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MTBE and Other VOCs in Drinking Water in the Northeast and Mid-Atlantic Regions

A cooperative study with the USEPA Office of Ground Water & Drinking Water

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U.S. Department of the Interior
U.S. Geological Survey

Study Design

- Only community water systems (CWSs)
- Representative 20-percent sample
- Stratified-random selection by source of water, size of system, and State
- Data for 1993-98 SDWA compliance monitoring

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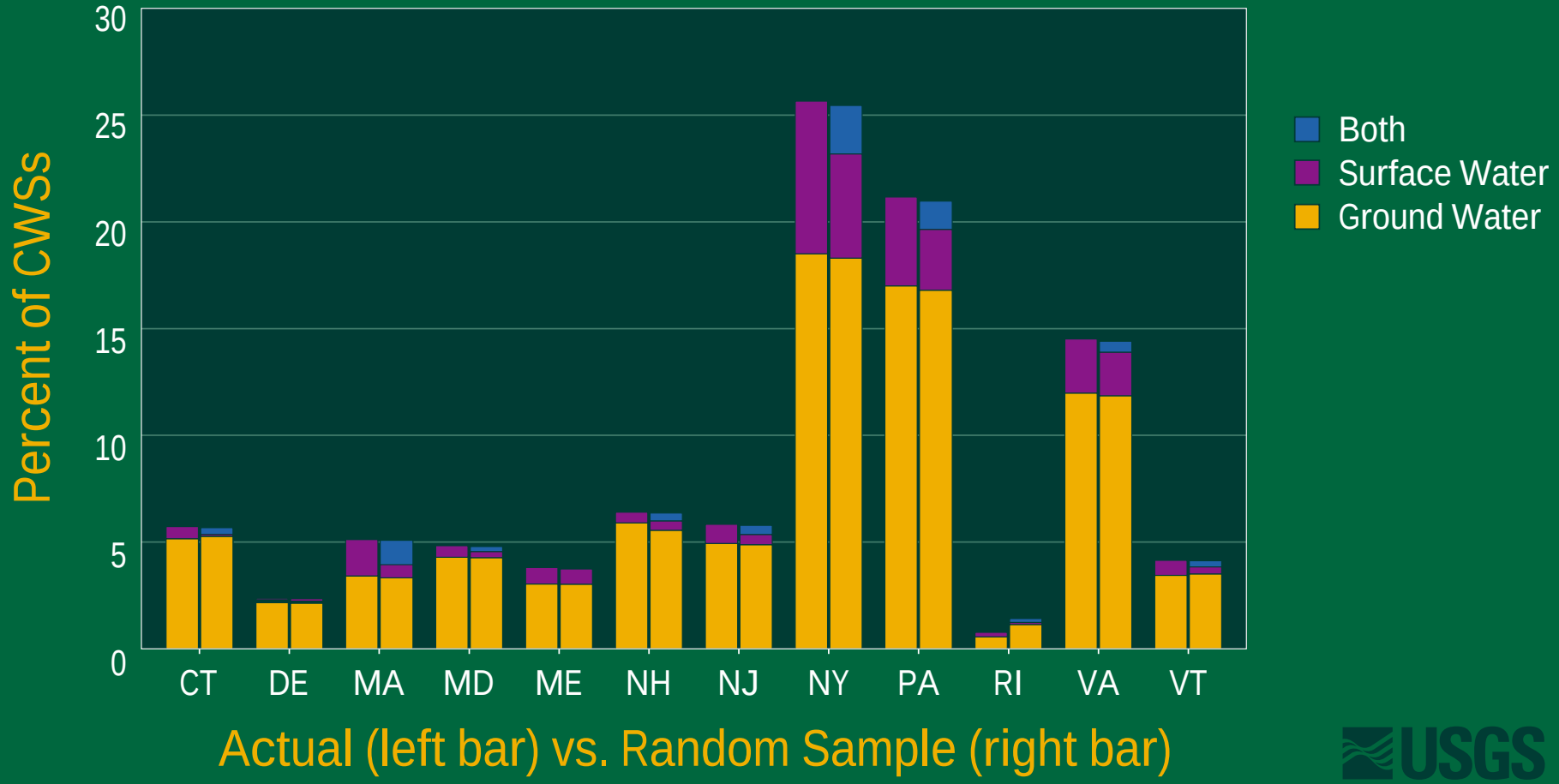
Distribution of CWSs

by Source of Water



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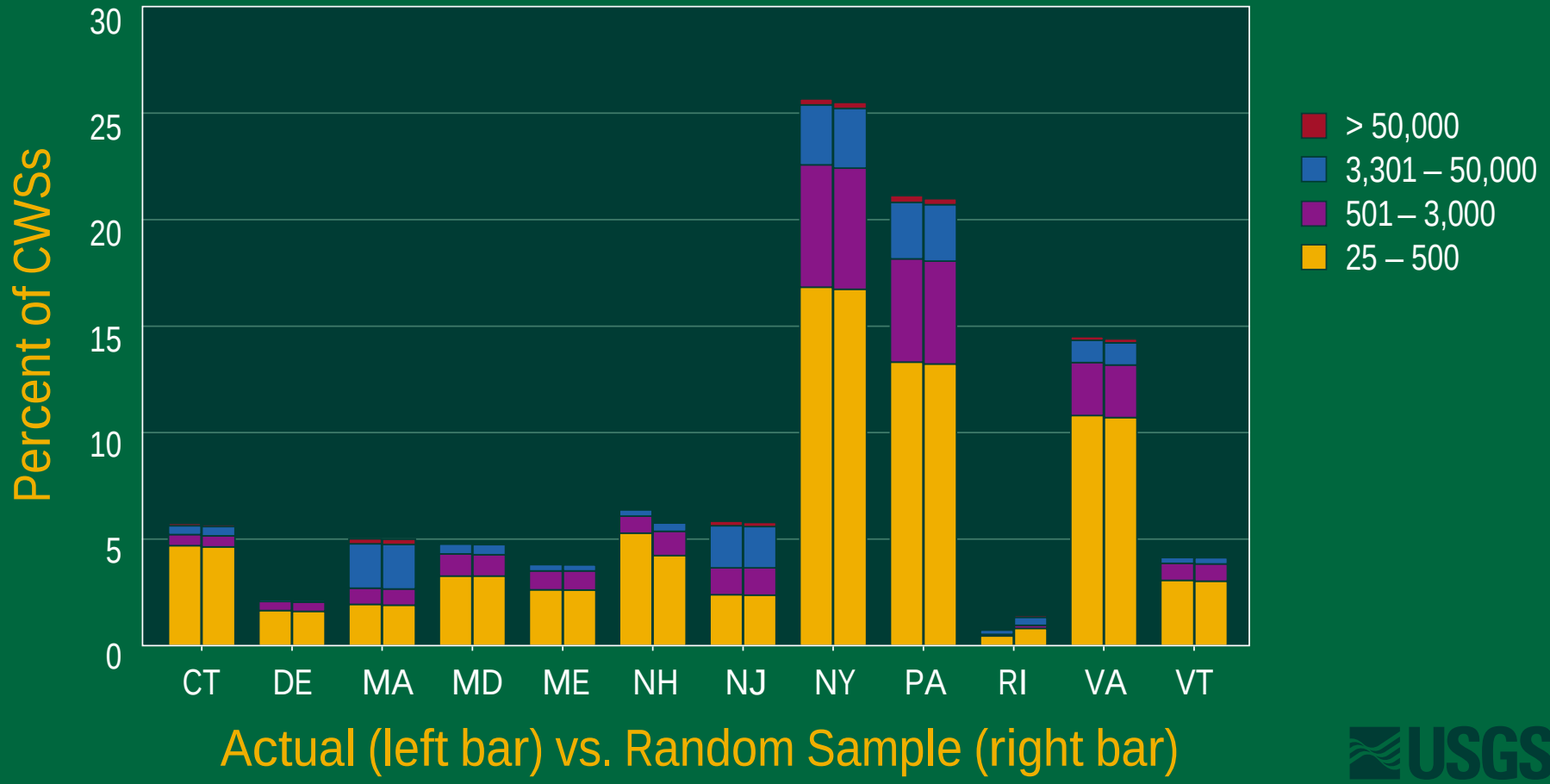
Distribution of CWSs

