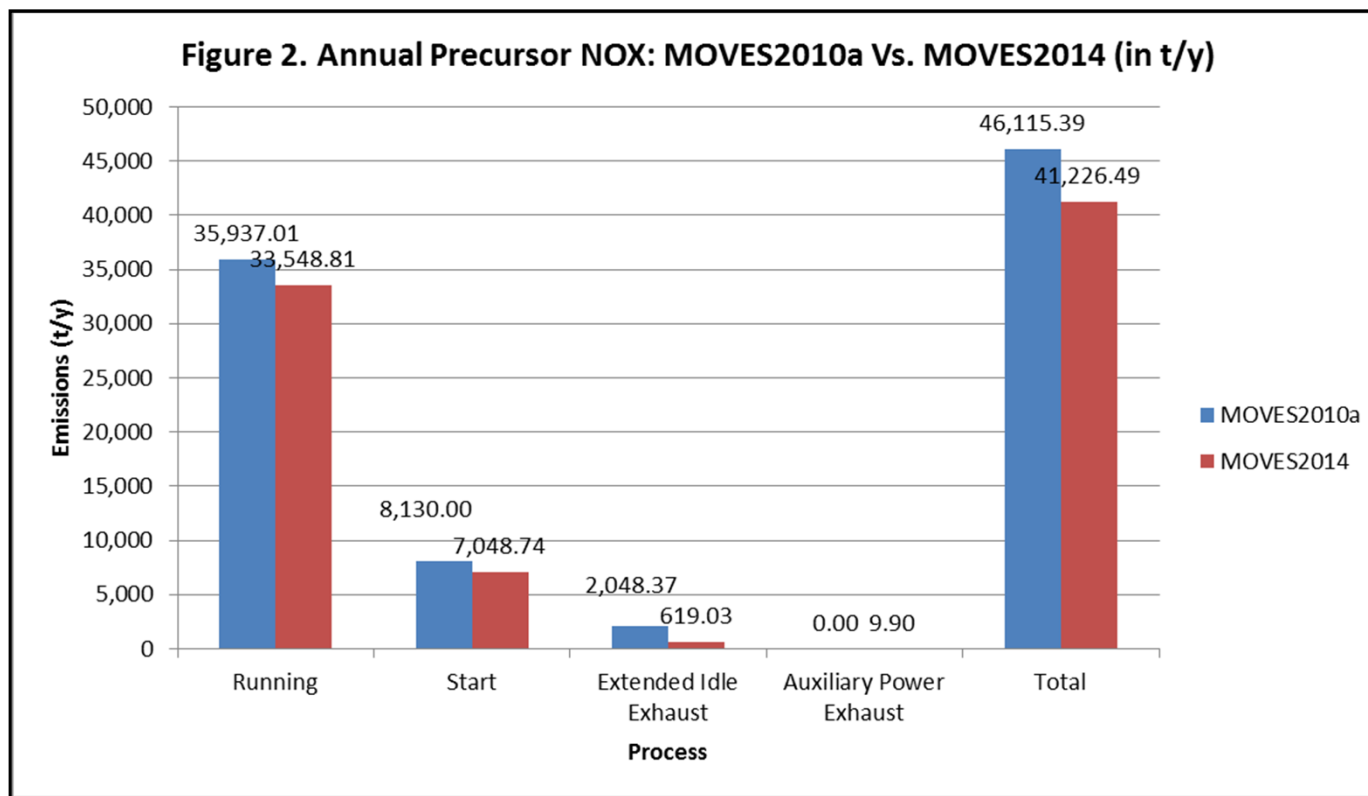
Process	MOVES2014	MOVES2010a	Δ	%Δ
Running	1,153.12	1,353.80	-200.68	-14.8%
Start	140.75	196.50	-55.75	-28.4%
Extended Idle Exhaust	8.66	14.59	-5.93	-40.6%
Auxiliary Power Exhaust	0.58	ND	0.58	ND
Brake/TireWear	352.46	361.52	-9.06	-2.5%
Total	1,655.56	1,926.40	-270.84	-14.1%



Regional Total Emissions - Components: 2015 Fine Particles (Precursor NO_x)

Table 2. Annual Precursor NO_x: MOVES2010a Vs. MOVES2014 (in t/y)

