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Commercial Vehicle Transport of NORM Commodities

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Number of Domestic Establishments Producing NORM

Table 1: Number of establishments that supply nuisance source commodities

Commodity	Establishments	Nuisance Source Likelihood (Low, Medium, High)
Miscellaneous Mining Commodities	4235	H
Clay Products	549	H
Fertilizer	791	H
Tobacco	114	H
Ceramics	1253	H
Miscellaneous Earth Materials	3339	H
Animal Feed	1567	M
Asphalt	1560	M
Explosives	254	M
Glass	2261	M
Concrete	9410	M
Chemicals	1409	L
Plastics	3254	L
Miscellaneous Industrial Products	169	L
Gas & Petroleum Products	7888	L
Coal Products	1120	L
Wood Products	10464	L
Paper	6023	L
Metal	12001	L
Electronics	2217	L

- More than 70,000 establishments ship commodities that may contain NORM
- ~10,000 Establishments ship NORM that most commonly generate alarms

Table 2: Number of establishments for select nuisance source commodities

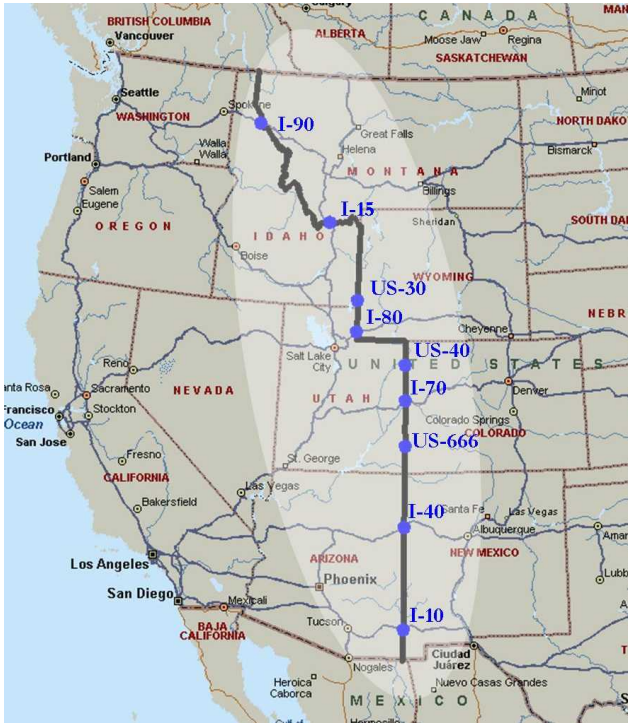
Commodity	Establishments
Ceramic wall & floor tile manufacturing	203
Phosphatic fertilizer manufacturing	44
Gypsum products	309
Kaolin & ball clay	33
Uranium-radium-vanadium mining	17
Sanitary china fixtures	50
Asphalt shingle manufacturing	206