by Population Served



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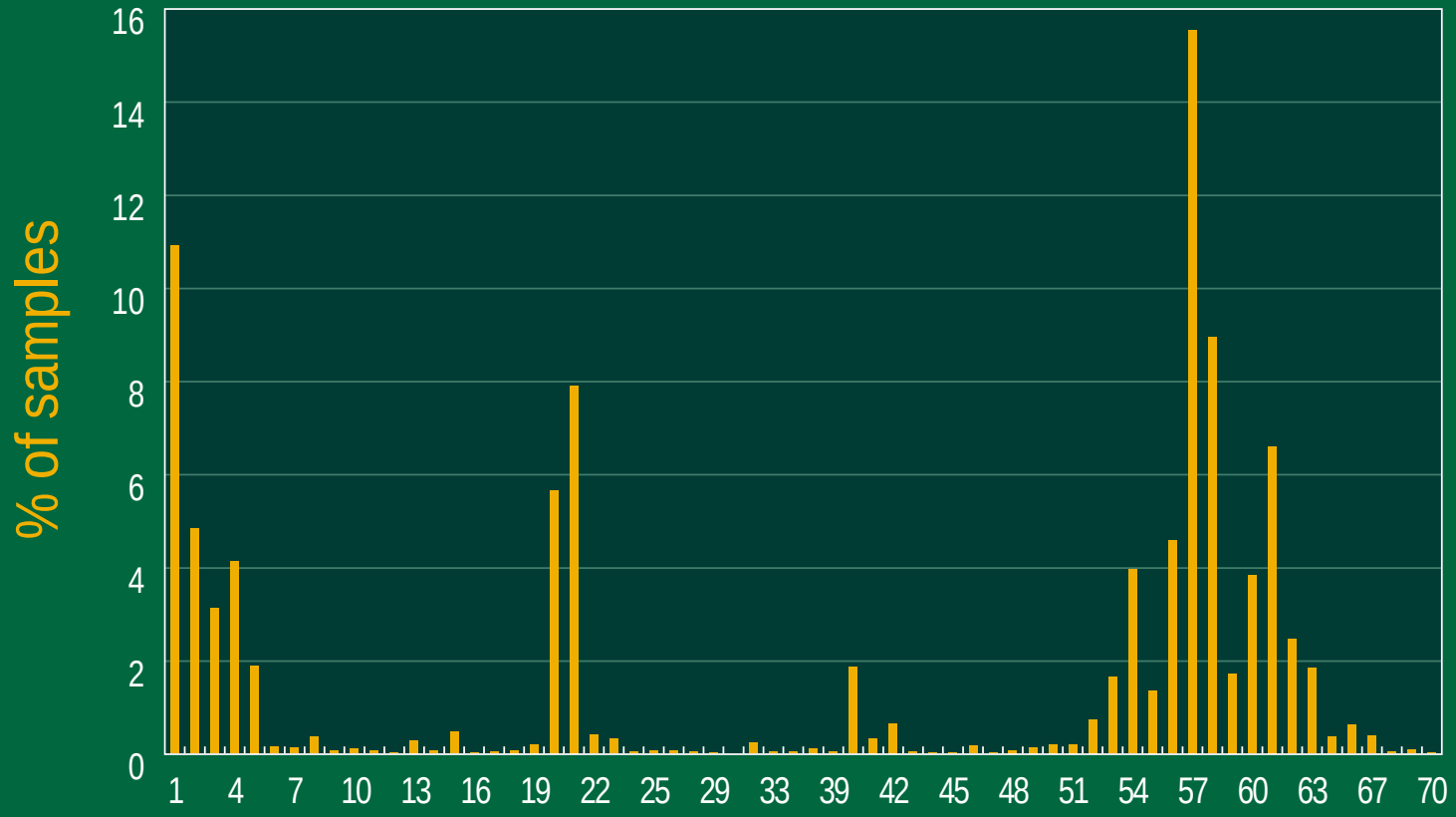
VOC Analytes per Sample

21,635 Samples from 2,110 CWSs



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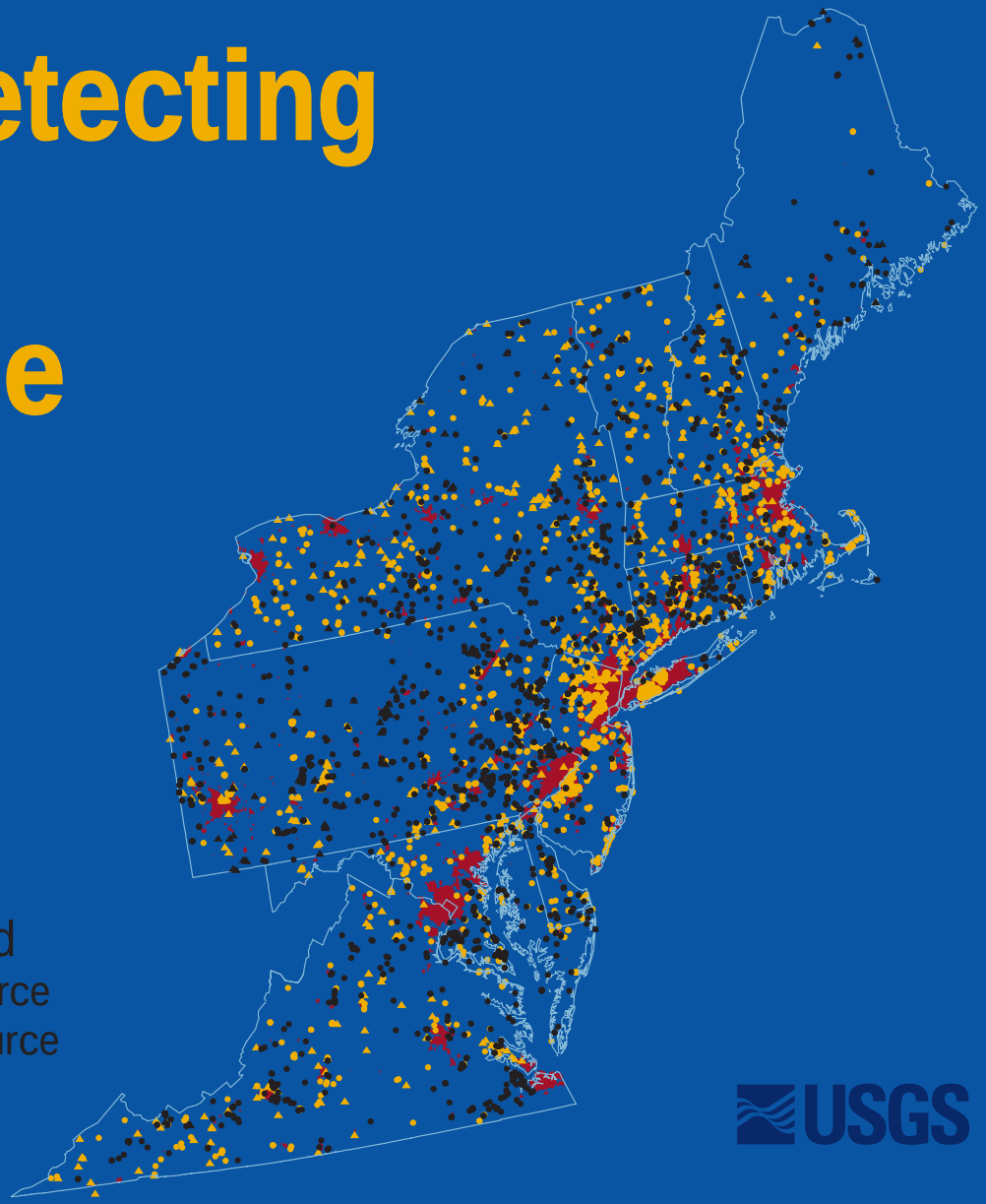
Probability of detecting VOCs is related to urban land use

% of CWSs with VOCs
— 67% in urban areas
— 42% in rural areas



VOCs detected
- Ground-water source
- Surface-water source

VOCs not detected
- Ground-water source
- Surface-water source

Urban areas (pop. > 1,000 people/mi²)