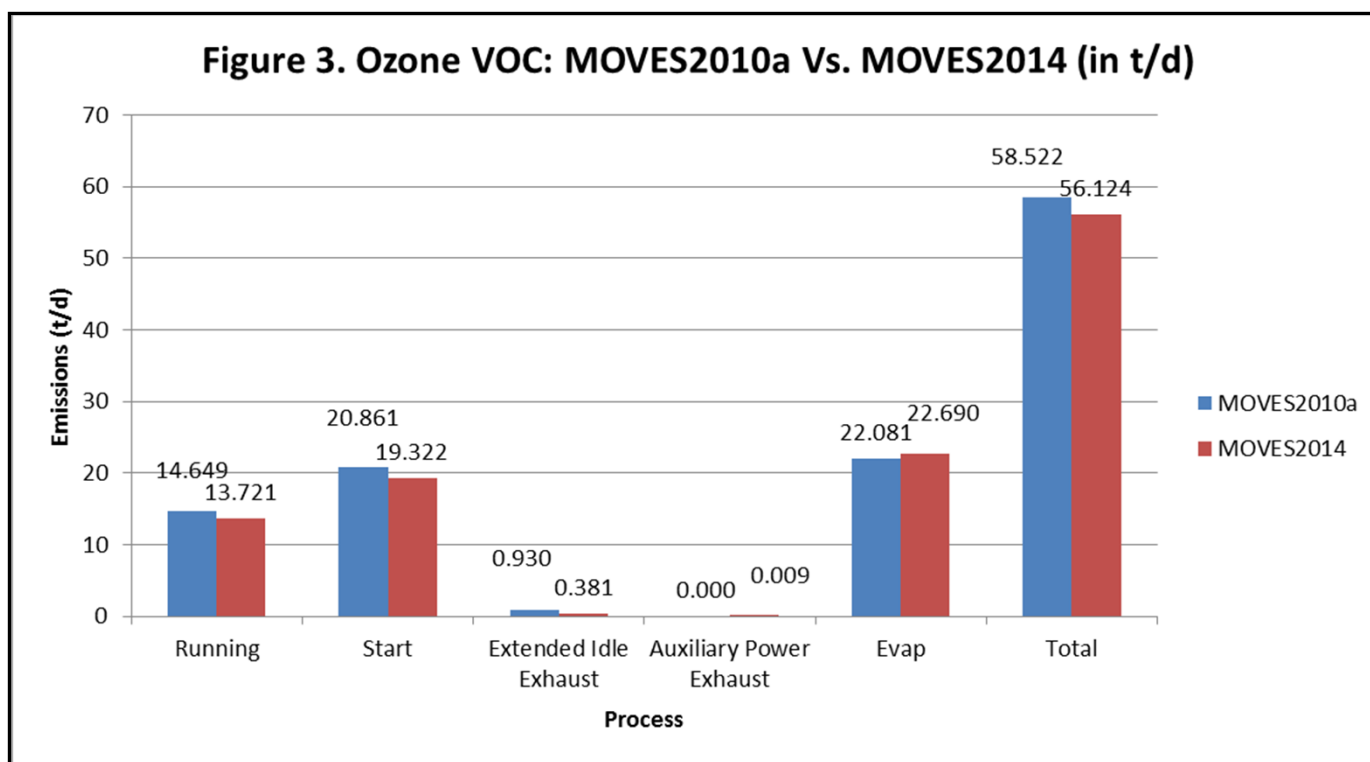
Process	MOVES2014	MOVES2010a	Δ	%Δ
Running	33,548.81	35,937.01	-2,388.20	-6.6%
Start	7,048.74	8,130.00	-1,081.26	-13.3%
Extended Idle Exhaust	619.03	2,048.37	-1,429.34	-69.8%
Auxiliary Power Exhaust	9.90	ND	9.90	ND
Total	41,226.49	46,115.39	-4,888.90	-10.6%



Regional Total Emissions - Components: 2015 Ozone (VOC)

Table 3. Ozone VOC: MOVES2010a Vs. MOVES2014 (in t/d)

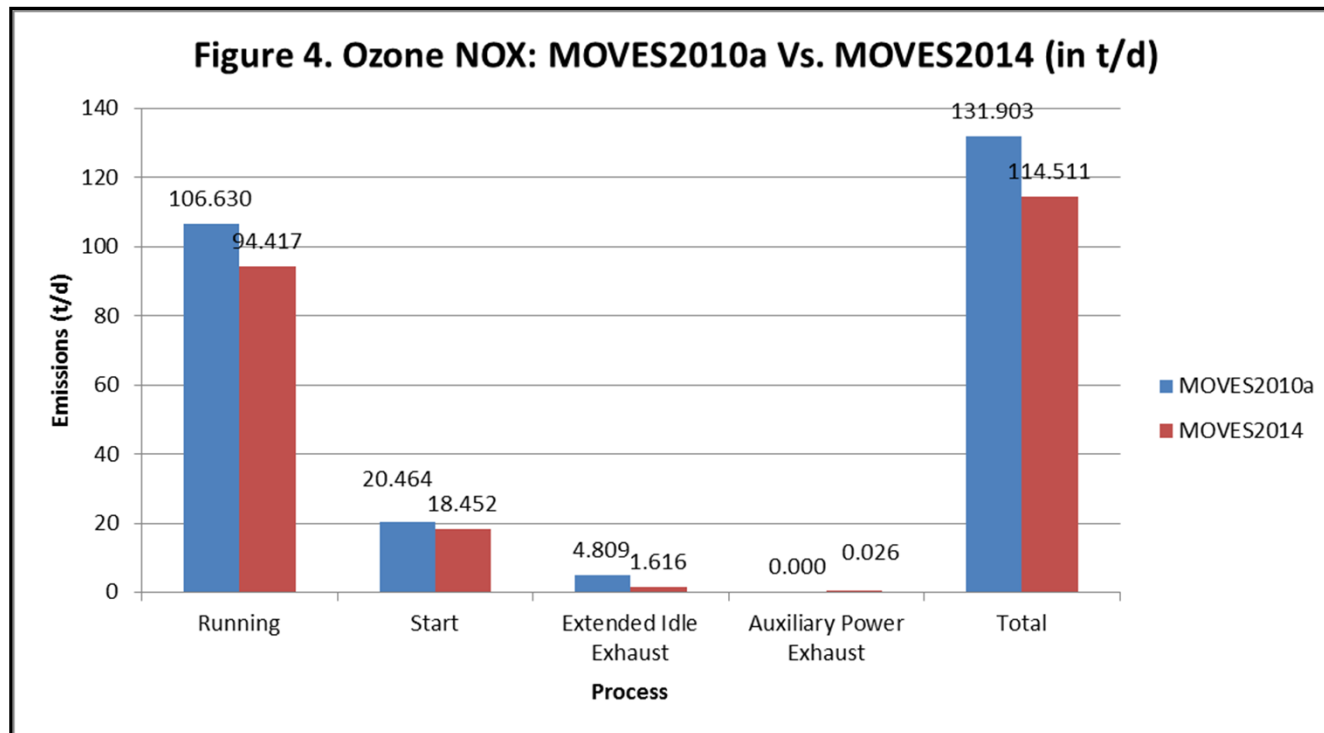
Process	MOVES2014	MOVES2010a	Δ	%Δ
Running	13.721	14.649	-0.928	-6.3%
Start	19.322	20.861	-1.539	-7.4%
Extended Idle Exhaust	0.381	0.930	-0.550	-59.1%
Auxiliary Power Exhaust	0.009	ND	0.009	ND
Evap	22.690	22.081	0.610	2.8%
Total	56.124	58.522	-2.398	-4.1%



