

**Union Pacific Railroad Project Plan Outline for Emission Estimation  
and Dispersion Modeling of Railyards Under the ARB/Railroad  
Statewide Agreement of June 2005**

**DRAFT – September 23, 2005**

**TASK OUTLINE**

**General Data Applicable to All Yards**

1. Emission Factors
  - 1.1. Locomotives (g/hr)
    - 1.1.1. By model group
    - 1.1.2. By throttle notch
    - 1.1.3. Adjustment factors for Tier 0, 1, and 2
    - 1.1.4. Adjustment factors for fuel sulfur
  - 1.2. Off-road equipment (g/bhp-hr)
    - 1.2.1. By horsepower
    - 1.2.2. By model year
    - 1.2.3. Deterioration rate equation
    - 1.2.4. Adjustment factors for fuel sulfur
    - 1.2.5. Conversion factor for bhp-hr/gallon of fuel to produce g/gal emission factors
  - 1.3. On-road diesel vehicles
    - 1.3.1. EMFAC2002 scenario specs (CY2004 County-specific)
    - 1.3.2. Default age and mileage accumulation assumptions if fleet-specific data are not available
    - 1.3.3. Adjustment factors for fuel sulfur (if ULSD is used)
    - 1.3.4. Method for estimating idle emission rates
2. Base Activity and Equipment Parameters
  - 2.1. Locomotives
    - 2.1.1. In-yard default duty cycle if data/engineering estimates not available (EPA switch cycle w/o N7 or N8)
    - 2.1.2. Assumed duration of idle events for non-auto-start-stop (ZTR, AESS) units
    - 2.1.3. Assumed duration of idle events for auto-start-stop units
    - 2.1.4. Idling stack parameters by model group
    - 2.1.5. Volume source parameters for in-yard movements

## 2.2. Off-road equipment

- 2.2.1. Default annual operating hours by equipment type if data not available
- 2.2.2. Default average load factor by equipment type if data not available
- 2.2.3. Develop method to reconcile operating schedule and load factors with total fuel deliveries, if fuel consumption is available
- 2.2.4. Stack parameters by equipment type and horsepower range for stationary and slow moving equipment (e.g., RTG cranes)
- 2.2.5. Volume source parameters for moving off-road equipment (e.g., yard hostlers)
- 2.2.6. Default average diurnal operations profiles by equipment type

## 2.3. On-road vehicles

- 2.3.1. Default stack parameters for idling by vehicle class
- 2.3.2. Default idling event duration
- 2.3.3. Default on-site speed distribution
- 2.3.4. Default volume source parameters for moving vehicles by vehicle class

## **Yard-Specific Data and Tasks**

### 3. Georeferenced Facility Information (UTM)

- 3.1. Boundaries
- 3.2. Main line (through) tracks
- 3.3. Arrival and departure tracks
- 3.4. Switching operational areas
- 3.5. Hump operational areas
- 3.6. Service areas
- 3.7. Maintenance and testing areas
- 3.8. Other consist idling locations
- 3.9. Operational locations and areas for off-road intermodal equipment by equipment type
- 3.10. Operational areas for on-road freight vehicles (container, auto carrier)
- 3.11. Yard entrances
- 3.12. Routes followed by on-road freight vehicles
- 3.13. DTL fueling areas and tanker routes

### 4. Activity Data by Yard

#### 4.1. Locomotives on Trains (Transient)

- 4.1.1. Select base year period (2004? 7/04 – 6/05?)

- 4.1.2. Train data for base year
- 4.1.3. Process train data
  - 4.1.3.1. Number by time of day, direction, arrival and departure area
  - 4.1.3.2. Consist characteristics by area (model group distribution, number working per consist, Tier, auto start-stop)
  - 4.1.3.3. Baseline characteristics (total trailing tons, horsepower, etc.)
- 4.2. Consist service, maintenance and movements
  - 4.2.1. Routes, speeds and notch for in-yard consist movement
  - 4.2.2. Idle time estimates by location/service event type
  - 4.2.3. Service and shop release data for base year
  - 4.2.4. Process service, shop and train data
    - 4.2.4.1. Number of movements between areas
    - 4.2.4.2. Number of service events by type
    - 4.2.4.3. Number of load tests by model group and type
- 4.3. In-yard (Resident) Locomotive Operations
  - 4.3.1. Population of working in-yard locomotives by model group, Tier, auto start-stop
    - 4.3.1.1. Trim
    - 4.3.1.2. Hump
    - 4.3.1.3. Flat switching
    - 4.3.1.4. Remote control locomotives (RCLs)
    - 4.3.1.5. Other
  - 4.3.2. Work areas, speeds and routes by activity
  - 4.3.3. Diurnal work patterns (on-shift, off-shift, tradeouts)
  - 4.3.4. Duty cycle by activity while working
  - 4.3.5. Idling duration (if any) for off-shift periods
- 4.4. Off-road Yard Equipment
  - 4.4.1. Census of captive off-road equipment
    - 4.4.1.1. Type (e.g., yard hostler, RTG crane, gen-set)
    - 4.4.1.2. Horsepower
    - 4.4.1.3. Model year
    - 4.4.1.4. Assigned activity or work area
  - 4.4.2. Activity data (depending on availability)