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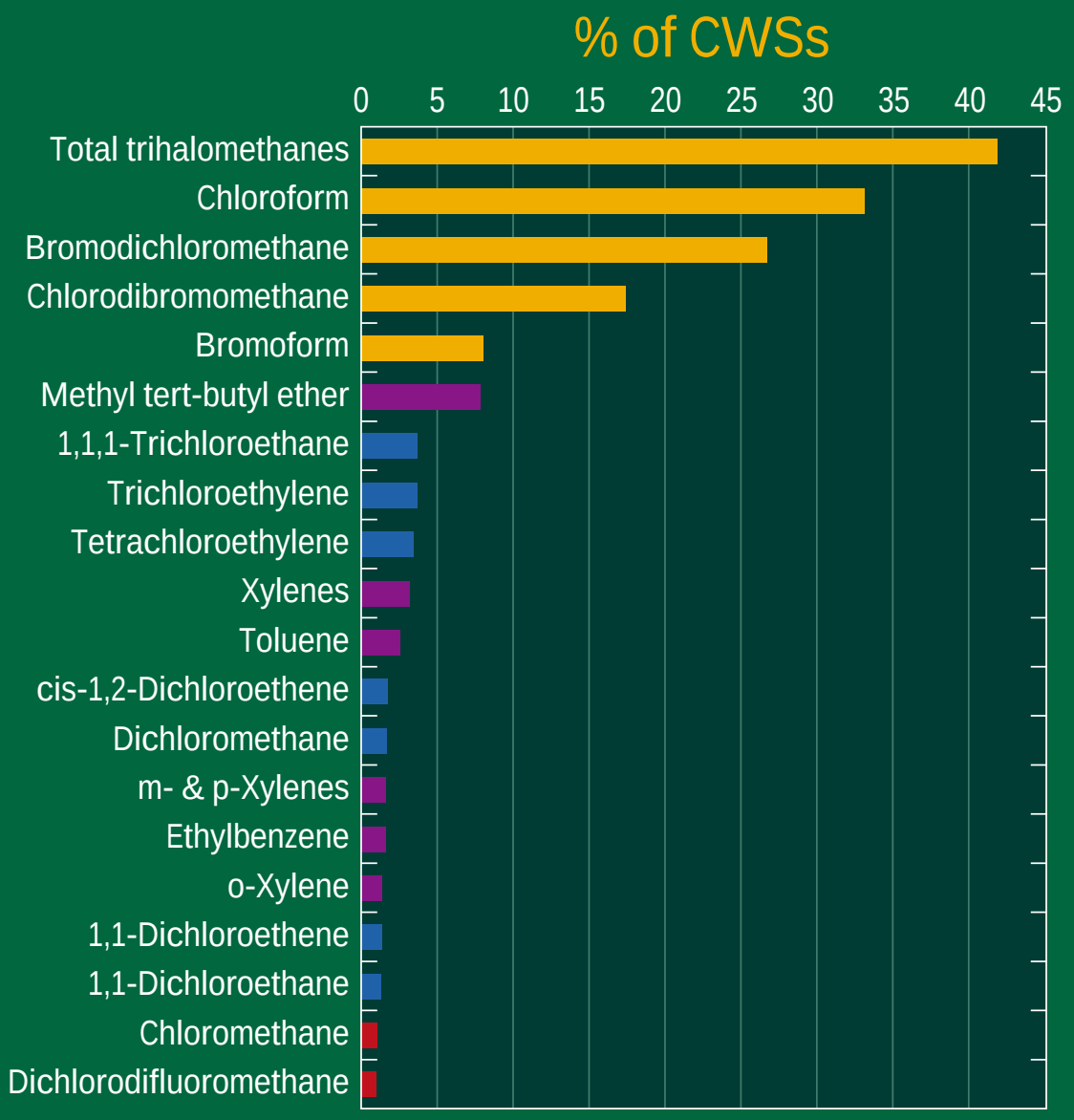

Frequency of VOC Detection ≥ 1.0 µg/L

Disinfectant by-product
Gasoline component
Solvent
Refrigerant

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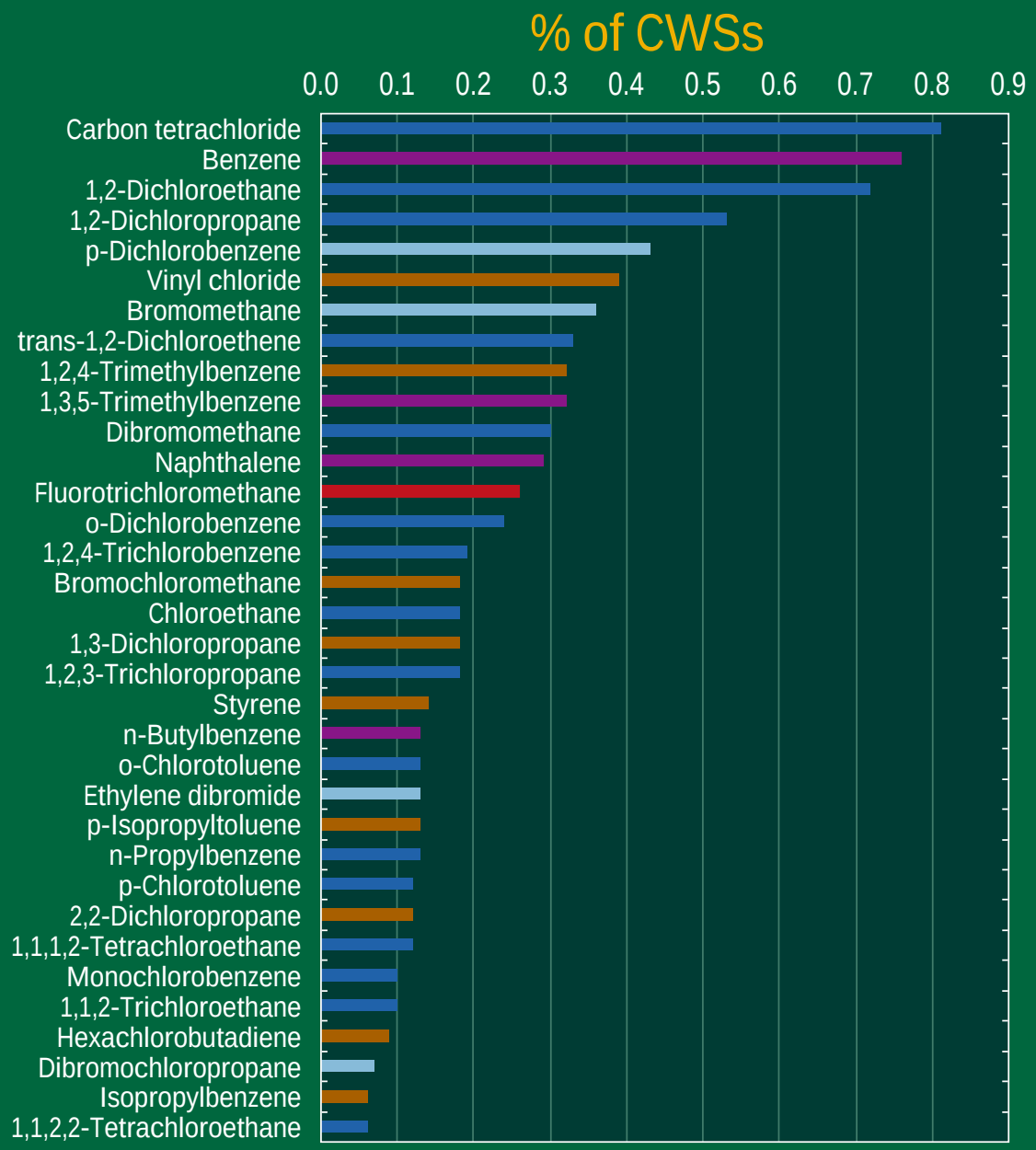

Frequency of VOC Detection ≥ 1.0 µg/L

- Solvent
- Gasoline component
- Organic synthesis compound
- Fumigant
- Refrigerant

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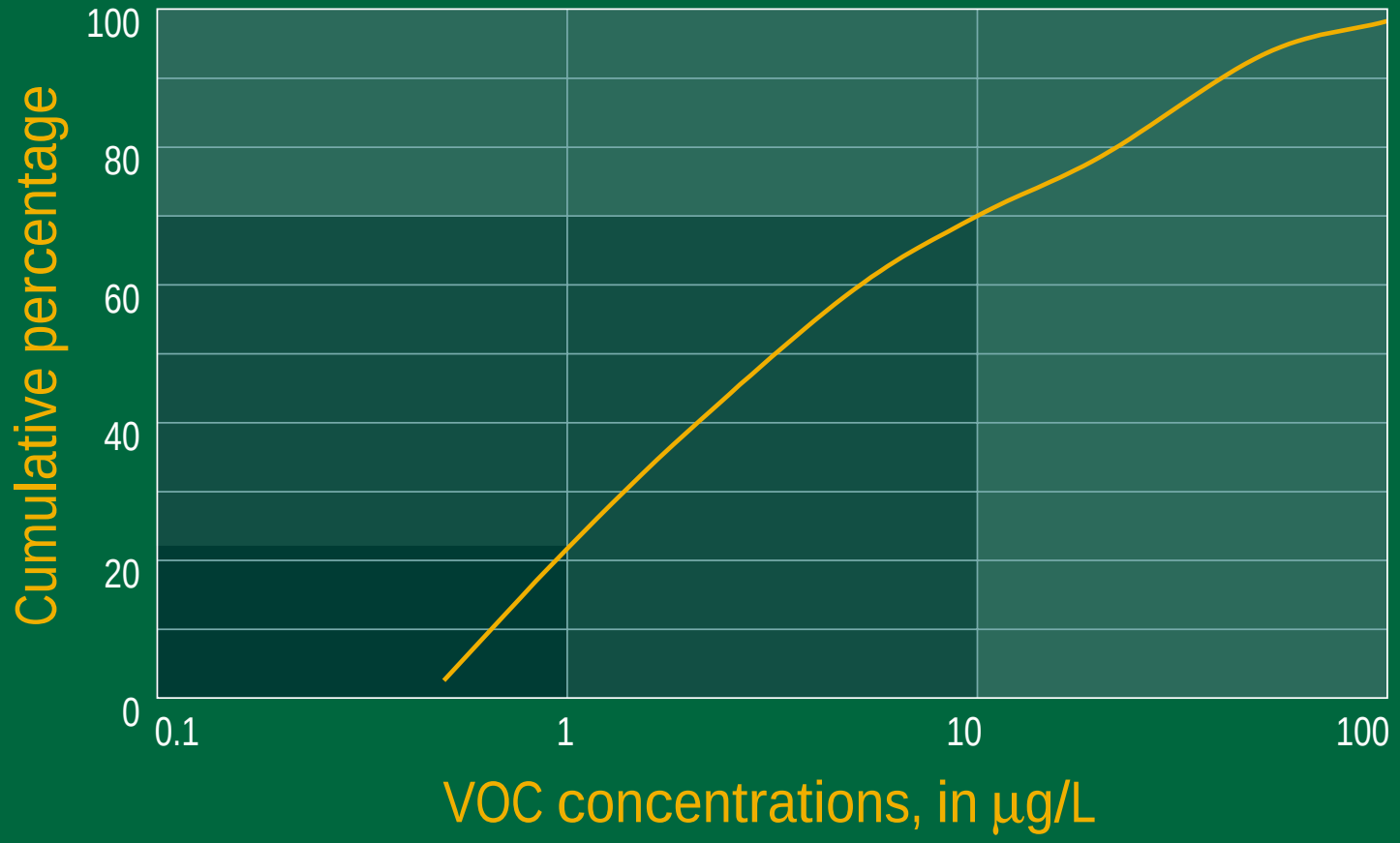
Cumulative Distribution of VOC Concentrations



