PM2.5 Emissions from Open Burning, Construction Activities

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EFIG's Needs

- Top down inventory
- Inexpensive data sources

Open Burning - The Way We Were

- Grown from 1985 NAPAP unless States provided data

Open Burning Categories

- Residential Municipal Solid Waste
- Residential Yard Waste
  - Leaves and Brush
- Land Clearing Debris (Construction)
- Slash (Timber Harvesting)

Residential MSW Burning

- Ecty = (Pcty x Rfrac) x W x Bfrac x (EF)
- **Pcty** is pop of county
- **Rfrac** is fraction of county that is rural
- **W** is per capita waste gen (0.60 tons/person/year)
- **Bfrac** is fraction of waste gen (0.28) that is burned
- **EF** is 34.8 lbs PM2.5/tons waste burned

Residential MSW (cont.)

- Assumes no burning in county if urban population exceeds 80 percent of total population

Res. Yard Waste Burning

- Ecty = (Pcty x Rfrac) x (YW x Ywfrac) x CF x Bfrac x EF
- **YW** is per capita yard waste gen (0.10 tons/person/year)
- **Ywfrac** is fraction of yard waste components (.25 for leaves, .25 for brush)
- **CF** is correction factor

Residential Yard Waste Burning (Cont.)

- Ecty = (Pcty x Rfrac) x (YW x Ywfrac) x CF x Bfrac x EF
- **Bfrac** is fraction of waste burned (0.28)
- **EF** is 38 for leaves, 17 for brush (lbPM2.5/tons burned)

CF - Differences in Biomass Ground Cover

- Used BELD3 database from BEIS to determine # of acres of forest, ag land, and miscellaneous vegetation per county
- Subtract out Ag lands before determining percent forested acres.
- Determine % forested

Correction Factor (CF)

Percent Forested Acres per county	Correction Factor (CF)
<10%	Zero
>=10% & <50%	0.5
>=50%	1.0

Slash Burning

- No changes made. Continue to use state-supplied data.

Land Clearing Debris Burning

- Emissions = Acres x LF x EF
- Acres cleared for Construction
- LF is fuel loading factor
- EF is emission factor

Land Clearing Debris Burning (cont.)

- Acres Cleared
  - discuss later (fugitive dust from construction)

Fuel Loading for Land Clearing Debris Burning

- Used BELD3 database to determine proportion of hardwoods, softwoods, and grass in each county
- USFS factors for piled residue.
  - Fuel loading factors from Forest Service for hardwoods, softwoods, and grass
- Adjusted USFS fuel loading factors by 1.5 to account for additional mass (tree roots)

Fuel Loading Factors (US Forest Service)

Fuel Type	Fuel Loading (tons/acre)
Hardwood	99
Softwood	57
Grass	4.5

Emission Factors

- Obtained from US Forest Service
- 17 lbs. PM2.5/ton of fuel

PM 2.5 Open Burning Estimates

All categories	1,900	0
Res MSW	178,787	172,584
Res leaves	0	6,654
Res brush	0	2,977
Land Clearing	0	293,218
Slash	2,498	2,498
Totals	**183,184**	**477,932**

Fugitive Dust from Construction Activities

Construction - The Way We Were

- Dollars spent on construction
- Convert dollars to acres disturbed
- Use emission factor to determine emissions

Construction Categories

- Residential
- Road
- Non-residential (commercial, industrial, government, public works)

Adjustments

- Soil Moisture
- Silt Content

Residential Construction

- Ecty = EF x B x f x m
- **EF** = Emission factor
- **B** = # of units by county
- **f** = building-to-acres conversion factor
- **m** = duration of construction activity (months)

Buildings to Acres Conversion Factor

Housing Type	**Acres Disturbed**
Single-Family	‘1/4 acre/building
Two-Family	‘1/3 acre/building
Apartment	‘1/2 acre/building

Duration

Housing Type	**Duration**
Single-Family	6 months
Two-Family	6 months
Apartment	12 months

Adjustment for Basements

- Houses built with basements move more dirt
- Regionally specific building practice
- Obtain number of new houses built with full or partial basements from DOC

Needs Improvement

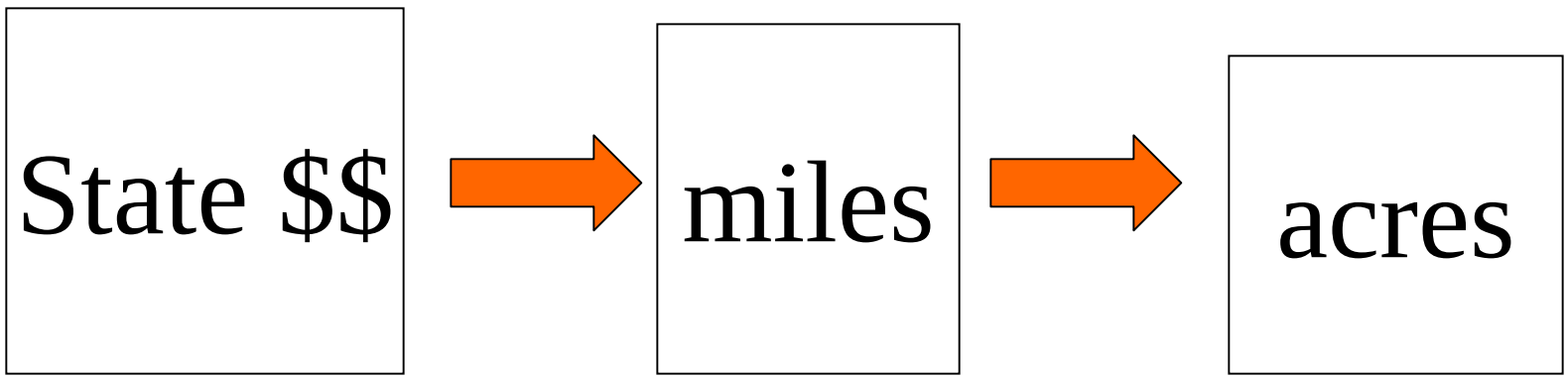
- Does not include trackout
- Double counts diesel emissions

Road Construction

Roadway Construction

- E = EF x $ x f1 x f2 x m
- **EF** = emission factor
- **$** = State Expenditures for road construction
- **f1** = $ to miles conversion
- **f2** = miles to acres conversion
- **m** = duration (12 months)

Roadway Construction



FHWA State Expenditure Data for Capital Outlay

- Interstate; urban
- Interstate; rural
- Other arterial; urban
- Other arterial; rural
- Collectors; urban
- Collectors; rural

FHWA Data includes;

- Buying right of way
- Road construction
- Major widening
- Building bridges
- NO RESURFACING
- NO PRIVATE ROAD CONSTRUCTION

$$ to Miles

- $4 million/mile for interstates
- $1.9 million/mile for arterial and collectors

Miles to Acres

- 15.2 acres/mile for interstates and urban arterial
- 12.7 acres/mile for rural arterial
- 9.8 acres/mile for urban collectors
- 7.9 acres/mile for rural collectors

Needs Improvement

- Uses North Carolina cost figures
- Does not include privately constructed roads
- Dollars to miles to acres

Non-Residential Construction

Non-Residential

- Uses the **National** value of construction put in place
- $$ allocated to counties using construction employment data

Non-Residential Construction

- E = EF x $ x f x m
- **EF** = Emission factor (tons/acre/month)
- **$** = county $
- **f** = dollars-to-acres conversion (1.6 acres/million dollars
- **m** = duration (11 months)

Last Point

- Some opportunities for improvement
  - Improve methods
  - State/local data
- That’s it