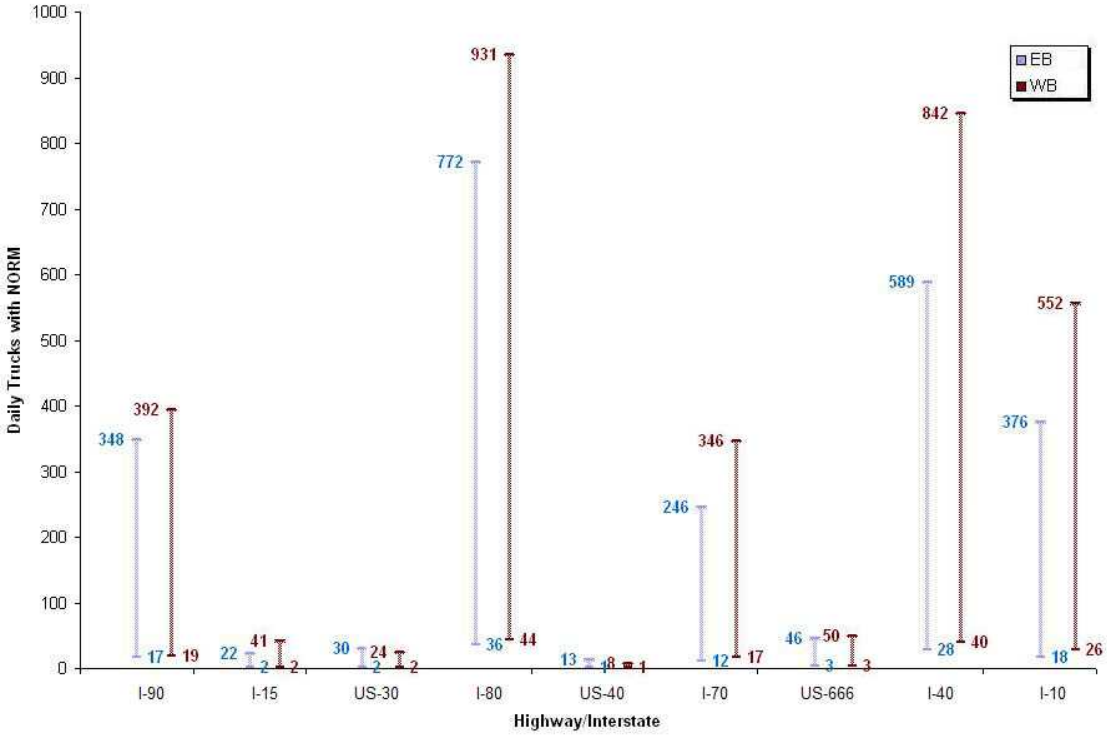
Site-to-Site Variability

- **Hypothesis: There are major differences in relative frequency of domestic nuisance sources depending on location of interest**

- **Primary focus here is on NORM**
  - Medical, Industrial, & HazMat is also of interest, but limited data on distribution is available
- **Approach**
  - Initial study to look at particular example
  - Expansion to U.S.-wide commercial truck shipments

Initial Site-to-Site NORM Variation Study





- **Case Study conducted in Jan 2006: Hypothetical Detection Layer Spanning East-West Corridors**
  - 9 checkpoints across Mountain states
- **Used DOT Freight Analysis Framework 1 and "brute-force" calculations**
- **Estimates of NORM load on major U.S. roads based on different thresholds**
- **Apparent site-to-site variability**

Initial study suggested need for further investigation into site-to-site variability

- **What do things look like nationally?**
- **Can we use better data?**
- **Can we provide some level of automation to speed up the process?**

- **Purpose:**
  - Estimate the primary and secondary inspection resources required at a given location based on expected load due to NORM
  - Find local concentrations of commodities of interest (e.g. fertilizer shipments or non-metallic minerals)
  - Conduct case studies for domestic interstate-based architecture
    - For example, commodities that flow into New York or Chicago area

The mechanics of establishing the routing of commodities

- **Data from DOT Freight Analysis Framework (FAF2):**
  - Estimate of all U.S. commercial tonnage by shipment origin and destination, mode of travel, and commodity
- **We extracted all domestic truck shipments (98% of trucks) and routed the shipments along interstates, assuming trucks will take shortest route**
  - 114 origins & destinations, used center of population as location
  - Local discrepancies due to location estimation
- **After routing, a database was created with commodity tonnage information for interstates in the U.S.**
- **Tonnage was converted to number of trucks using estimated average weight of truck shipments for each commodity class (estimate created from DOT Commodity Flow Survey (CFS))**
  - Only large commercial vehicles used in estimation