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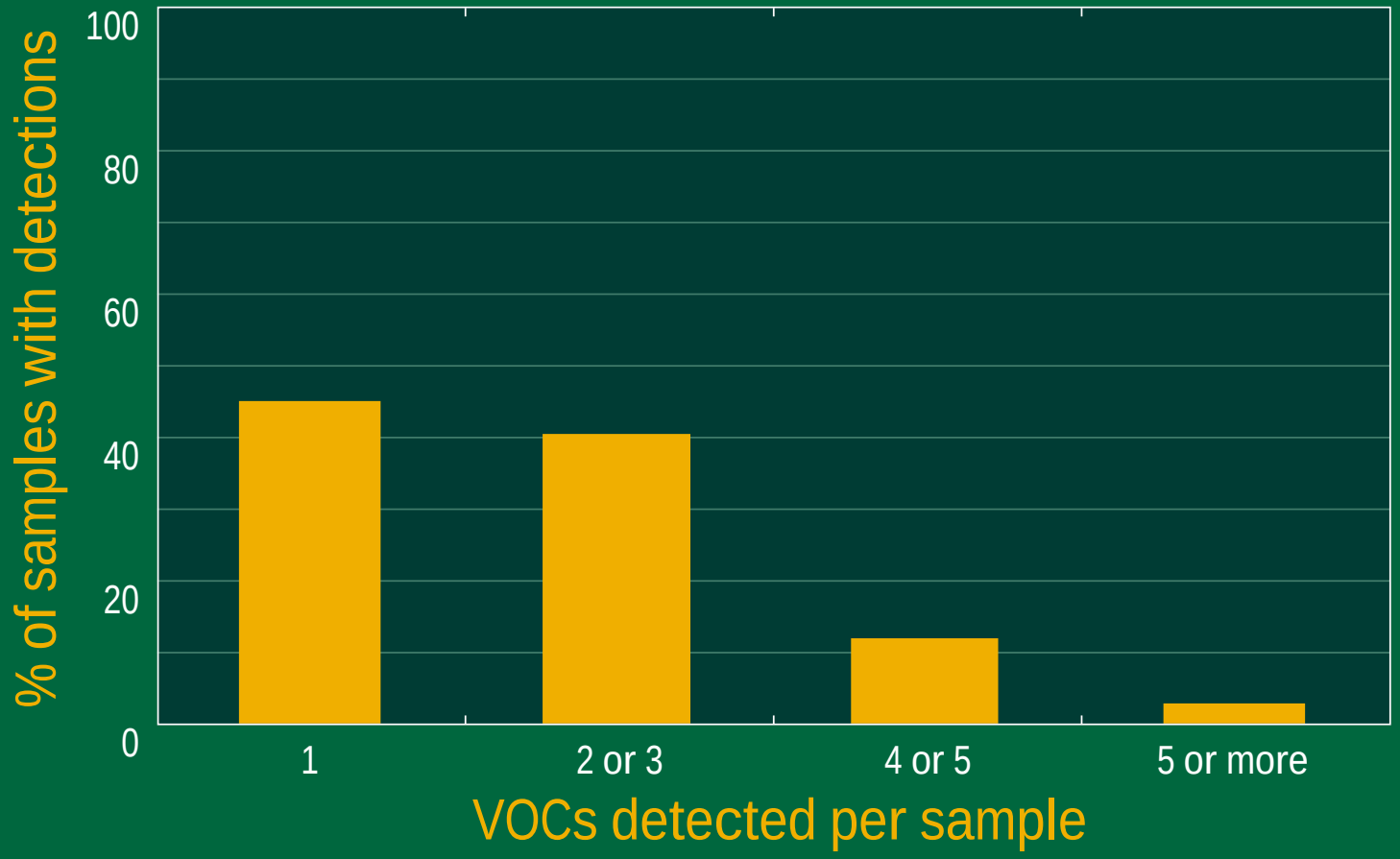
Frequency of VOC Co-Occurrence in Drinking Water



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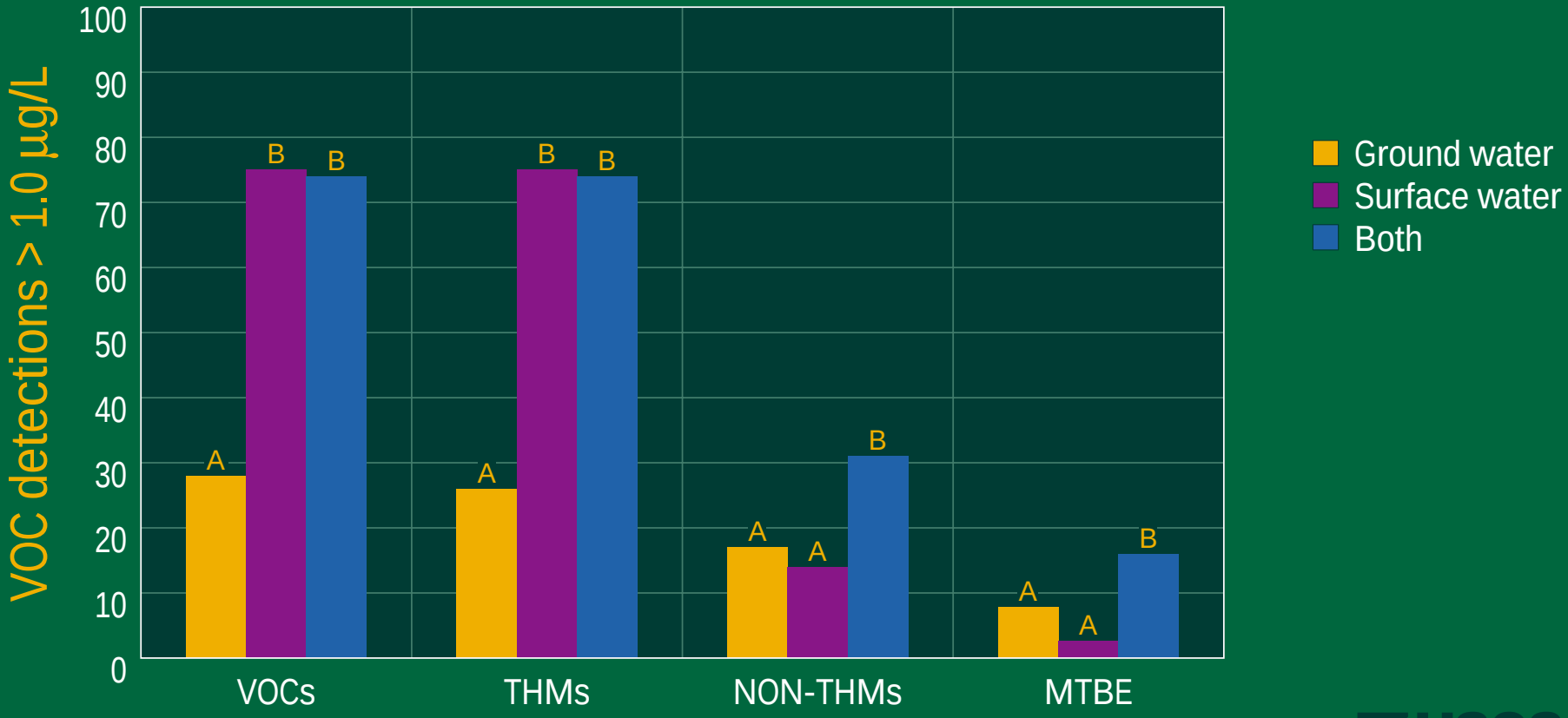
VOC Detections

