# MOVES Emissions Inventory Quality Assurance Tool

L.D. White

Texas A&M Transportation Institute

2017 International Emissions Inventory Conference



# Background

- Latest version of MOVES MOVES2014a
- Applications of MOVES
- Quality and integrity of user inputs critical
- Long MOVES run times (e.g,. Annual runs)



# Background

- MOVES performs limited QA
- Input errors => Duplication of effort
- Texas large state (254 counties)



#### Overview

- TCEQ and TTI recognized need for QA tool
- QA checks focused on Texas data
- QA output
- Option to create MOVES output summary



#### Overview

- Performs QA based on MOVES14a
- No license or installation suite
- GUI facilitates user selection of inputs
- Works with MySQL to perform QA operations



# QA Tool – Basic Operation

**GUI** 

- Stage 1 MySQL Connection/Input Specs
- Stage 2 Specific Inputs/Outputs

OA

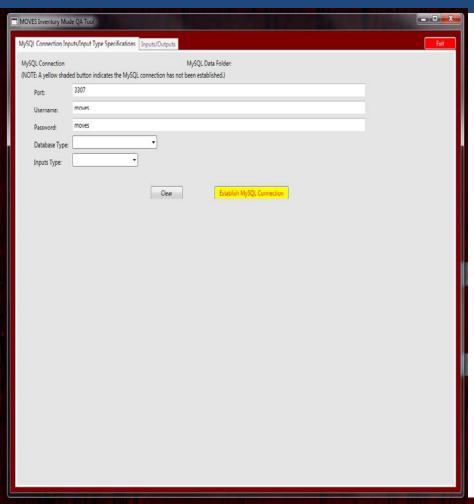
- Creates MySQL scripts, other files
- Executes MySQL scripts in DOS

Output

- Write QA output
- Performs clean up of temporary files



## **QA Tool GUI**

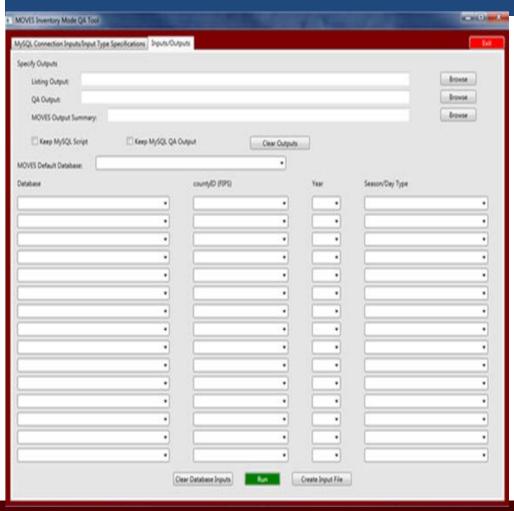


#### Stage 1

- MySQL Connection Inputs
  - Port
  - Username
  - Password
- Input Specifications
  - Database Type
  - Input Type



## **QA Tool GUI**



#### Stage 2

- Outputs
  - Execution Listing
  - QA Output
  - MOVES Output Summary
- Temporary File Options
- MOVES Default Database
- Database Specific Inputs
  - Name
  - County
  - Year
  - Season/Day Type



## QA Process

#### Creation of External Files

MySQL Scripts

**DOS Batch File** 



#### **Execution of External Files**

**Command Prompt Window** 

**Execute DOS Batch File** 



#### **Processing Script Output**

Save QA results

Retain/Delete Temporary Files



## QA Checks - CDBs

- 365 individual checks 26 tables
- Basic Checks
  - Table exists
  - Number of records
- Data validation
  - Valid values
  - Sums of distributions
- Focused on Texas-specific data



## QA Checks – Inventory Mode Output

- 26 individual checks 4 output tables
- Basic Checks
  - Table exists
  - Number of records
- Data Validation
  - Valid values
  - Checks moveserror table
- Activity and emissions output summary



# **QA Tool Outputs**

- Execution Summary (Listing) Output
- Tab-delimited QA Output

Database	Table	<b>Check Condition</b>	Check Description
cdb_1	avft	GOOD	No errors or warnings found
cdb_1	county	ERROR	Table does not exist
cdb_1	countyyear	WARNING	Table does not exist (default used if not found)



### QA Tool – Activity and Emissions Output

				,			Motorcycle - 11	Passenger Car - 21
Database	County	Year	Season	ActivityType/ Pollutant	Emissions Process	Units	Gasoline - 1	Gasoline - 1
MVS_out	48021 - Bastrop County	2014	Annual	distance – 1	N/A	mi	571909.8	5.69E+08
MVS_out	48021 - Bastrop County	2014	Annual	starts – 7	N/A	starts	511252	67429000
MVS_out	48021 - Bastrop County	2014	Annual	Carbon Monoxide (CO) – 2	Running Exhaust - 1	ton	9.318388	1722.725
MVS_out	48021 - Bastrop County	2014	Annual	Carbon Monoxide (CO) – 2	Start Exhaust - 2	ton	2.509385	641.4039



#### **MOVES Test Run**

- Description of MOVES run
  - -Annual Run
  - -Pollutants: VOC, CO, NOx, PM2.5, PM10
- MOVES run time approximately 300 minutes (5 hours)
- MOVES QA tool run time 15 seconds



## Summary

- Potential to save a substantial amount time and resources
  - Detects potential problems prior to MOVES runs
  - Detection of errors in MOVES inventory mode output
  - Activity and emissions output summaries
- Establishes standard protocol for QA checks/procedures
- Ensures consistency across geography and time



#### **Future Work**

- Phase II discussions with TCEQ
  - Inclusion of MOVES rate mode
  - Other refinements
- Expansion for applications outside Texas
- Other Opportunities
  - MOVES Run Spec (MRS) QA
  - Non-road



# Acknowledgements

- The Texas Commission on Environmental Quality (TCEQ)
  - Mary McGarry-Barber, TCEQ Project Technical Manager
- TTI Transportation Modeling Program
  - Dennis Perkinson, Ph.D.
  - Madhusudhan Venugopal, P.E.
  - Marty Boardman
  - Stacey Schrank



# Questions?



