Development of an Air Emission Inventory for the Western Arizona Sonora Border Air Quality Study (WASBAQS) Part 2 – Mexico Emission Inventory

Presentation to the

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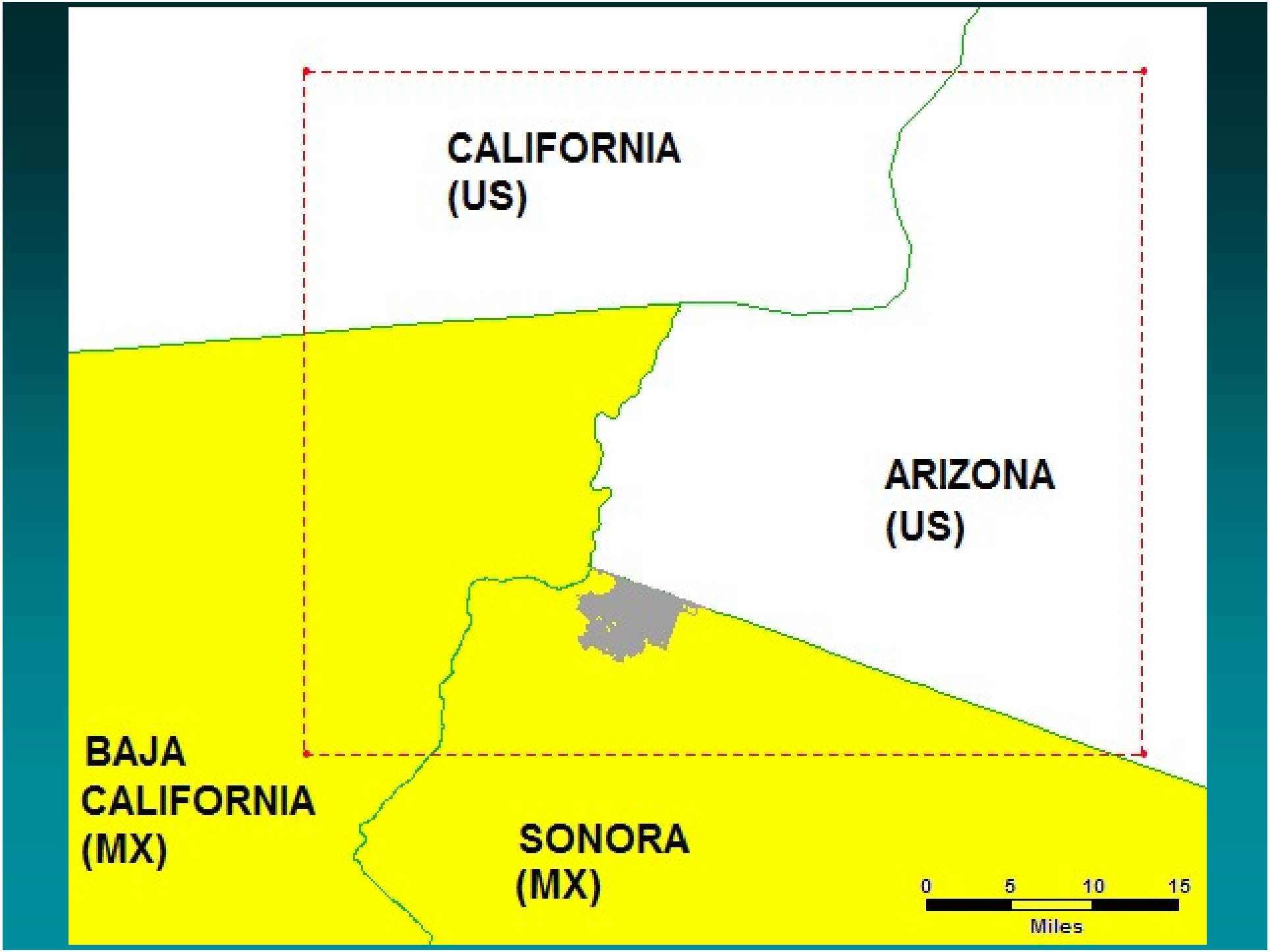
Presentation Overview

- **Inventory scope**
- **Methodology and data collection**
  - Point sources
  - Area sources
  - On-road motor vehicles
  - Nonroad mobile sources
- **Conclusion**

Inventory Scope

- **Pollutants and sources types as discussed in Part 1 presentation**
- **Inventory Domain**
  - NW portion of municipality of San Luis Río Colorado (SLRC), Sonora
    - Municipality population of 157,076 (90% in domain)
    - Includes urban area
  - NE portion of municipality of Mexicali, Baja California
    - Municipality population of 855,962 (9% in domain)
    - Agricultural *ejido* (communes); does not include urban area