Regional Total Emissions - Components: 2015 Ozone (NO_x)

Table 4. Ozone NOX: MOVES2010a Vs. MOVES2014 (in t/d)

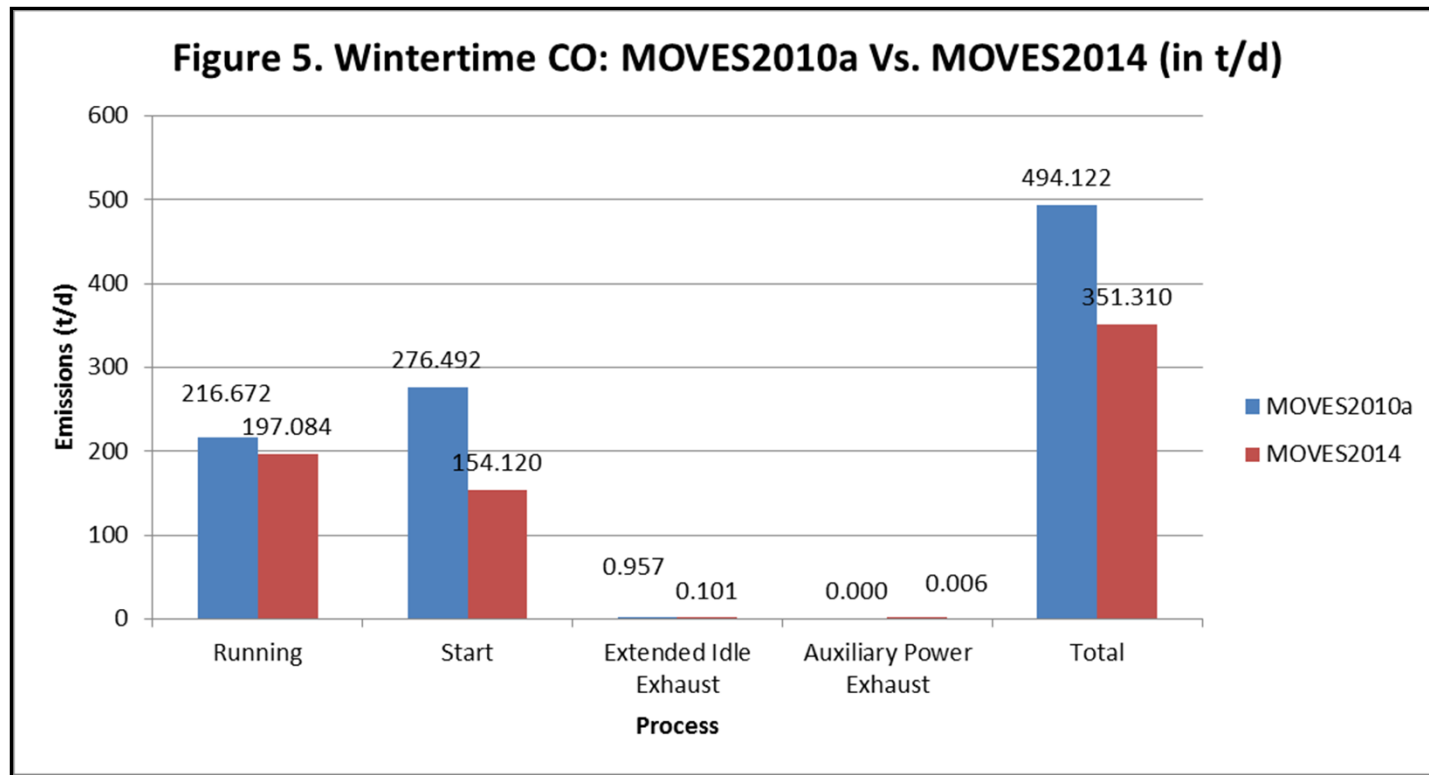
Process	MOVES2014	MOVES2010a	Δ	%Δ
Running	94.417	106.630	-12.213	-11.5%
Start	18.452	20.464	-2.012	-9.8%
Extended Idle Exhaust	1.616	4.809	-3.193	-66.4%
Auxiliary Power Exhaust	0.026	ND	0.026	ND
Total	114.511	131.903	-17.391	-13.2%



Regional Total Emissions - Components: 2015 Winter CO

Table 5. Wintertime CO: MOVES2010a Vs. MOVES2014 (in t/d)