Assigning NORM Commodities

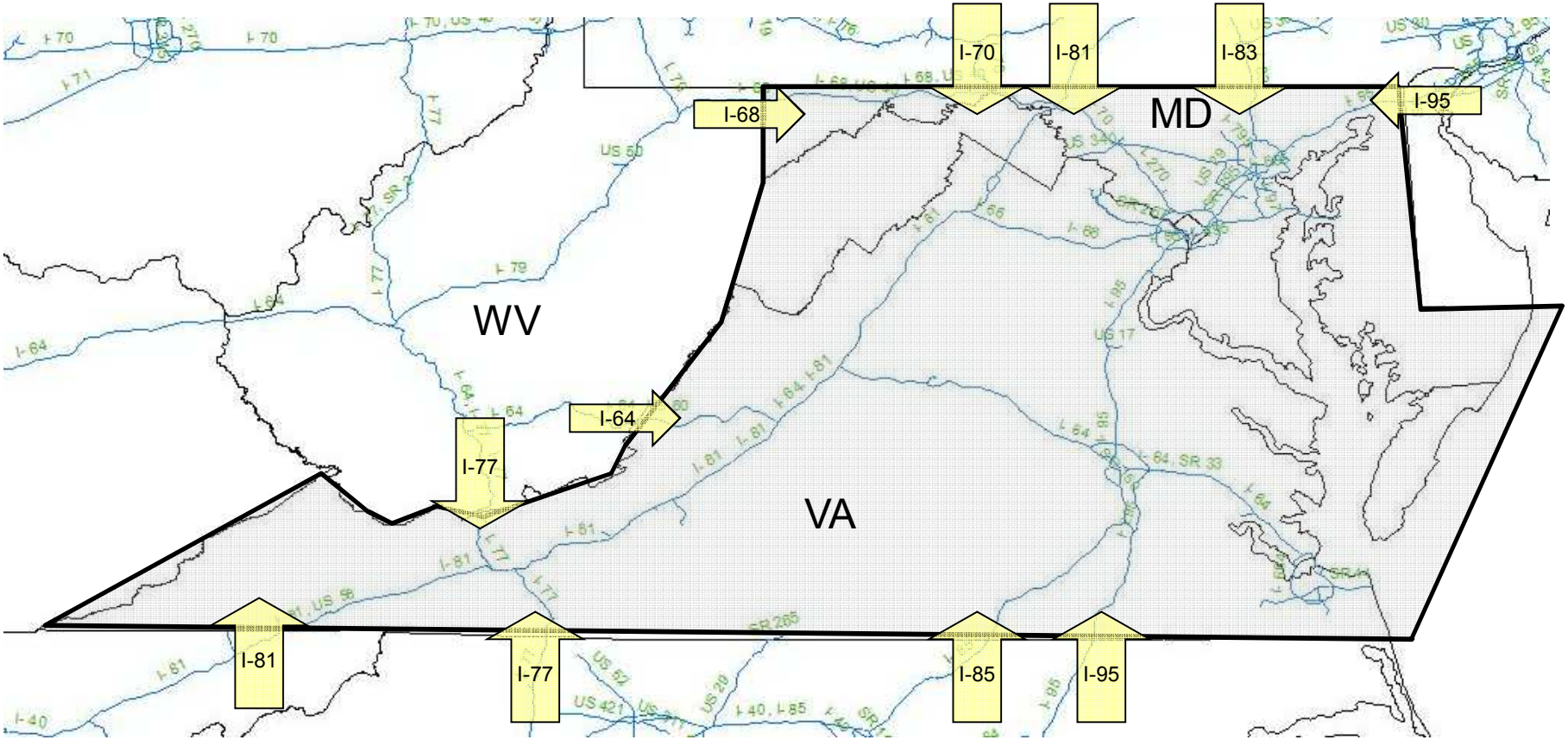
- **NORM commodities were assigned using data from deployment data and other open-source information**
  - Commodities that might cause frequent alarms (>5% of total) were assigned "*Probable NORM*"
    - Such as: non-metallic minerals (earth materials, clay, ceramics), stone, fertilizers, and chemical products
  - Commodities that might cause less frequent alarms (>1% of total) were assigned "*Possible NORM*"
    - Such as: animal feed, tobacco, coal, textiles, and waste
  - Commodities that rarely cause alarms were assigned "*Rarely NORM*"

- **Classification of NORM commodities can be easily changed when other data becomes available**

FAF_abbrev	NORM?
Live animals/fish	Rarely NORM
Cereal grains	Rarely NORM
Other ag prods.	Possible NORM
Animal feed	Possible NORM
Meat/seafood	Rarely NORM
Milled grain prods.	Rarely NORM
Other foodstuffs	Possible NORM
Alcoholic beverages	Rarely NORM
Tobacco prods.	Possible NORM
Building stone	Probable NORM
Natural sands	Probable NORM
Gravel	Probable NORM
Nonmetallic minerals	Probable NORM
Metallic ores	Probable NORM
Coal	Possible NORM
Crude petroleum	Rarely NORM
Gasoline	Rarely NORM
Fuel oils	Rarely NORM
Coal-n.e.c.	Rarely NORM
Basic chemicals	Probable NORM
Pharmaceuticals	Possible NORM
Fertilizers	Probable NORM
Chemical prods.	Probable NORM
Plastics/rubber	Rarely NORM
Logs	Rarely NORM
Wood prods.	Rarely NORM
Newsprint/paper	Rarely NORM
Paper articles	Rarely NORM
Printed prods.	Rarely NORM
Textiles/leather	Possible NORM
Nonmetal min. prods.	Probable NORM
Base metals	Rarely NORM
Articles-base metal	Rarely NORM
Machinery	Rarely NORM
Electronics	Rarely NORM
Motorized vehicles	Rarely NORM
Transport equip.	Rarely NORM
Precision instruments	Rarely NORM
Furniture	Rarely NORM
Misc. mfg. prods.	Possible NORM
Waste/scrap	Possible NORM
Unknown	Rarely NORM
Mixed freight	Possible NORM