CALIFORNIA
(US)
ARIZONA
(US)
BAJA
CALIFORNIA
(MX)
SONORA
(MX)
0
5
10
15
Miles


Vicente Guerrero (Algodones)
Ciudad Morelos (Cuervos)
Ejido Yucatan
Ejido Lazaro Cardenas (La Mosca)
Poblado Paredones
Benito Juarez (Tecolotes, Ejido Campeche)
Ejido Tabasco
Ejido Queretaro
Ejido Monterrey (Colonia Bataquez)
Ejido San Luis Potosi
Ejido Hermosillo
Ejido Jiquilpan
Ejido Colima 1
San Luis Rio Colorado
Ejido Quintana Roo
Ejido Tlaxcala
Ejido Saltillo
Ejido Vicente Guerrero
Ejido Veracruz Dos
Islita
Poblado Lazaro Cardenas La 28 (La Veintiocho)
Ejido Patzcuaro
4
Estacion Pescaderos (Km. 39)
Guadalupe Victoria (Km. 43)

Point Sources – Definition

- **Classified as federal or state jurisdiction**
  - Federal – 11 industrial sectors or location
  - State – not federal jurisdiction
- **Submit emissions data by Annual Operating Certificate (*Cédula de Operación Annual – COA*)**
- **No point sources (> 10 tons or more) identified in the 1999 Mexico NEI**
- **SLRC Municipal Office of Economic Development and Tourism identified 32** *maquiladoras*

Point Sources – Methodology

- **32** *maquiladoras*
  - 12 textile or clothing manufacturers
  - 20 clustered in Industrial Parque east of town
  - None in Mexicali portion of domain
- **SLRC identified most significant 15 sources in Industrial Parque**
- **SLRC mailed out point source surveys to significant sources**
- **Follow-up by CESUES students**

Point Sources – Survey Results

- **8 responses**
  - 1 facility not operating in 2005
  - Fuel combustion – stack test data (4)
  - Paint usage (4); VOC content (1)
- **Reconciliation**
  - Diesel and LPG quantities subtracted from area source fuel combustion
  - Employment counts subtracted from industrial surface coating
- **Stack Parameters (except coordinates)**
- **Operating Schedules**

Point Sources – Results (tpy)

Facility	NO_x	SO_2	VOC	CO	PM_{10}	$PM_{2.5}$
Acero Ameri-mex	0.0	0.0	3.2	0.0	0.0	0.0
Demda Mexico (Daewoo)	0.0	0.0	7.8	0.0	0.0	0.0
G.P.I. Mexicana	0.1	<0.1	0.0	0.3	0.0	0.0
Mecox Resources	0.0	0.0	5.5	0.0	0.0	0.0
Phoenix Textiles	19.7	0.0	0.0	10.4	0.0	0.0
SANA Internacional	4.2	12.5	0.0	27.5	<0.1	<0.1
TSE de Mexico	2.7	0.0	16.4	82.1	0.0	0.0
Total	**26.7**	**12.5**	**32.9**	**120.3**	**<0.1**	**<0.1**

Area Sources – Definition

- **Area source list based upon previous inventories**
  - ADEQ Ambos Nogales
  - ADEQ Douglas/Agua Prieta
  - Mexico National Emissions Inventory
- **Some General Groups**
  - Solvents
  - Agricultural
  - Paved and unpaved road dust
  - Other

Area Sources – Solvents

- **Mexico-specific emission factors from MNEI**
  - Architectural surface coating
  - Industrial surface coating
  - Autobody refinishing
  - Graphic arts
- **Adjustment of consumer solvents**
  - Aftermarket automotive adjustment factor of 0.116
  - Household cleaning products adjustment factor of 0.25
- **Dry cleaning**
  - Interviews with 2 out of 5 dry cleaners, including largest one
- **PEMEX gasoline stations**
  - Gasoline quantities not provided, but station locations identified

Area Sources – Agricultural Sources

- **SAGARPA**
  - Contacts with SLRC only, unable to contact Mexicali
- **Tilling and Harvesting**
  - SAGARPA crop calendar
  - ARB emission factors and acre-passes
- **Pesticide Application**
  - Typical application quantities from SAGARPA cost production estimates
- **Agricultural Burning**
  - Limited to wheat fields
  - Occasionally government subsidies to not burn

Area Sources – Paved/Unpaved Road Dust

- **Sampling conducted in Yuma and SLRC**
  - 10 paved samples each
  - 10 unpaved samples each
  - Per AP-42 Appendix C.1 and C.2
- **Yuma**
  - Collection by ERG
- **SLRC**
  - Collection by Mexicali subcontractor
  - Analysis by Tijuana laboratory