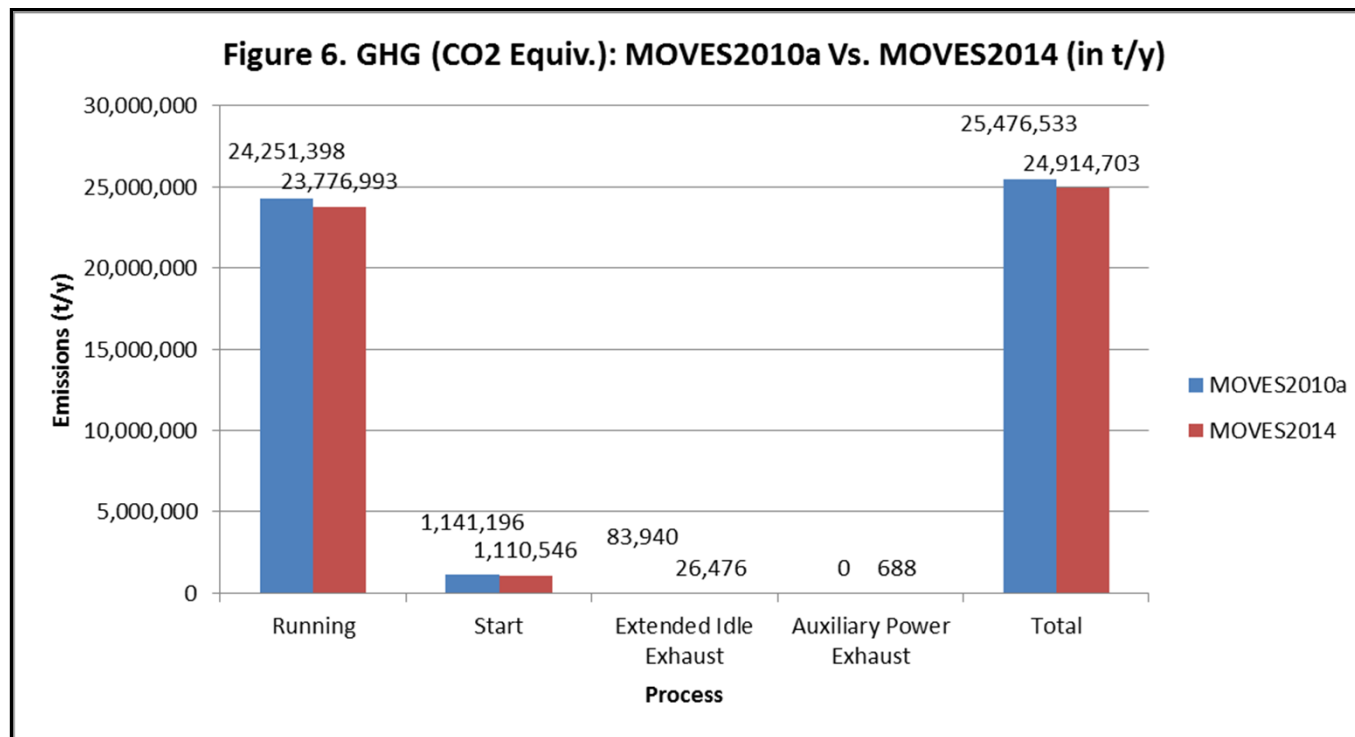
Process	MOVES2014	MOVES2010a	Δ	%Δ
Running	197.084	216.672	-19.589	-9.0%
Start	154.120	276.492	-122.373	-44.3%
Extended Idle Exhaust	0.101	0.957	-0.856	-89.5%
Auxiliary Power Exhaust	0.006	ND	0.006	ND
Total	351.310	494.122	-142.812	-28.9%



Regional Total Emissions - Components: 2015 GHG (CO₂ Equivalent)

Table 6. GHG (CO₂ Equiv.): MOVES2010a Vs. MOVES2014 (in t/y)

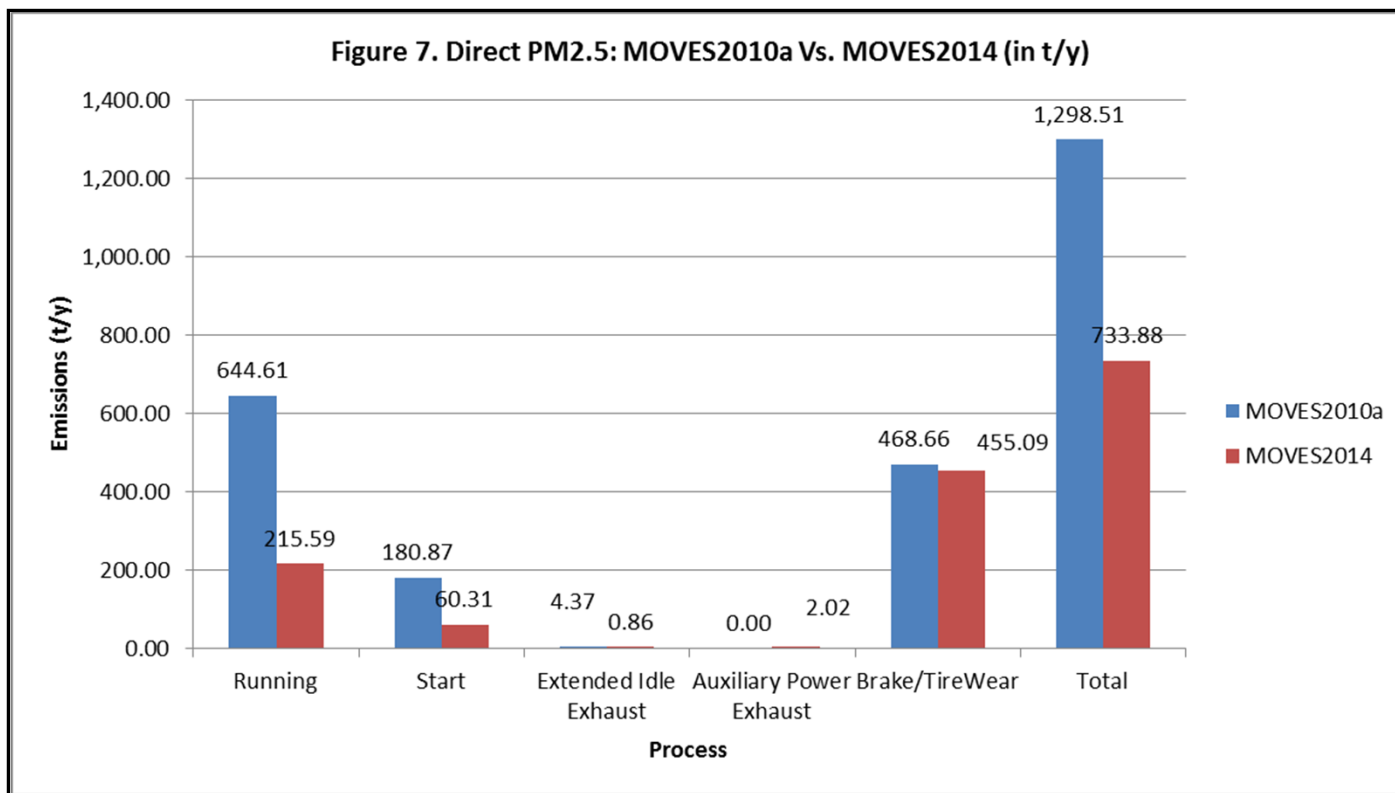
Process	MOVES2014	MOVES2010a	Δ	%Δ
Running	23,776,993	24,251,398	-474,406	-2.0%
Start	1,110,546	1,141,196	-30,650	-2.7%
Extended Idle Exhaust	26,476	83,940	-57,463	-68.5%
Auxiliary Power Exhaust	688	ND	688	ND
Total	24,914,703	25,476,533	-561,831	-2.2%