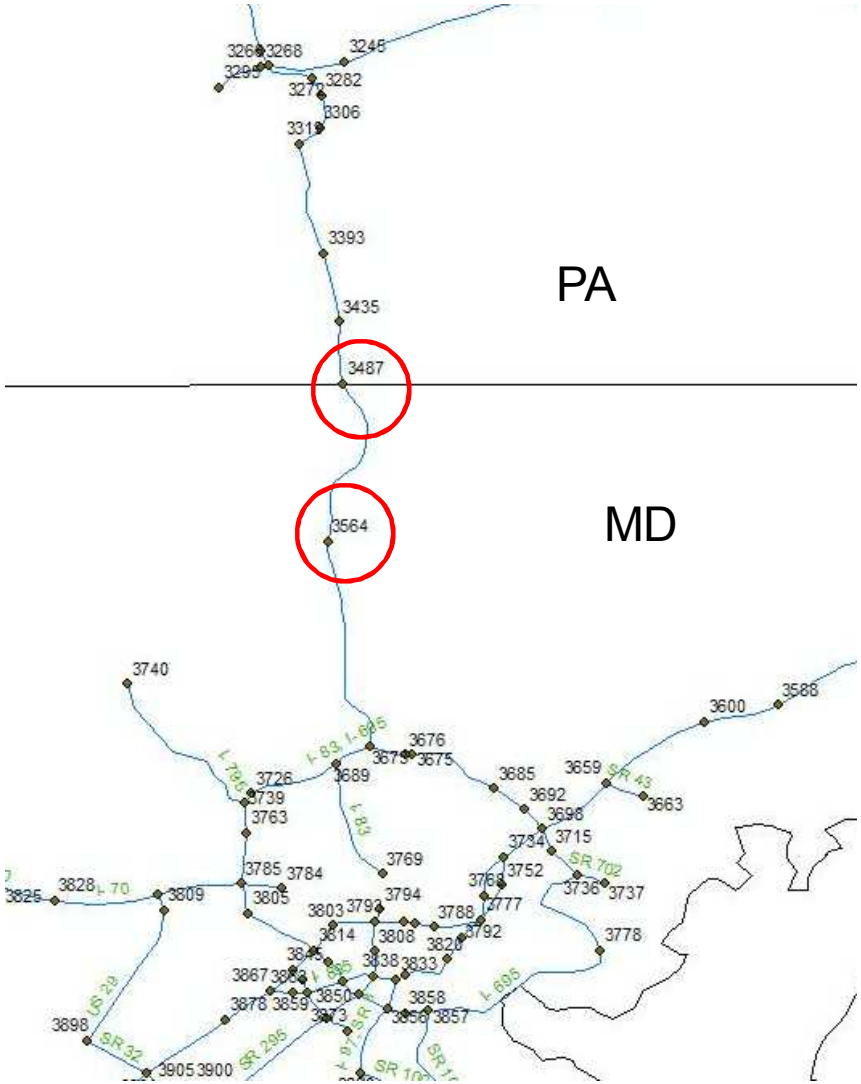
Case Study: Perimeter Around Virginia & Maryland