EXPLOSION
POLICIA
SAN LUIS R.C.
671

Area Sources – Paved/Unpaved Road Dust Results

- **Paved**
  - SLRC – silt (0.78-3.80%); silt loading (0.09-0.65 g/m2)
  - Yuma – silt (5.5-28.9%); silt loading (0.13-225 g/m2)
- **Unpaved**
  - SLRC – silt (0.34-1.85%); moisture (0.03-0.57%)
  - Yuma – silt (4.3-10.8%); moisture (0.2-0.8%)
- **Emission Factors (average)**
  - SLRC paved – 0.004 lbs/VMT
  - Yuma paved – 0.059 lbs/VMT
  - SLRC unpaved – 0.134 lbs/VMT
  - Yuma unpaved – 1.125 lbs/VMT
- **Yuma emission factors – order of magnitude higher**
- **SLRC dust – "sandy", entrained plumes barely visible**

Area Sources – Other Sources

- **Charbroiling/Street Vendors**
  - Interviews at main charbroiling facility and smaller ones
  - Minimal number of street vendors
- **Border Crossings**
  - SLRC and Andrade (NE tip of Mexicali)
  - Hourly vehicle counts and wait times from Customs and Border Protection
  - Emission factors from MOBILE6-Mexico


POLLOS EL CORRETEADO
POLLO ASADO ESTILO SINALOA

Area Sources – Other Sources

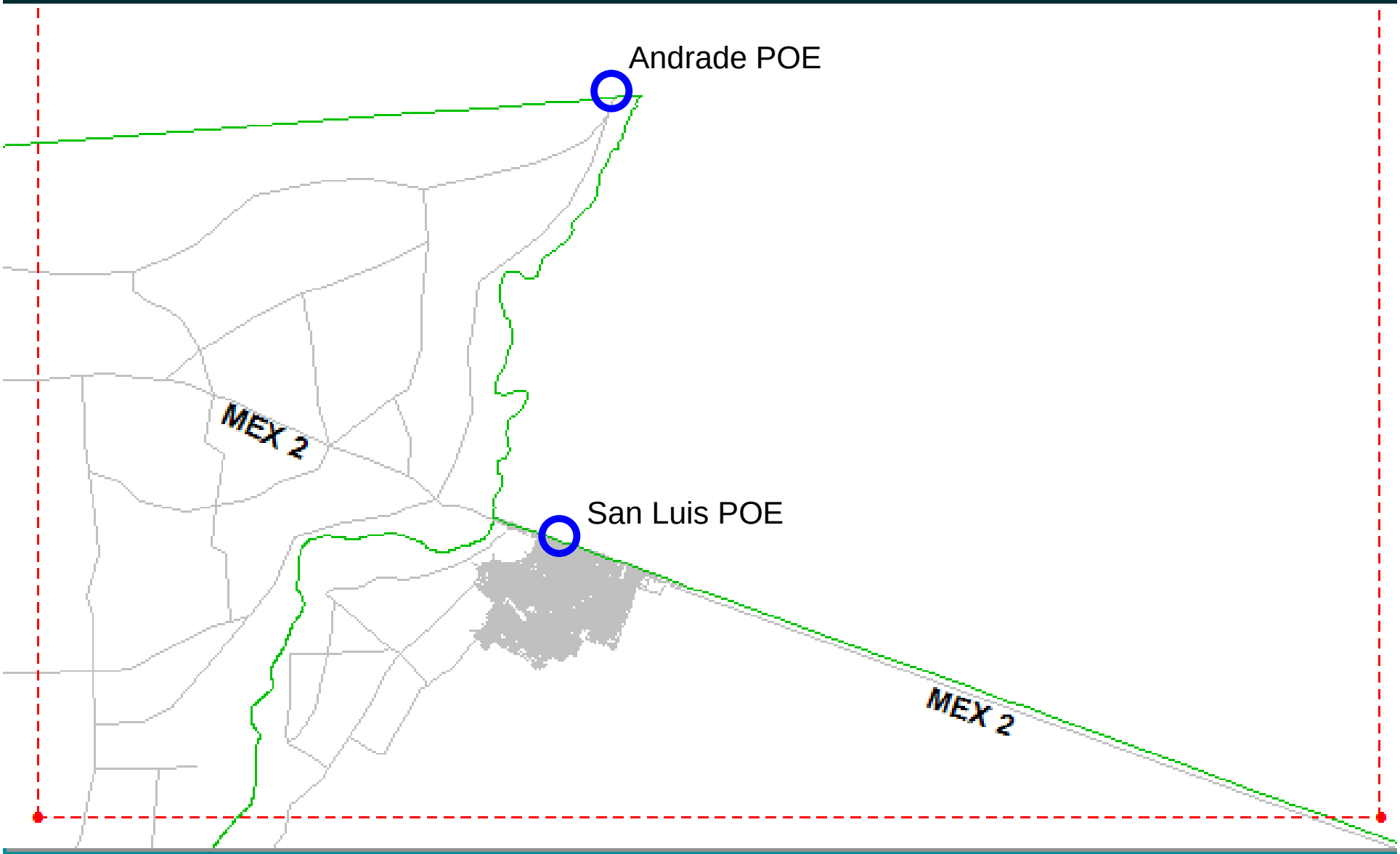
- **Brick Kilns**
  - Two neighborhoods in SLRC and one in Algodones (NE tip of Mexicali)
  - Regulated in SLRC with burn schedules coordinated by city and brick kiln associations
  - Temporary kilns
  - Various fuels
  - Fuel and brick/burn quantities estimated through interviews