Regional Total Emissions - Components: 2040 Fine Particles (Direct PM2.5)

Table 7. Direct PM2.5: MOVES2010a Vs. MOVES2014 (in t/y)

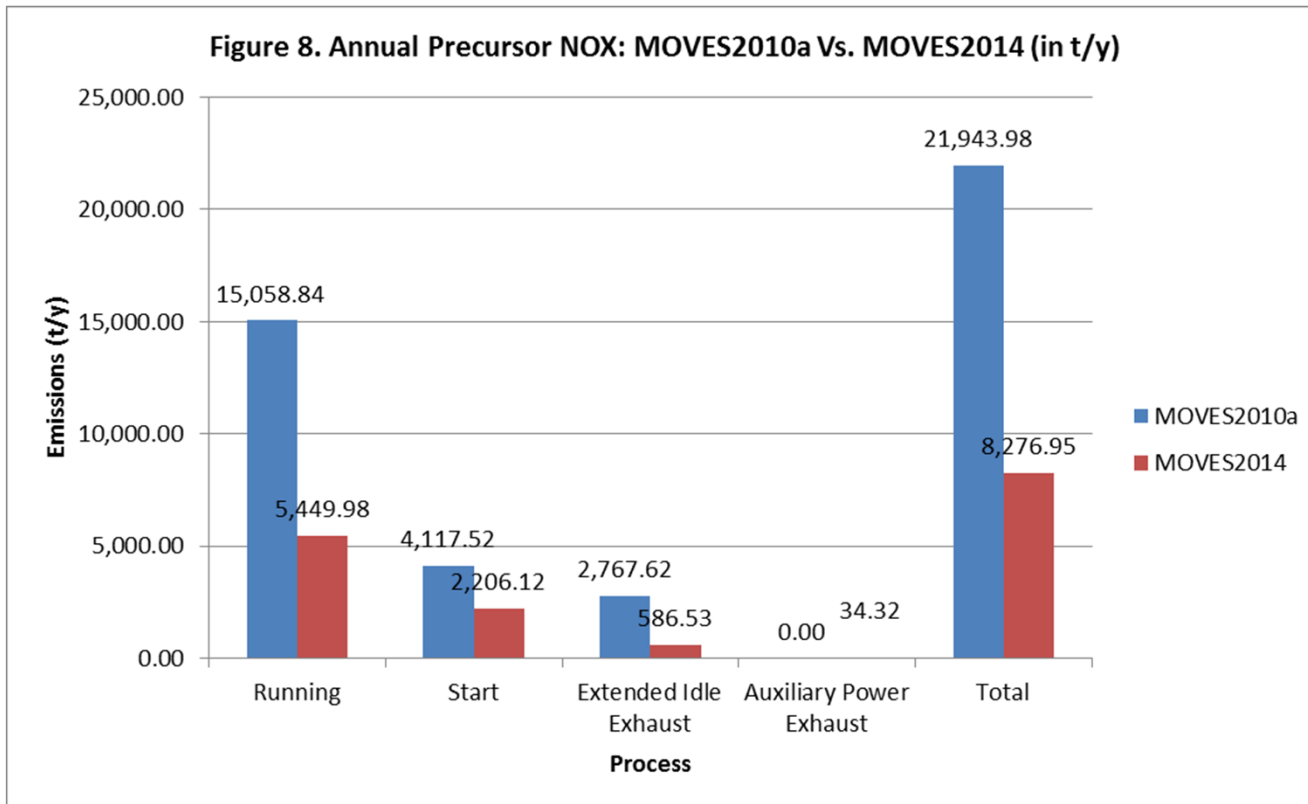
Process	MOVES2014	MOVES2010a	Δ	%Δ
Running	215.59	644.61	-429.01	-66.6%
Start	60.31	180.87	-120.56	-66.7%
Extended Idle Exhaust	0.86	4.37	-3.50	-80.3%
Auxiliary Power Exhaust	2.02	ND	2.02	ND
Brake/TireWear	455.09	468.66	-13.57	-2.9%
Total	733.88	1,298.51	-564.63	-43.5%



Regional Total Emissions - Components: 2040 Fine Particles (Precursor NO_x)

Table 8. Annual Precursor NOX: MOVES2010a Vs. MOVES2014 (in t/y)