Varied by Source of Water



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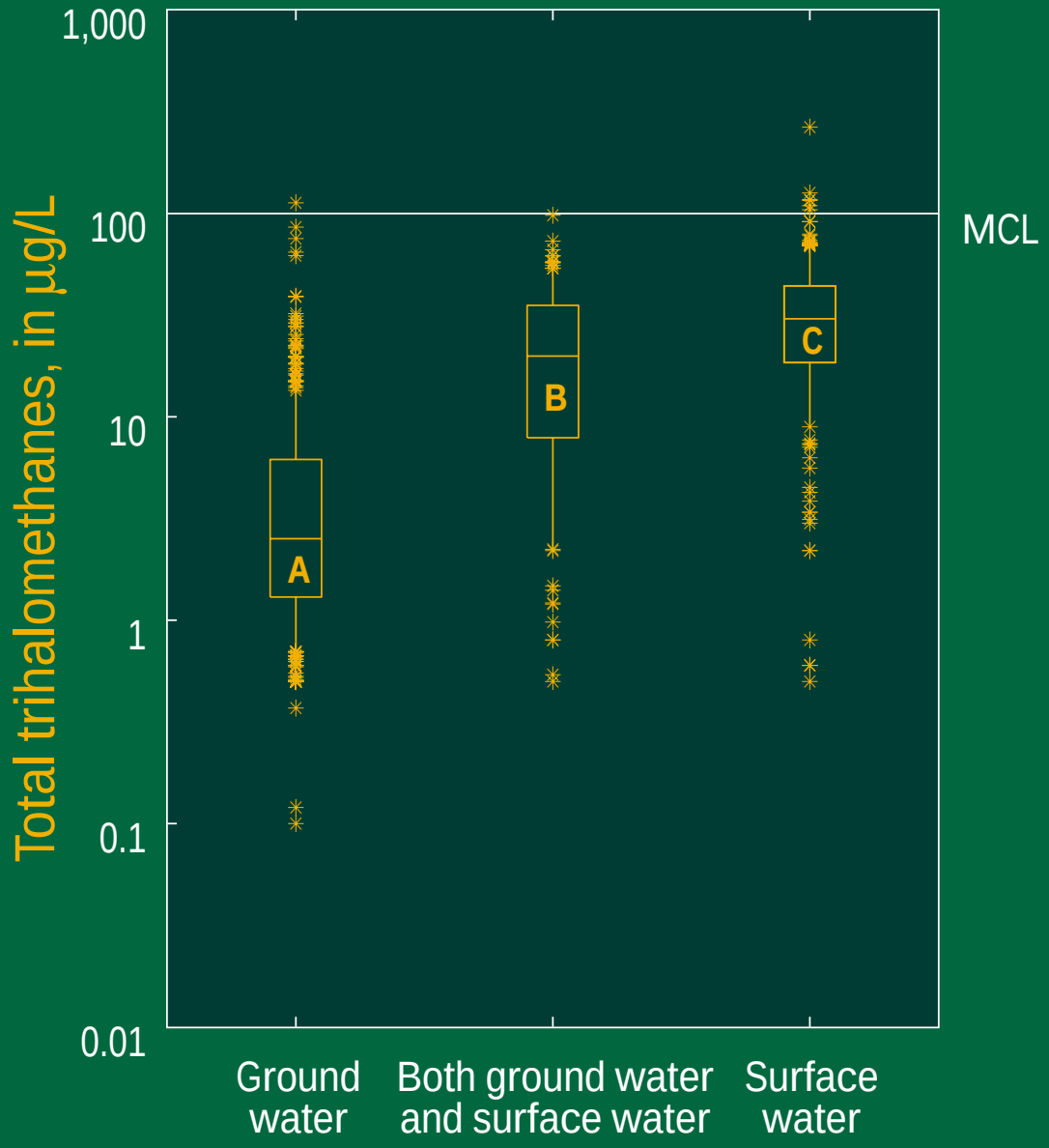
Total Trihalomethane Concentrations Compared by Source



p<0.0001

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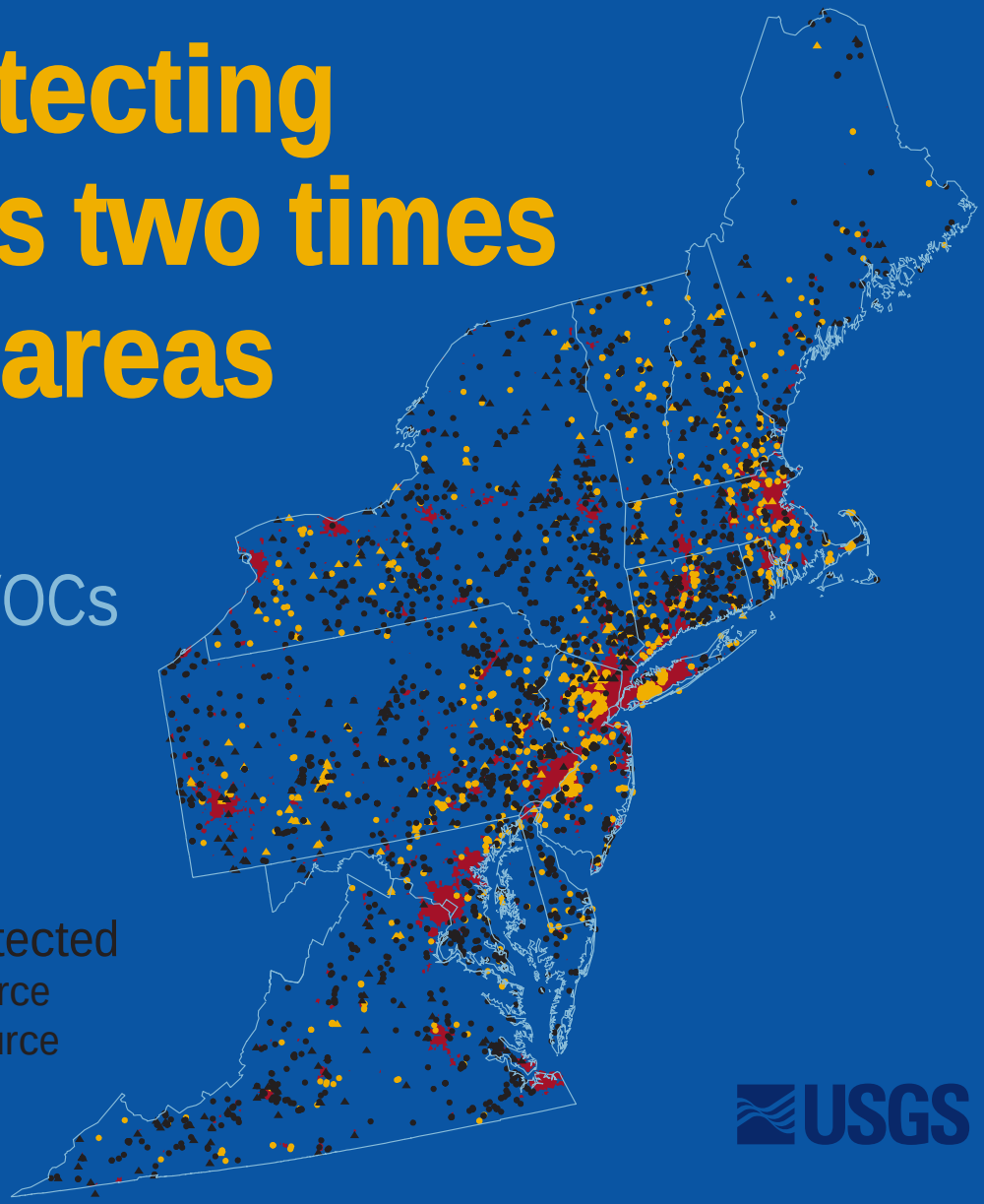
Probability of detecting non-THM VOCs is two times greater in urban areas

% of CWSs with non-THM VOCs

— 46% in urban areas

— 22% in rural areas



non-THMs detected

- Ground-water source
- Surface-water source

non-THMs not detected

- Ground-water source
- Surface-water source

Urban areas (pop. > 1,000 people/mi^2)