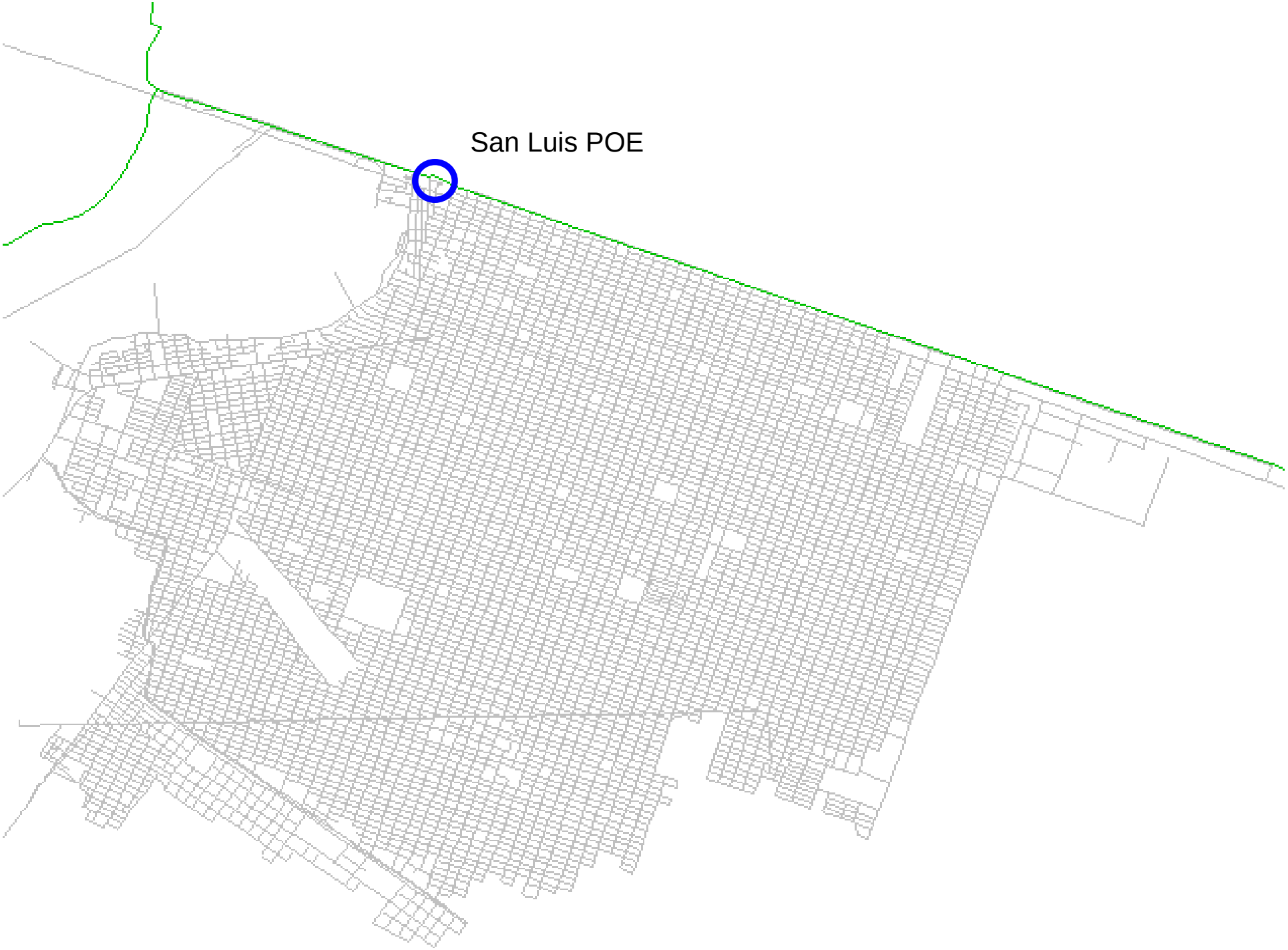
Area Sources – Results

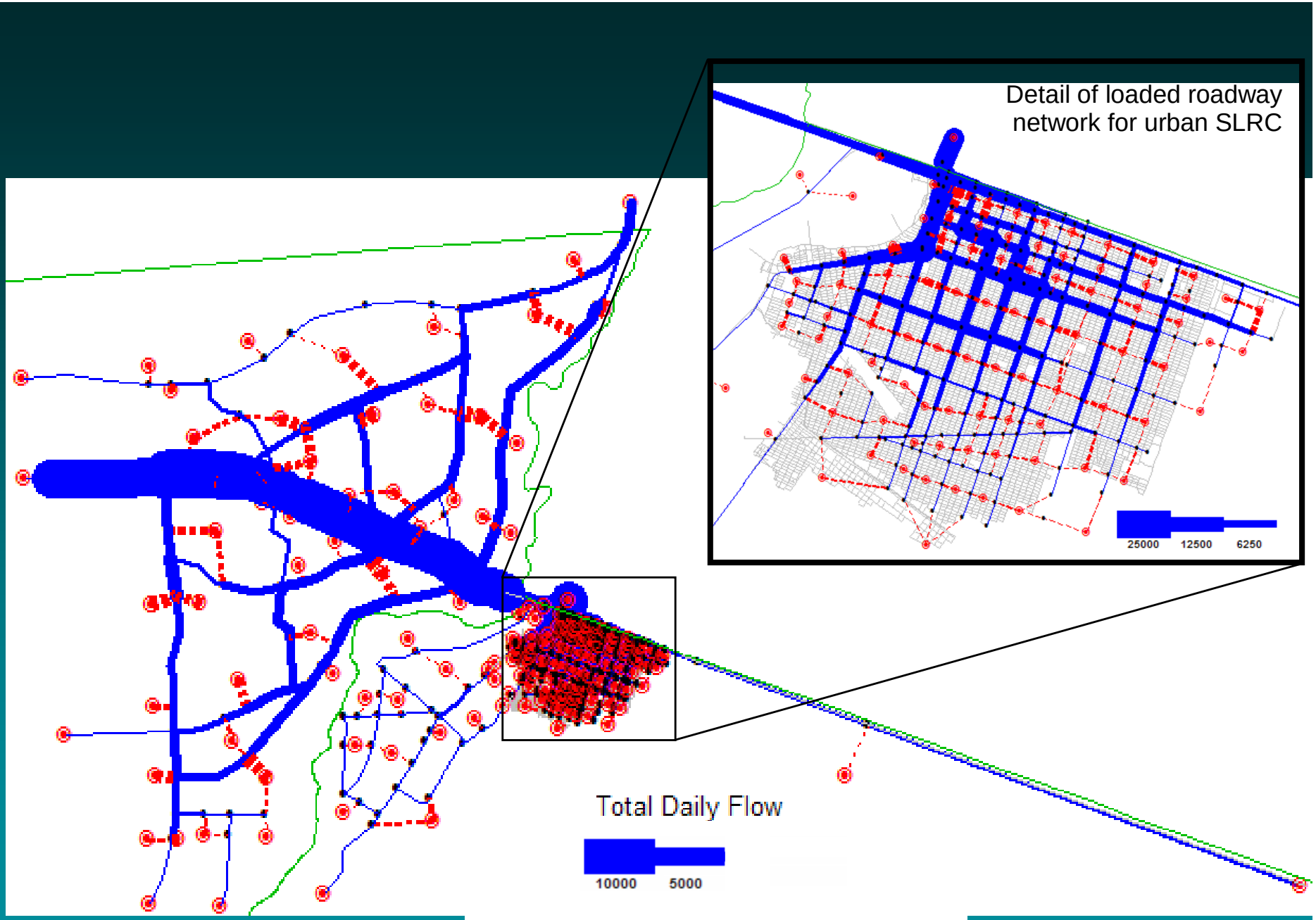
- **Significant Sources**
  - Agricultural burning – Mexicali (CO, NOx, PM2.5)
  - Unpaved and paved road dust (PM10)
  - Agricultural tilling and harvest – Mexicali (PM10)
  - Brick kilns (CO, PM2.5, HAPs)
  - Solvents (VOC)
  - Industrial residual combustion (SO2)