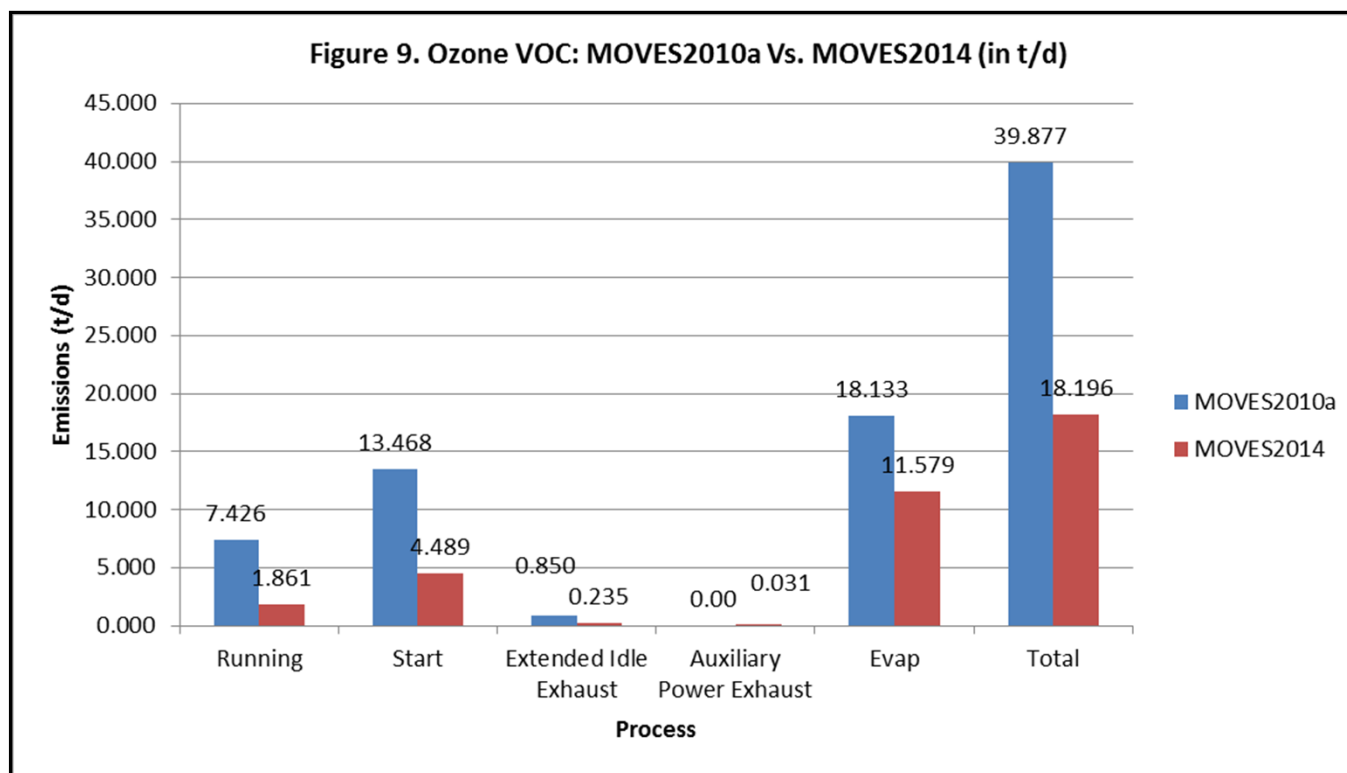
Process	MOVES2014	MOVES2010a	Δ	%Δ
Running	5,449.98	15,058.84	-9,608.87	-63.8%
Start	2,206.12	4,117.52	-1,911.39	-46.4%
Extended Idle Exhaust	586.53	2,767.62	-2,181.09	-78.8%
Auxiliary Power Exhaust	34.32	ND	34.32	ND
Total	8,276.95	21,943.98	-13,667.03	-62.3%



Regional Total Emissions - Components: 2040 Ozone (VOC)

Table 9. Ozone VOC: MOVES2010a Vs. MOVES2014 (in t/d)

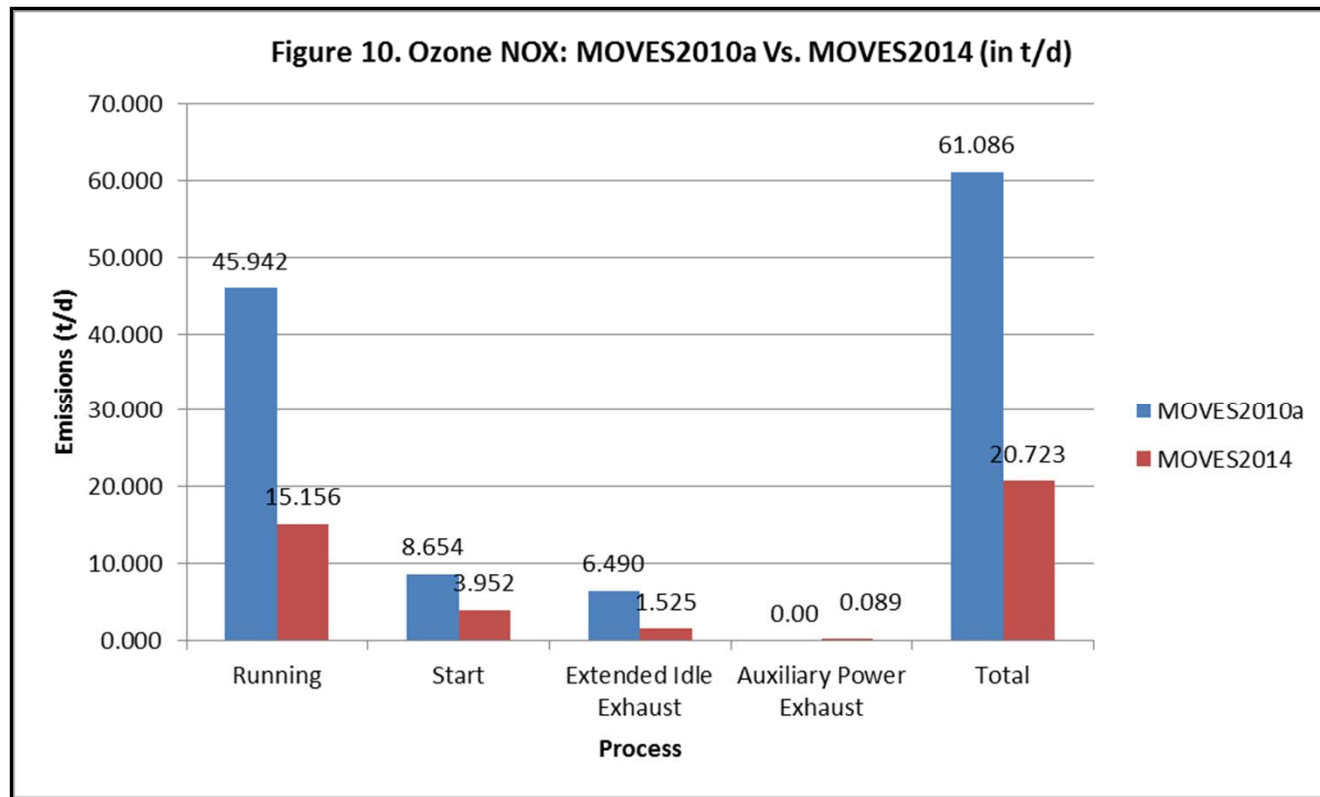
Process	MOVES2014	MOVES2010a	Δ	%Δ
Running	1.861	7.426	-5.564	-74.9%
Start	4.489	13.468	-8.979	-66.7%
Extended Idle Exhaust	0.235	0.850	-0.614	-72.3%
Auxiliary Power Exhaust	0.031	ND	0.031	ND
Evap	11.579	18.133	-6.554	-36.1%
Total	18.196	39.877	-21.681	-54.4%