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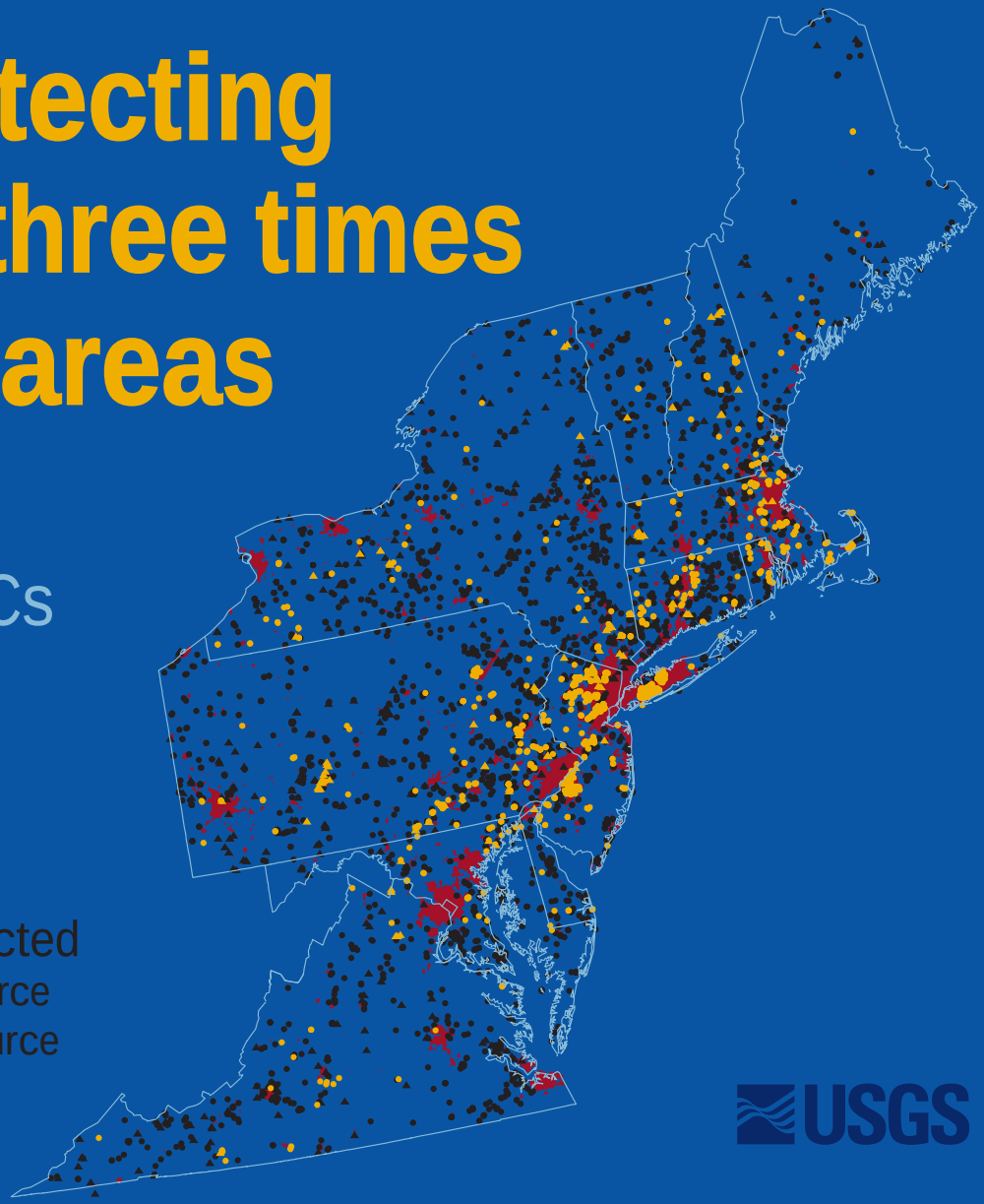
Probability of detecting solvent VOCs is three times greater in urban areas

% of CWSs with solvent VOCs

— 33% in urban areas

— 11% in rural areas



Solvents detected
- Ground-water source
- Surface-water source

Solvents not detected
- Ground-water source
- Surface-water source

Urban areas (pop. > 1,000 people/mi²)

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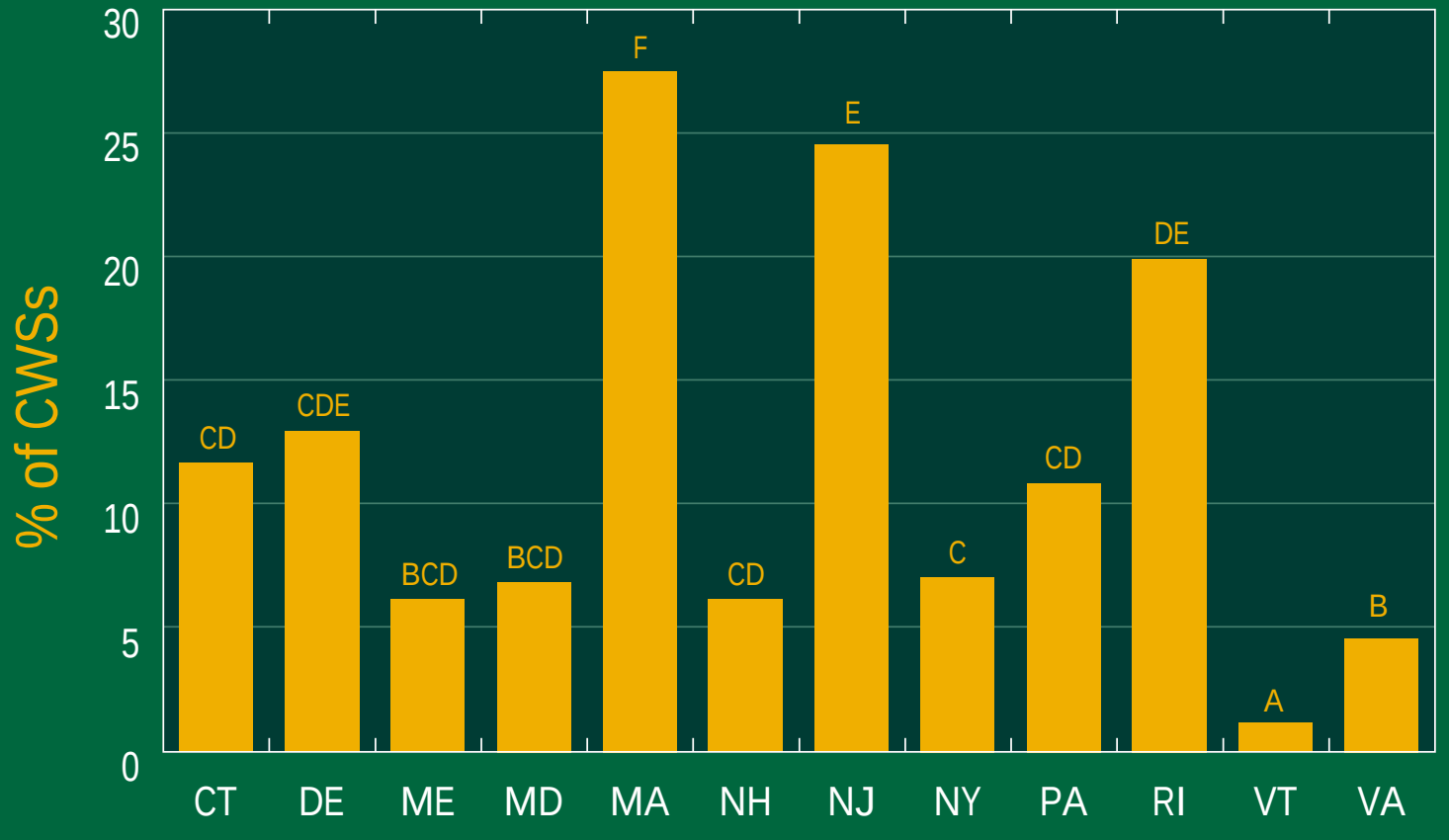
Frequency of Detection of Solvents ≥ 1.0 µg/L



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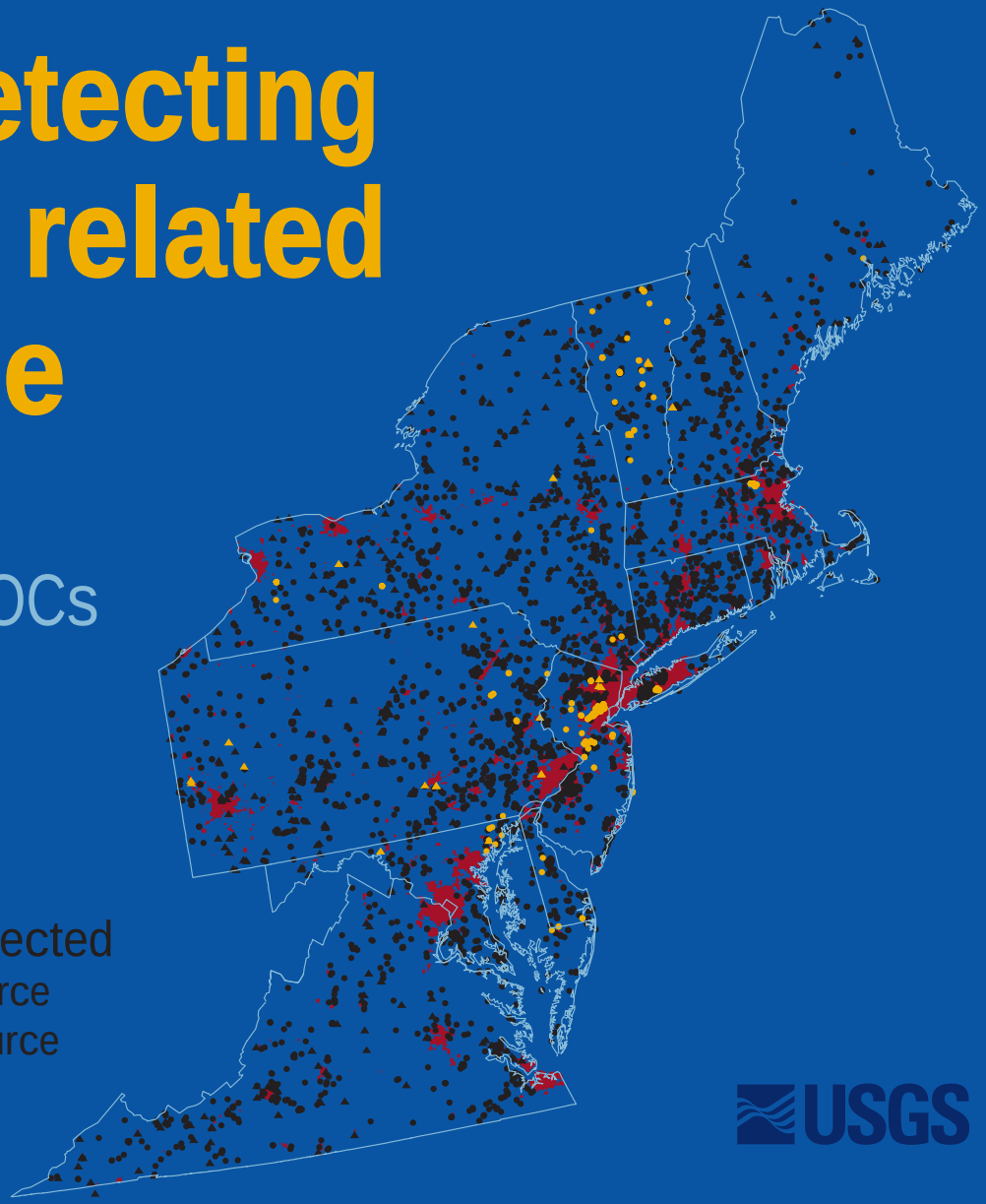
Probability of detecting fumigants is not related to urban land use