- 4.4.2.1. Annual operating hours
    - 4.4.2.2. Fuel deliveries
    - 4.4.2.3. Diurnal activity profile
    - 4.4.2.4. Routes and speeds
  - 4.5. Transient Off-road Equipment
    - 4.5.1. Number, type, and horsepower arriving daily
      - 4.5.1.1. TRUs
      - 4.5.1.2. Other?
    - 4.5.2. Average duration on-site
    - 4.5.3. Duty cycle
  - 4.6. Transient On-road Vehicles
    - 4.6.1. Number of trucks arriving by carrier
    - 4.6.2. Age (model year) and vehicle class by carrier
    - 4.6.3. On-site dwell by carrier
    - 4.6.4. Diurnal arrival and departure profile
    - 4.6.5. Entrance and routes
    - 4.6.6. On-site speeds
    - 4.6.7. Idle duration on arrival, during loading/unloading, departure gate
- 5. Preliminary Emission Inventory Preparation and Review
  - 5.1. Calculate emission totals by major activity
    - 5.1.1. Transient locomotive arrival and departure
    - 5.1.2. Consist movement in yard
    - 5.1.3. Idling and load testing during service
    - 5.1.4. Resident locomotive operations
    - 5.1.5. Captive off-road equipment by activity (container loading/unloading, yard hostlers, other)
    - 5.1.6. Transient off-road equipment
    - 5.1.7. Transient on-road vehicles
  - 5.2. Calculate approximate emission density by work area
  - 5.3. Assess level of spatial/temporal detail needed for emission inputs to modeling
  - 5.4. Collect additional data if needed
- 6. Prepare Emission Inputs for Modeling
  - 6.1. Define source groups

- 6.2. Disaggregate emissions by major activity to multiple point or volume sources
- 6.3. Spatially distribute individual sources
- 6.4. Prepare hourly activity factors for source groups
- 6.5. Prepare stack or volume source parameters for source groups
- 6.6. Assemble source pathway ISC inputs
- 6.7. Post-process ISC inputs to verify emission totals
7. Select Meteorological Inputs
  - 7.1. Review closest sites from SCAQMD 1981 data sets (SoCAB)
  - 7.2. Identify other APCD, ARB, EPA, or other available data
  - 7.3. Assess differences in wind speeds and directions, and potential terrain influences
  - 7.4. Select two or three most representative data sets
8. Conduct Preliminary Modeling
  - 8.1. Develop a coarse receptor grid (200+ meter spacing, 40 x 40 km domain)
  - 8.2. Exercise model for each meteorological data set
  - 8.3. Review isopleths to assess uncertainty associated with meteorological inputs
  - 8.4. Identify appropriate fine grid receptor arrays (locations and spacing)
  - 8.5. Identify appropriate total domain dimensions
9. Conduct Refined Modeling
  - 9.1. Prepare multiple fine and coarse grid receptor arrays
  - 9.2. Select meteorological data set(s)
  - 9.3. Conduct modeling for annual average concentrations
  - 9.4. Conduct modeling for near-field diurnal concentrations
  - 9.5. Generate annual average concentration isopleth plots for total facility and major source group emissions
10. Post-Process Modeling Results
  - 10.1. Obtain census block group boundaries and populations
  - 10.2. Calculate spatial average concentrations by census block group
  - 10.3. Calculate residential population potential exposure distributions
  - 10.4. Plot predicted diurnal concentration variation for near-field receptors
11. Reporting
  - 11.1. Document emission inventory preparation and assumptions
  - 11.2. Document assessment of meteorological data

- 11.3. Document predicted concentration patterns and assess the magnitude and source of major uncertainties
- 11.4. Document residential potential population exposures
- 11.5. Assemble electronic files documenting results (activity, emission calculations, model inputs, model outputs)