On-Road Motor Vehicles – Methodology

- **VKT Estimates**
  - Travel demand model (TDM)
    - Detailed for SLRC urban area
    - Coarse for SLRC non-urban area and Mexicali portion of domain
  - Link-level
  - Methodology explained in 2003 conference paper (see Wolf, Fields, and González-Ayala)
- **Emission Factors**
  - MOBILE6-Mexico
  - Link-level for a specific link-level congested speed


Andrade POE
MEX 2
San Luis POE
MEX 2


San Luis POE


Detail of loaded roadway network for urban SLRC
25000
12500
6250
Total Daily Flow
10000
5000

On-Road Motor Vehicles – Results

- **Significant Sources**
  - Heavy-duty diesel vehicles (NOx, SO2, PM10, and PM2.5)
  - Light-duty gas vehicles and trucks (VOC, CO, and HAPs)
- **Mexicali emissions > SLRC emissions**
  - SLRC more population and vehicle trips, but more concentrated activity
  - Mexicali trip origins and destinations more disperse
  - TDM performs best in urban areas; more uncertainty in rural areas

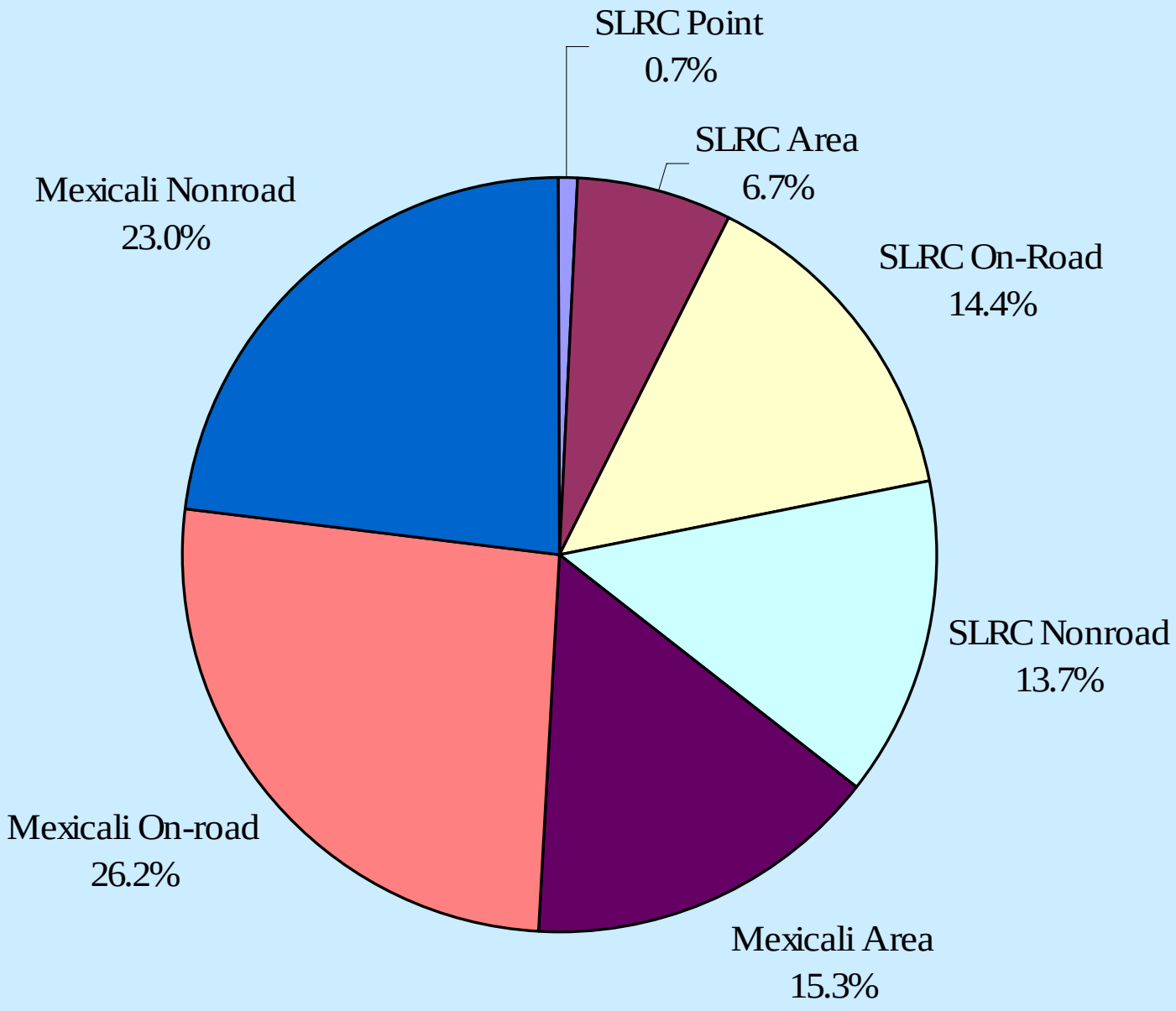
Nonroad Mobile Sources – Definition

- **Construction and agricultural nonroad equipment**
  - Estimated using NONROAD-Mexico
- **Other nonroad equipment**
  - Thought to be less significant; not in NONROAD-Mexico – not estimated
- **Railroads and commercial marine vessels**
  - Not present in domain – not estimated
- **SLRC airport**
  - Very infrequent general aviation – not estimated

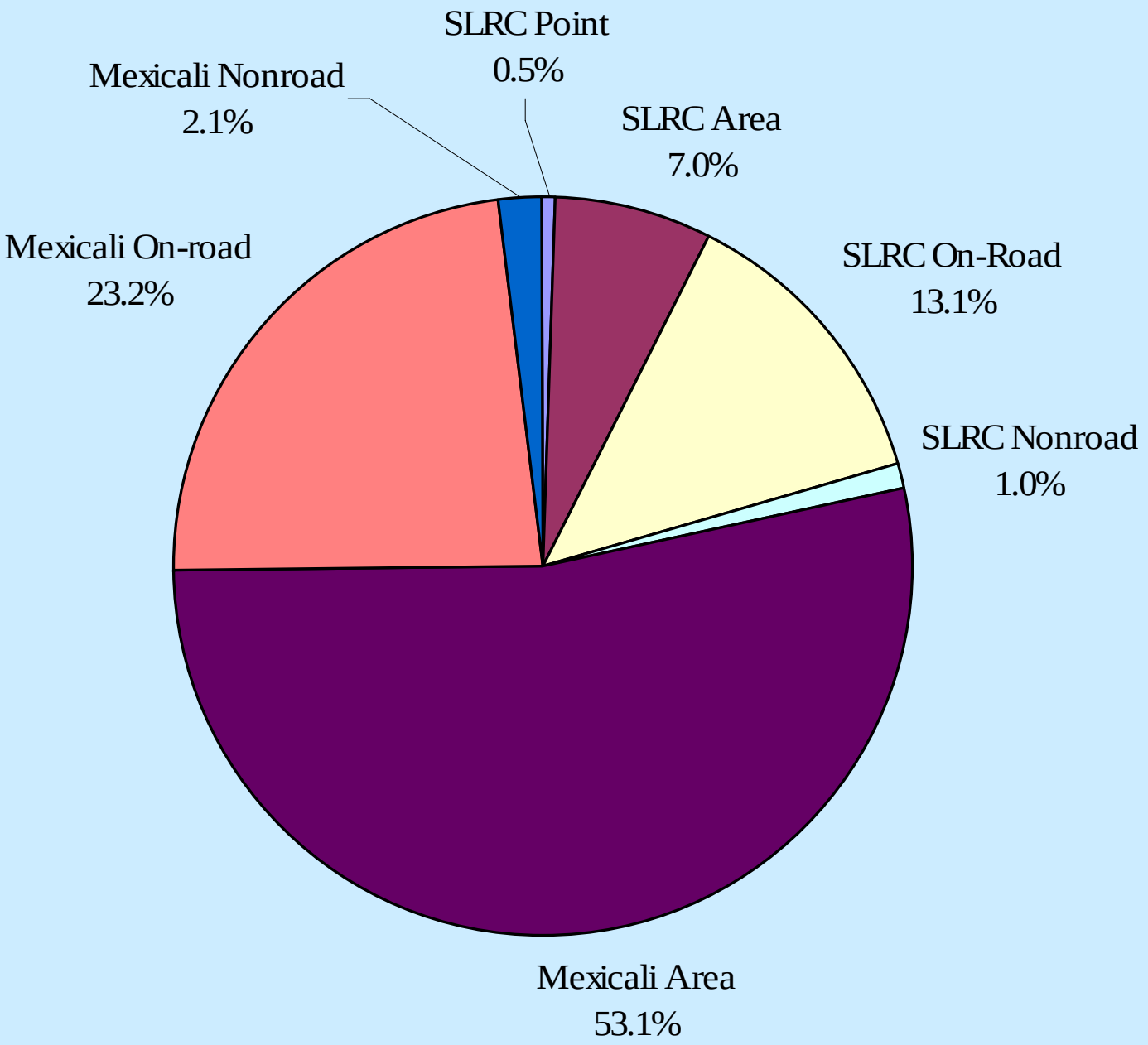
Non-Road Mobile Sources – Results

- **Mexicali > SLRC (~ 1.6-2.2 times)**
- **Mexicali**
  - Predominantly agricultural equipment (69-79%)
- **SLRC**
  - Predominantly construction equipment (75-84%)