% of CWSs with fumigant VOCs

— 4% in urban areas

— 3% in rural areas



Fumigants detected
- Ground-water source
- Surface-water source

Fumigants not detected
- Ground-water source
- Surface-water source

Urban areas (pop. > 1,000 people/mi^2)

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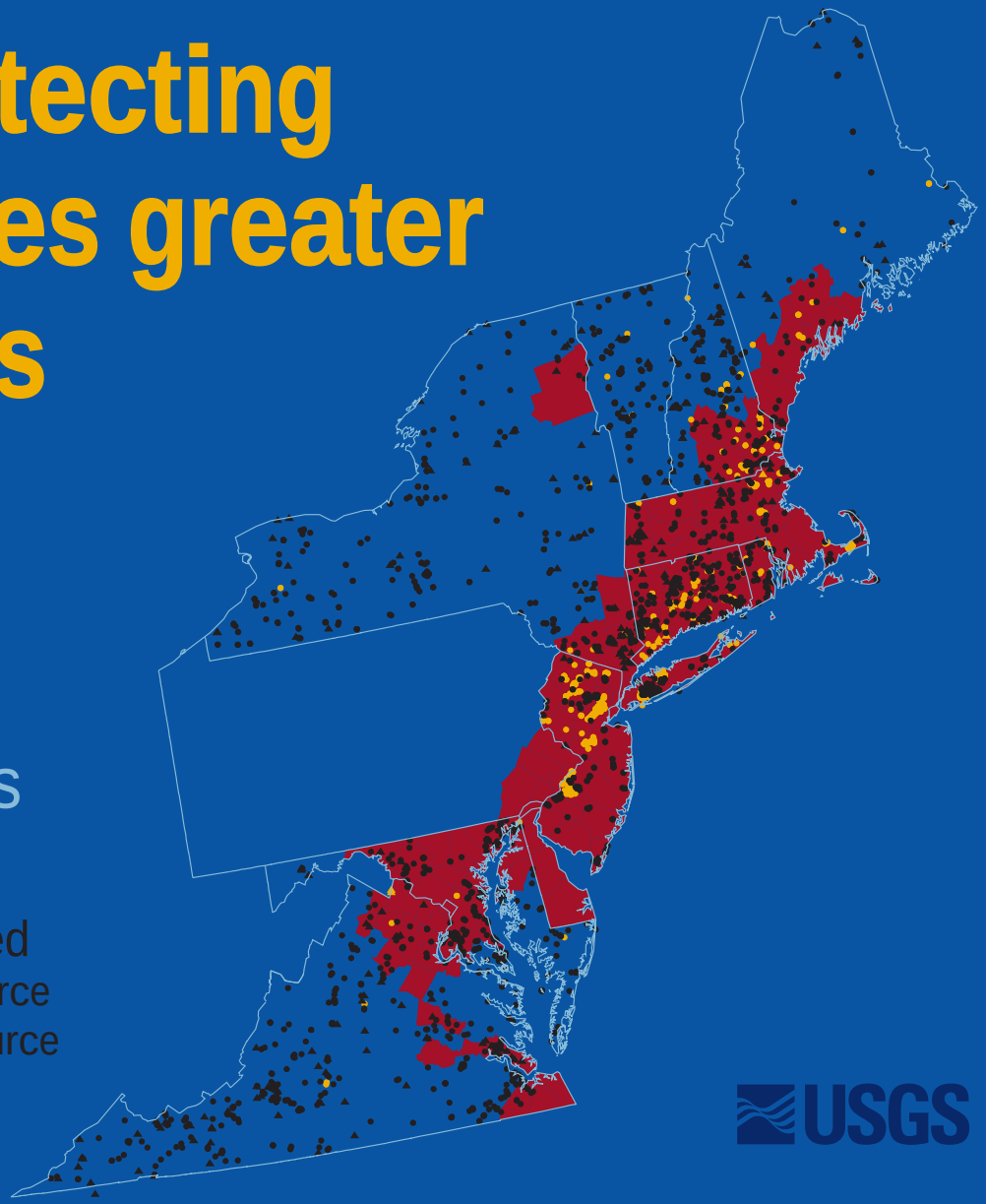
Probability of detecting MTBE is five times greater in RFG/OXY areas



% of CWSs with MTBE:

— 16% in RFG/OXY areas

— 3% out of RFG/OXY areas

MTBE detected
- Ground-water source
- Surface-water source

MTBE not detected
- Ground-water source
- Surface-water source

RFG/OXY areas

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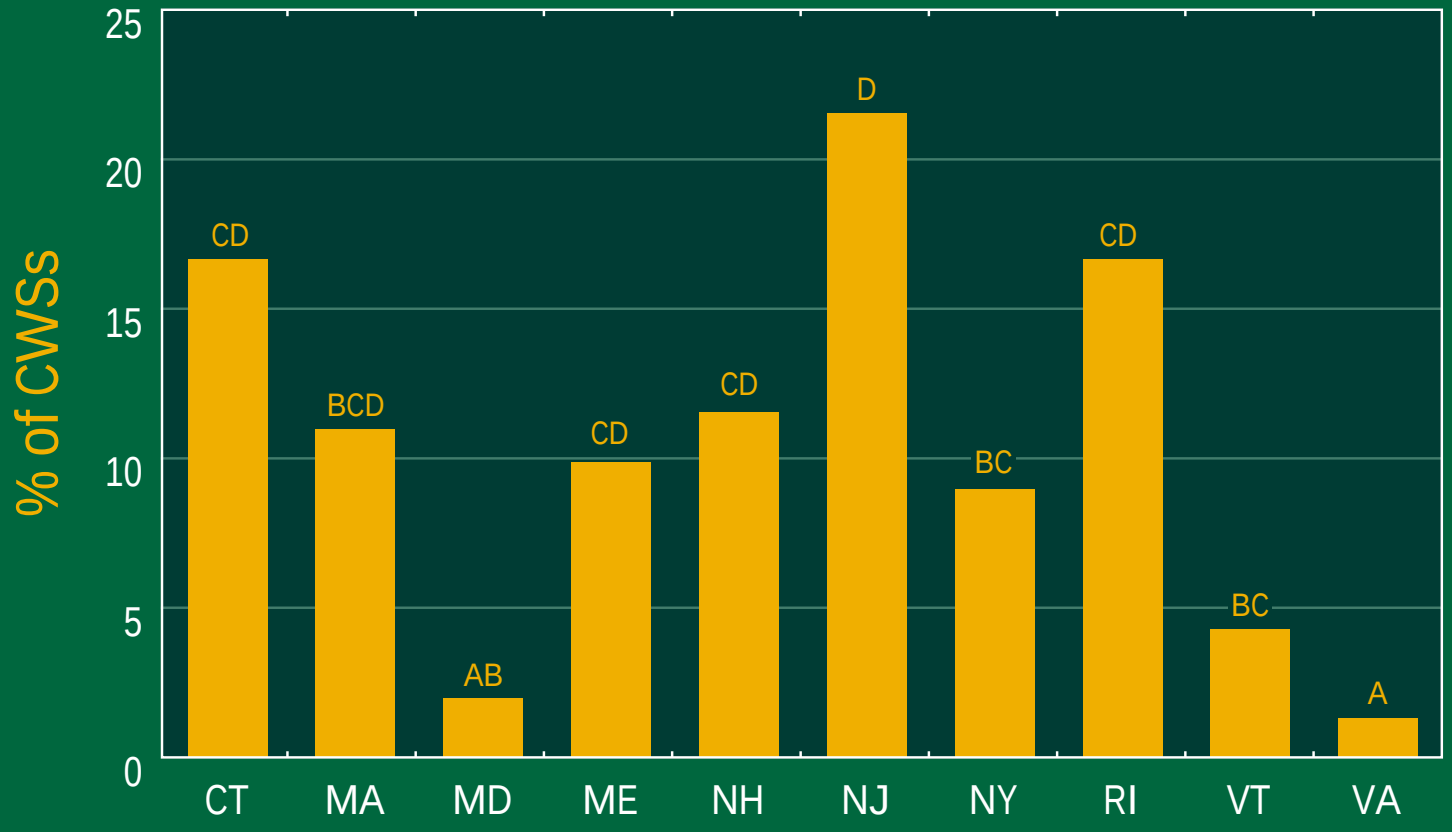
Frequency of Detection of MTBE ≥ 1.0 µg/L