- **Look at the commodities that are heading into VA & MD**



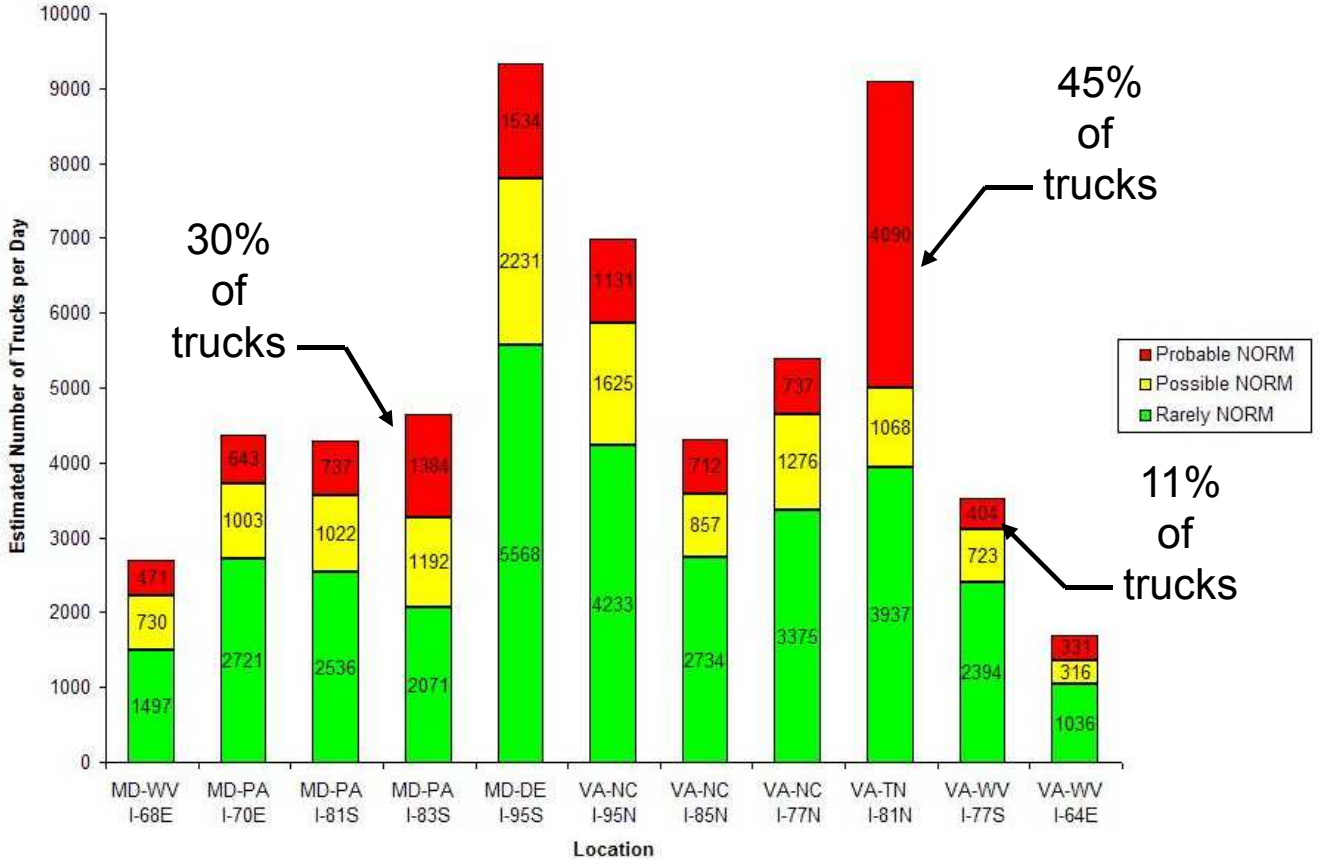
Finding Commodities at a Point of Interest

- **Input: 2 adjacent points along a highway into Matlab query**
  - 2 points needed in order to give directional information
- **Output: Total kilotons and # of trucks for each commodity class in the FAF**

