



Florida Department of
TRANSPORTATION

Florida's MSATs Model

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Florida's MSATs Model

•Background

- After issuance of the FHWA 2009 Interim Guidance on MSATs – FDOT embarked on a project to develop a Florida specific model to perform dispersion modeling of MSATs at the project level.
- Analyze the seven priority MSATs – at least for Type 3 projects (Higher Potential for MSAT effects), could be used as a screening model
- Ascertain if there is a potential MSATs problem in Florida.

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• Background (cont.)

- For Type 3 projects the guidance says “contact the Office of Natural Environment and the Office of Project Development and Environmental Review in FHWA Headquarters for assistance in developing a specific approach for assessing impacts.”

- Since there is no current way of performing a quantitative analysis – wanted to be proactive in developing a tool (screening) we could use for that purpose.

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•Background (cont.)

- Model developed by the University of Central Florida (UCF), Civil, Environmental and Construction Engineering Department
- No federal or state standards for maximum allowable concentrations of MSATs in ambient air. NO EPA NAAQS for MSATs.
- Used an approach to calculate - “Maximum Allowable Concentrations” (MACs) to derive threshold concentration values for the MSATs. (based on literature review – on line)

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•Background (cont.)

- Model development project consisted of:
 - Development of Maximum Allowable Concentrations for each MSAT.
 - Modify the CAL3QHC model to allow dispersion modeling of MSATs
CAL3MSAT.
 - In conjunction with FHWA, developed a GUI called Cal3i (includes standard highway layouts, links, signal data and numerous receptors). Requires running MOVES for EFs beforehand.
 - Model MSAT concentrations near several large intersections and freeways in Florida.

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Development of Maximum Allowable Concentrations (MACs)

Literature review:

- EPA's Integrated Risk Information System (IRIS)
- EPA's Office of Air Quality, Planning and Standards (OAQPS)
- Agency for Toxic Substances and Disease Registry (ATSDR)
- Health Effects Institute (HEI)
- State of California – Office of Environmental Health Hazard Assessment (OEHHA)
- FHWA

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Development of Maximum Allowable Concentrations (MACs) (Cont.)

- With this information – a Cancer Inhalation “Unit Risk Estimate” (URE) was determined for each primary MSAT
- URE – upper bound excess lifetime (70 year) cancer risk estimate that results from continuous exposure to a chemical concentration of $1 \mu\text{g}/\text{m}^3$ in air.
- URE used to determine proposed chronic lifetime MACs for the MSATs.

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Development of Maximum Allowable Concentrations (MACs) (Cont.)

$$(CR) = MSAT_{MASS} (URE)$$

$$MSAT_{MASS} = CR/URE$$

$$MSAT = MSAT_{MASS} (24.45/MOWT)$$

Where:

CR = Cancer Risk

MSAT_{MASS} = mass concentration of MSAT in $\mu\text{g}/\text{m}^3$

URE = Unit Risk Estimate

MSAT = Concentration of MSAT in ppbv

MOWT = Molecular weight of MSAT in g/mol

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Development of Maximum Allowable Concentrations (MACs) (Cont.)

Proposed Maximum Allowable Concentrations (MACs) for Chronic Cancer Risks

- 1-hr Acute MACs – used threshold concentrations in literature from National Research Council (supported by EPA for screening and risk assessments) -
- Chronic Lifetime MACs – Developed by considering the cancer risks using equations developed for the model.
- No Chronic Lifetime MACs for Acrolein and DPM+DEOG (no URE available for Acrolein, URE for DPM+DEOG were developed for California)

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Emission Factors Modeling:

- Emissions factors were modeled for the primary MSATs (except DPM and DEOG).
- For intersections - factors for both the AM and PM peak hours were modeled.
- For freeways - the peak hour emission factors were modeled.
- Determined there is no satisfactory way to obtain emission factors for DPM and DEOG – MOVES does not have the capability of reporting emission factors for these pollutants
- Results used to input into the dispersion model.

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Dispersion Model:

- In order to determine if “typical” intersections and freeways in Florida exceed the concentrations of the proposed MACs:
- A new dispersion model was developed based on the EPA's CAL3QHC – named *CAL3MSAT*
- “Worst case” maximum one-hour concentrations for seven areas in Florida were modeled: Jacksonville, Miami-Ft. Lauderdale, Orlando, Pensacola, Naples-Sarasota, Tallahassee and St. Petersburg-Tampa.
- Capability to predict: acetaldehyde, acrolein, benzene, 1,3- butadiene, and formaldehyde.
- Results in $\mu\text{g}/\text{m}^3$ and ppbv
- A persistence factor was determined to convert the *one-hour concentrations* into a *chronic annual concentration*.

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Dispersion Model Results– Intersections:

- Predicted worst-case peak hour max. concentrations – multiple orders of magnitude higher than proposed MACs
- Developed using very conservative process
 - Proposed MAC values are extremely conservative
 - TPF to convert 1-hour averaging to annual very conservative (.05)
 - Used maximum values of peak-hour traffic volumes
 - These high concentrations only @ receptor at 10 feet from road edge (lifetime exposure not likely)
- Concentration beyond 10 feet - below the proposed MACs
- **Conclusion:** No evidence of significant health risk to human health in Florida.

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Dispersion Model Results– Freeways:

- Predicted worst-case peak hour max. concentrations – multiple orders of magnitude higher than proposed MACs
- Developed using very conservative process
 - Proposed MAC values are extremely conservative
 - TPF to convert 1-hour averaging to annual very conservative (.05)
 - Used maximum values of peak-hour traffic volumes
 - These high concentrations only @ receptor at 10 feet from road edge (lifetime exposure not likely)
- Concentration beyond 10 feet - below the proposed MACs
- **Conclusion:** No evidence of significant health risk to human health in Florida.

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Conclusions:

- Much literature and sources reviewed to determine values for applicable maximum permissible exposure limits.
- Resulted in proposed MACs associated with chronic cancer scenarios.
- Area specific data to run MOVES were obtained and EFs generated.
- Intersection and freeway modeling dispersion model created based on CAL3QHC – CAL3MSAT.
- Dispersion model was run using Florida specific input files.
- Results analyzed and compared with the proposed MACs.
- No evidence of significant health risk to human health in Florida based on MSATs other than Acrolein and DMP+DEOG.

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Issues:

- Model work still in progress.
- Need concurrence with proposed acute 1 hr. concentrations used to develop the MACs for each MSAT (unofficial).
- Need to perform more research to develop MACs for Acrolein and DMP+DEOG.
- Get approval to use modification of CAL3QHC.
- Default values used in modeling are Florida specific.
- Need concurrence with conservative approaches used.
- So far, using the model not in agreement with the FHWA MSATs Guidelines.
- Potential for use as a screening model.
- CAL3i – GUI that includes various configurations of intersections and links (Windows based).

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More information contact:

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