Regional Total Emissions - Components: 2040 Ozone (NO_x)

Table 10. Ozone NOX: MOVES2010a Vs. MOVES2014 (in t/d)

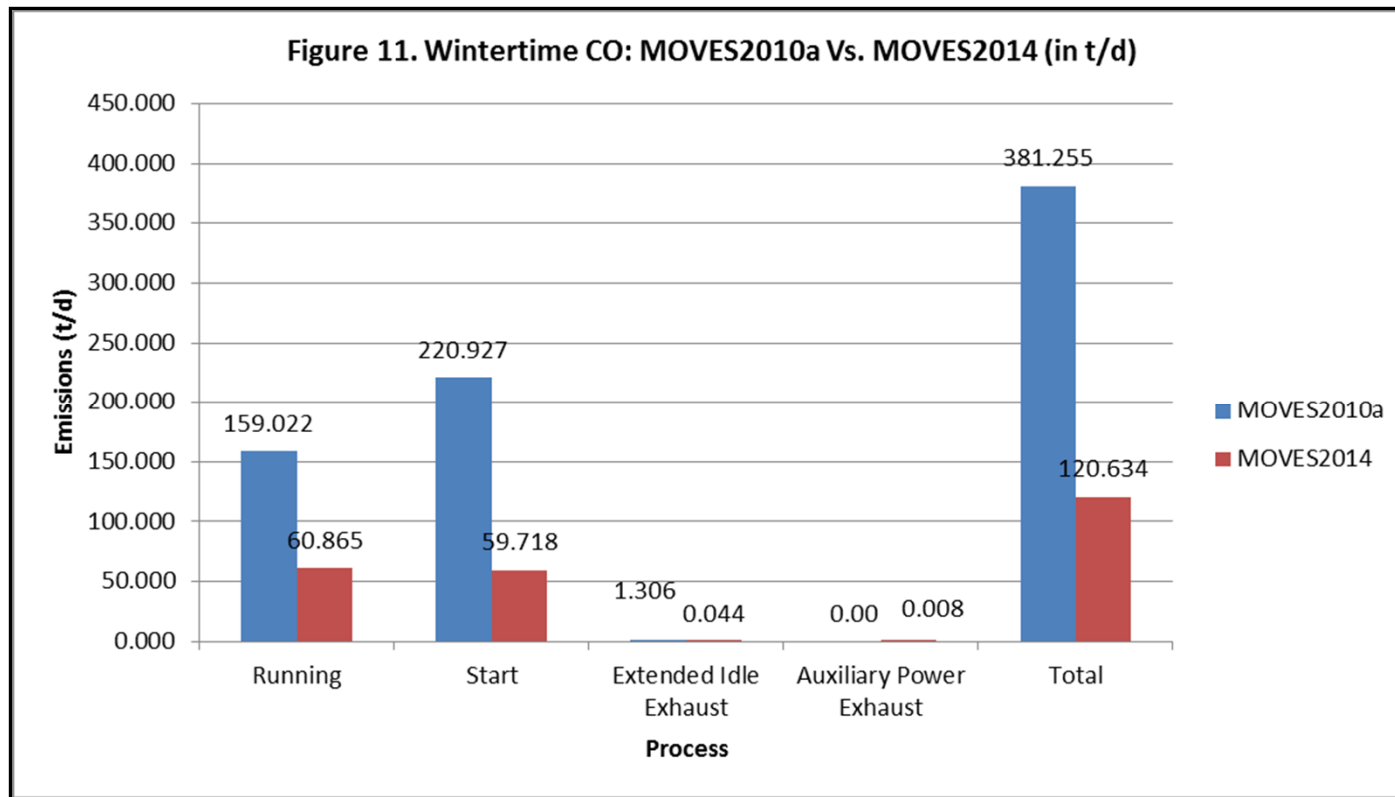
Process	MOVES2014	MOVES2010a	Δ	%Δ
Running	15.156	45.942	-30.786	-67.0%
Start	3.952	8.654	-4.702	-54.3%
Extended Idle Exhaust	1.525	6.490	-4.965	-76.5%
Auxiliary Power Exhaust	0.089	ND	0.089	ND
Total	20.723	61.086	-40.363	-66.1%



Regional Total Emissions - Components: 2040 Winter CO

Table 11. Wintertime CO: MOVES2010a Vs. MOVES2014 (in t/d)