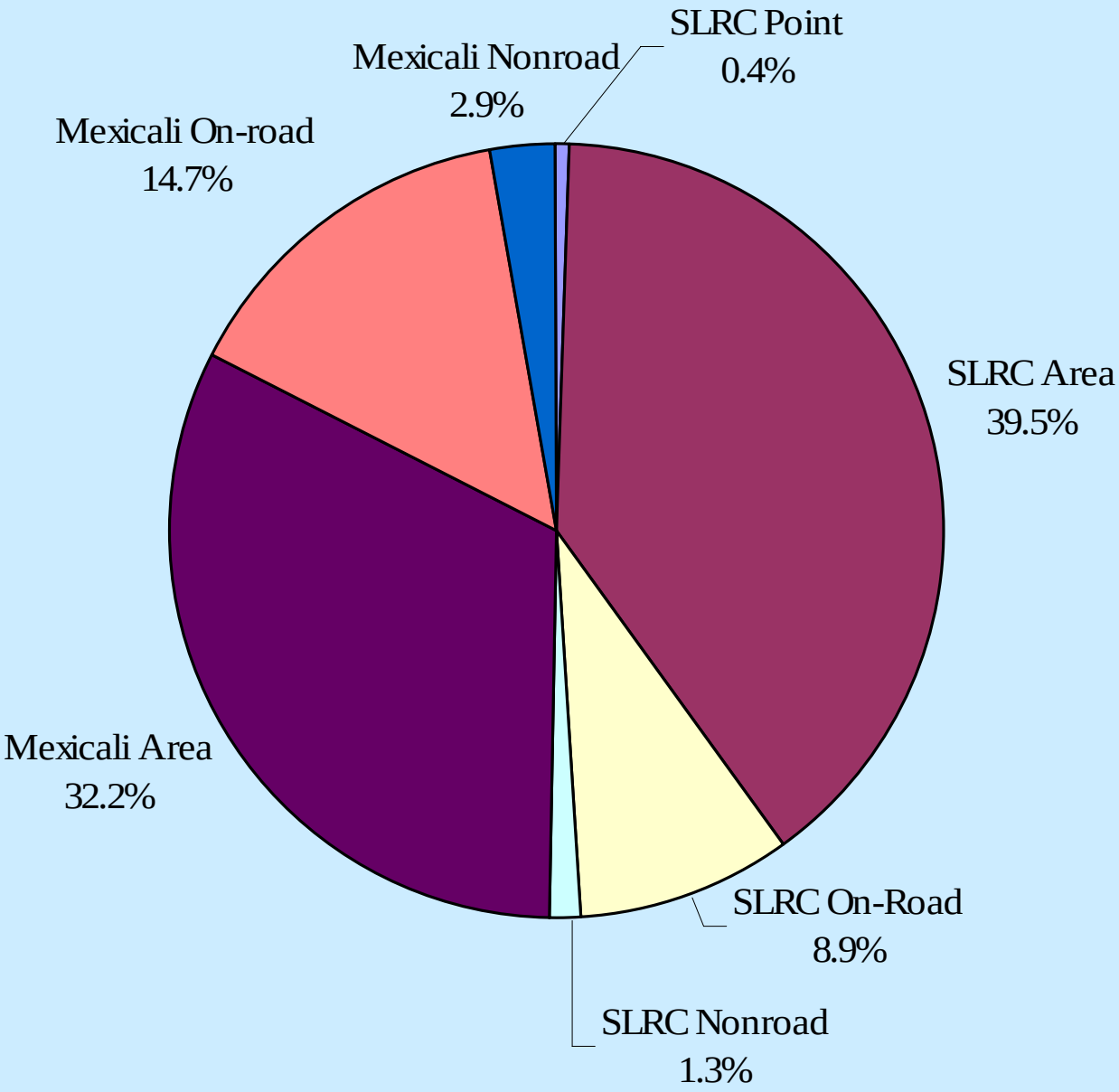
SLRC and Mexicali NOx Emissions



SLRC and Mexicali CO Emissions



SLRC and Mexicali Total HAPs



Conclusions

- **First-ever inventory for SLRC and rural Mexicali**
- **Local data supplemented with interpolation of national/state data**
- **More rigorous data collection needed (e.g., interviews, brick kiln fuel use, etc.)**
- **Need to confirm assumptions (e.g., industrial residual, Mexicali rural, etc.)**

Acknowledgements

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