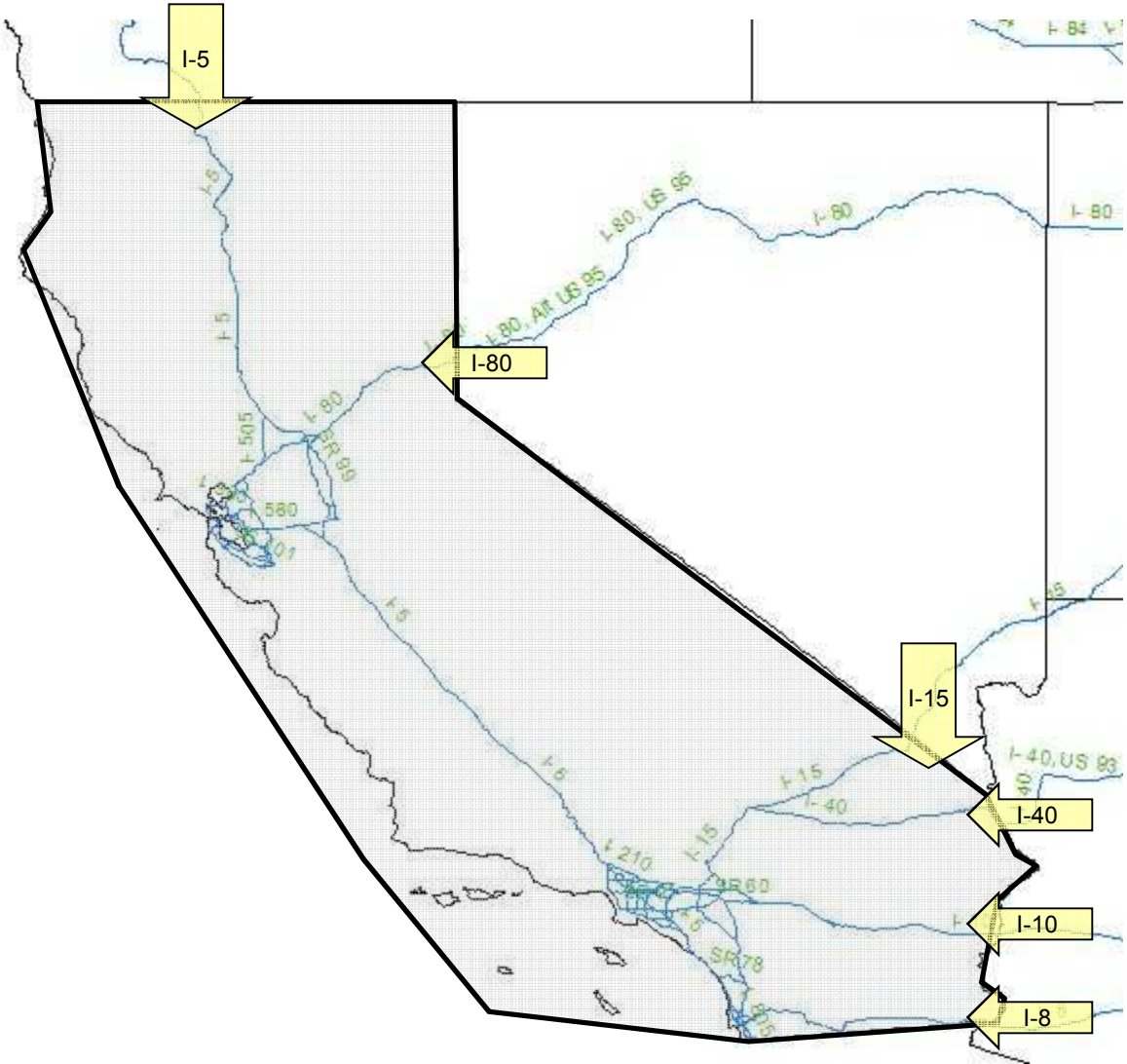


Perimeter around Virginia & Maryland shows site-to-site variability

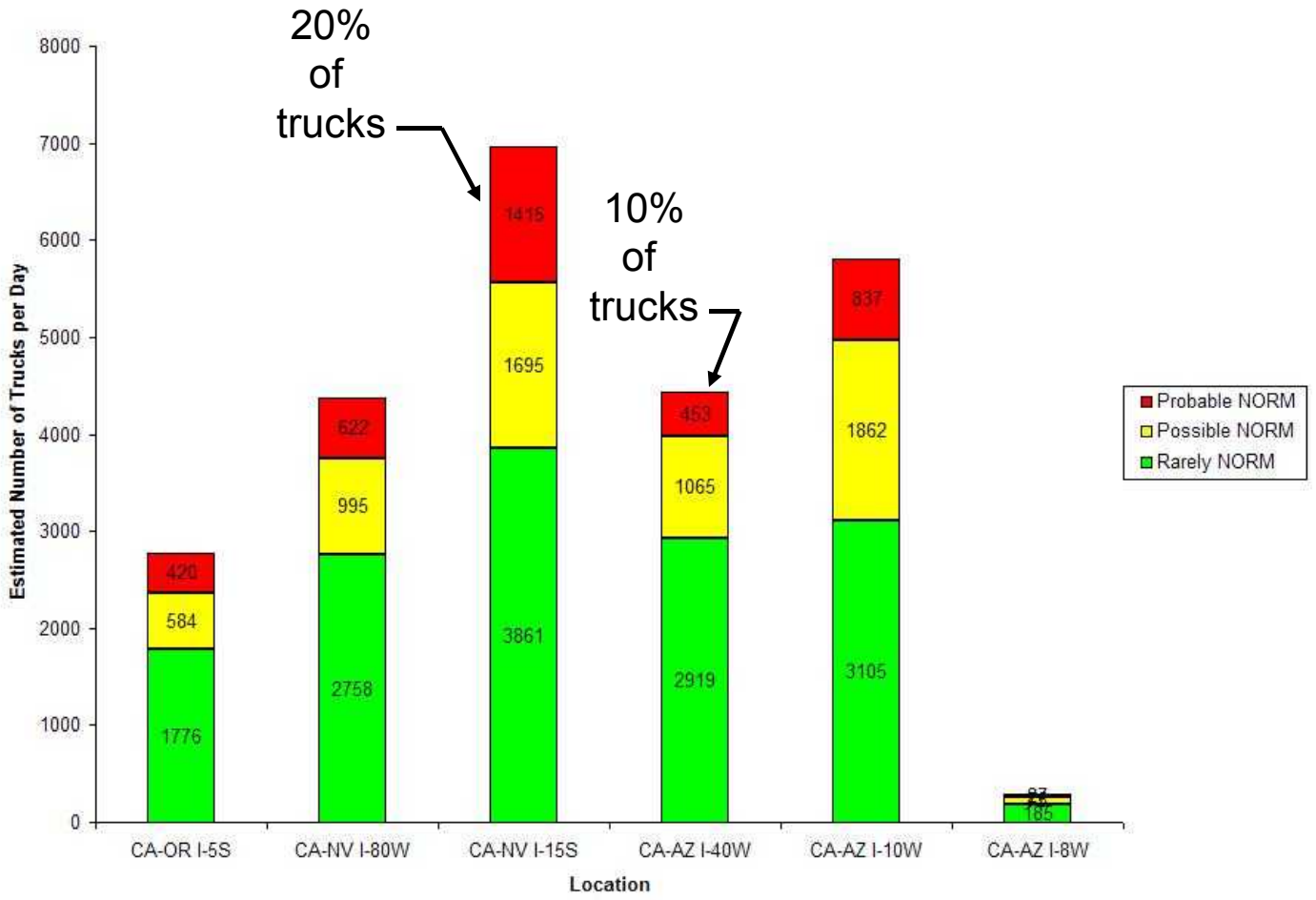
- **Looking at different locations, the total number of trucks varies and the distribution of NORM commodities varies**



Case Study: Perimeter Around California



Site-to-site variability exists around California



Limitations & Possible Enhancements

- **Limitations**
  - Truck flow limited to interstates
  - There will be local inaccuracies due to the fidelity of the data from the FAF (114 sectors covering the entire U.S.)
  - State borders have most accurate data because intra-sector shipments unable to be routed
  - Currently, no international data is included
  - For total number of trucks at a location, it is recommended to use state DOT information (data is measured locally and is updated more frequently)
- **Possible Enhancements**
  - Add additional data available in the FAF
    - International shipments and border information
    - Intra-sector data
  - Add GUI for point-and-click results
  - Estimate a NAR instead of a generic “NORM commodities”
  - Add data on Medical and Industrial nuisance sources
  - Look at other modes of transportation
  - Expand beyond passive radiation detection

Conclusions

- **Case studies of Virginia/Maryland and California show that site-to-site variability exists among commodities**
  - This could indicate higher Nuisance Alarm Rates (NAR) at one location versus another
  - Primary and secondary needs may vary amongst the different locations
  - Use of ASPs in primary/secondary may be more justified in some areas over others
- **There now exists a capability to estimate commercial vehicle NORM traffic throughout the U.S.**