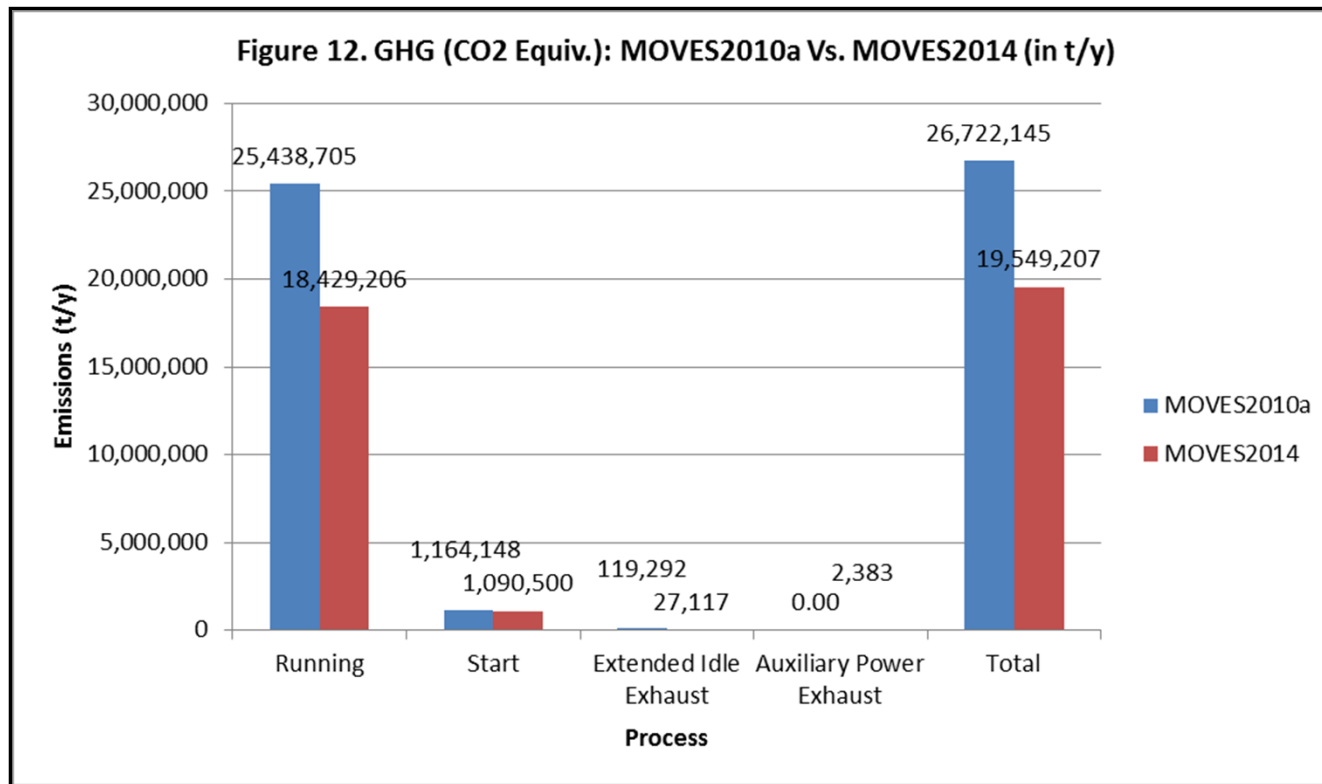
Process	MOVES2014	MOVES2010a	Δ	%Δ
Running	60.865	159.022	-98.158	-61.7%
Start	59.718	220.927	-161.209	-73.0%
Extended Idle Exhaust	0.044	1.306	-1.262	-96.6%
Auxiliary Power Exhaust	0.008	ND	0.008	ND
Total	120.634	381.255	-260.621	-68.4%



Regional Total Emissions - Components: 2040 GHG (CO₂ Equivalent)

Table 12. GHG (CO₂ Equiv.): MOVES2010a Vs. MOVES2014 (in t/y)

Process	MOVES2014	MOVES2010a	Δ	%Δ
Running	18,429,206	25,438,705	-7,009,499	-27.6%
Start	1,090,500	1,164,148	-73,648	-6.3%
Extended Idle Exhaust	27,117	119,292	-92,175	-77.3%
Auxiliary Power Exhaust	2,383	ND	2,383	ND
Total	19,549,207	26,722,145	-7,172,938	-26.8%



Full Regional Test Runs - Findings

Relative to MOVES2010a model estimates and with 2014 CLRP/FY2015-2020 TIP as a base:

- Estimates of mobile emissions across all pollutants tested for 2015 and 2040 are lower:
 - Inclusion of new federal control programs
 - New science-based model data updates
 - Methodological changes
- The greatest reduction was in Winter CO, a reduction of 29% and 68% across the region in 2015 and 2040.
- Both Ozone and PM2.5 precursor NO_x emissions reduced by 11% and 13% in 2015, and 66% and 62% in 2040.
- PM2.5 emissions are reduced by 14% in 2015, and 44% in 2040.
- Greenhouse gas emissions (CO2 equivalent) reduced by 2% in 2015 and 27% in 2040 across the region.
- Most of the overall emissions reductions by pollutant (with the exception of Winter CO and Ozone VOC) were attributed to the Running Exhaust emissions reductions
- Most of the overall reductions of Winter CO and Ozone VOC were attributed to the Start Exhaust emissions reductions

Conclusion

- Results of Regional Test Runs:
 - Consistent with EPA's MOVES2014 Model findings
 - Consistent with COG regional air and transportation agencies' experience
 - Reasonable relative to expectation from Travel Demand Forecasts control programs
- MOVES2014 model preparation complete and ready for use in regional Air Quality Conformity Analysis



Thank You

For questions: please contact

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