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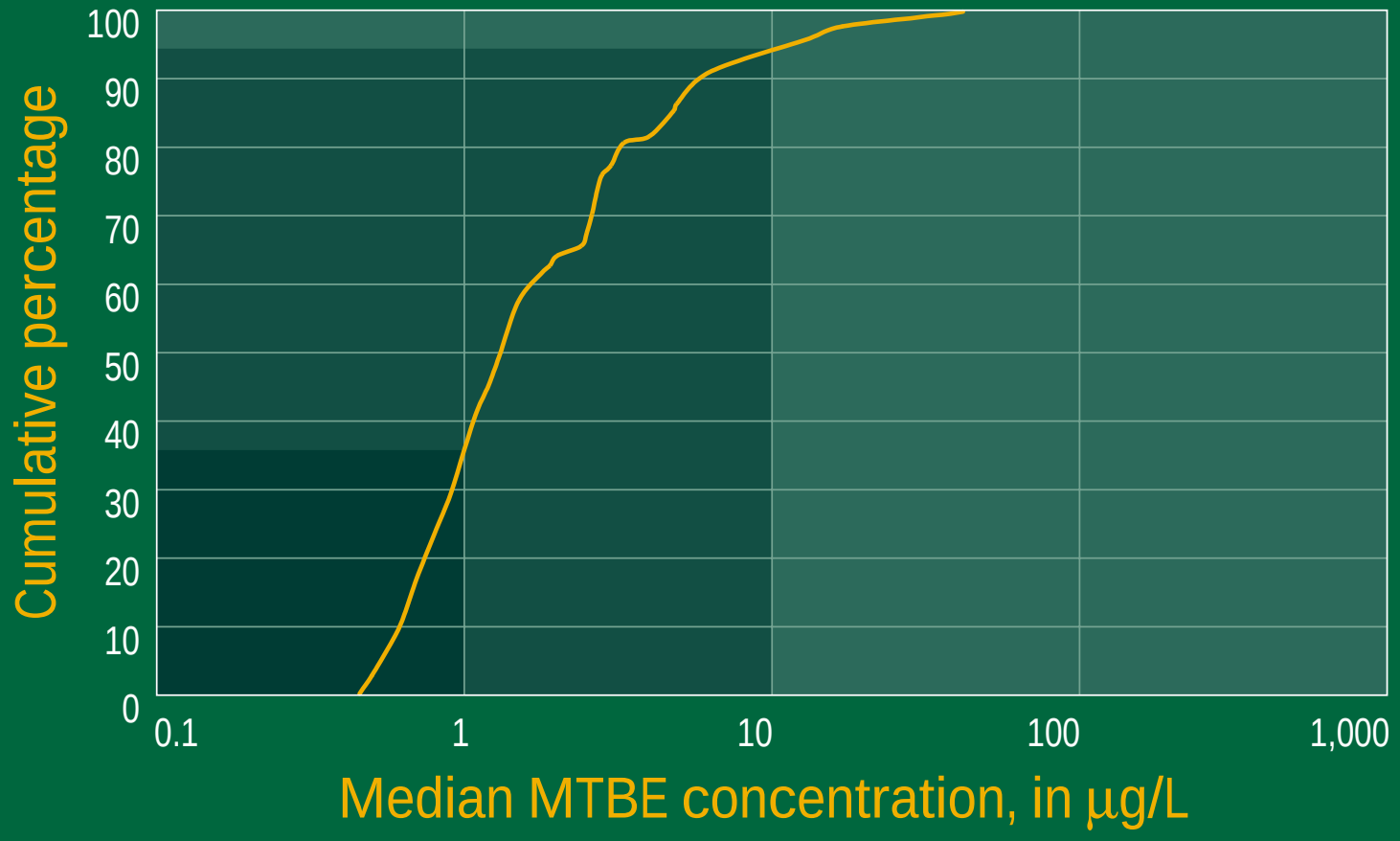
Cumulative Distribution of Median MTBE Concentrations



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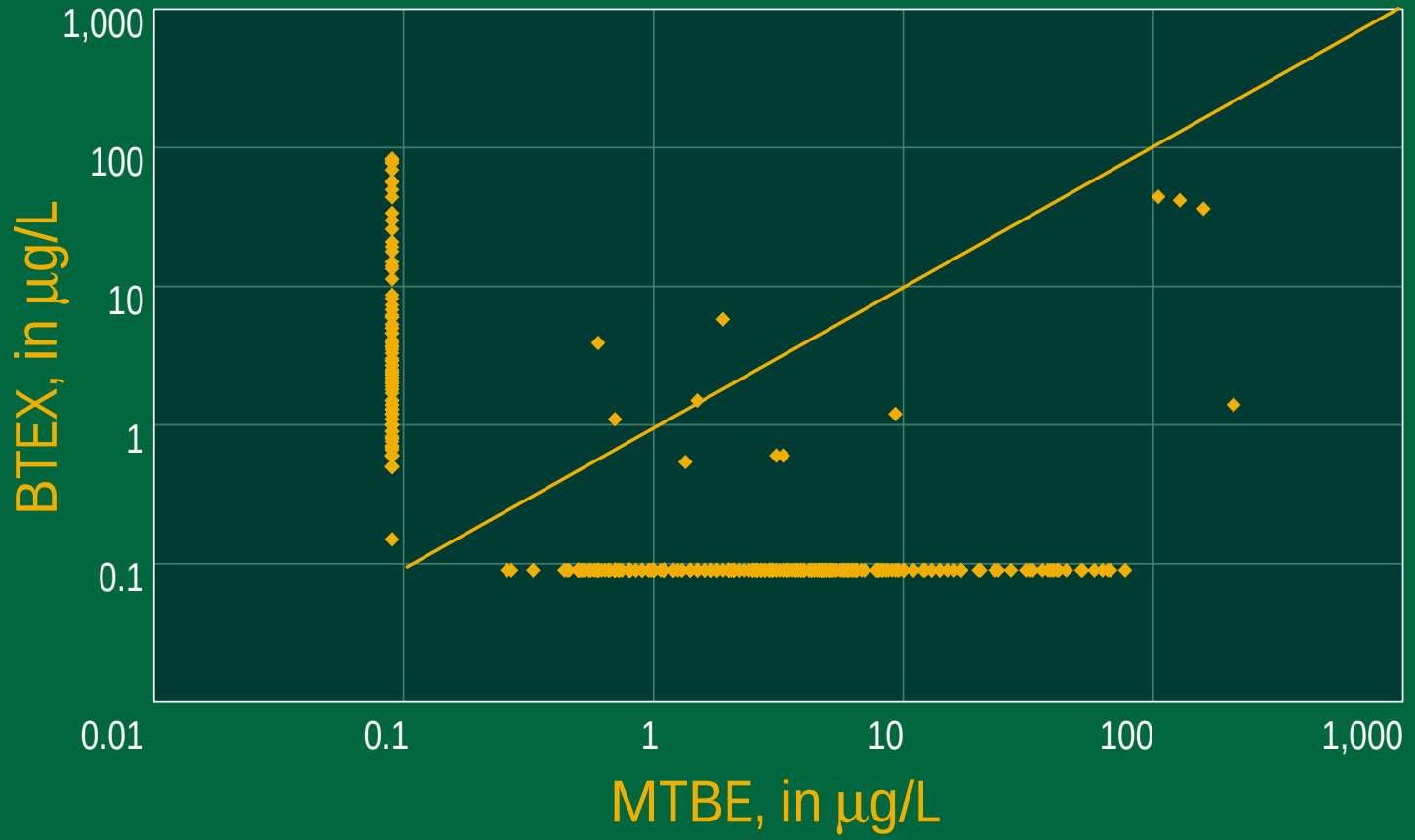
Concentrations of MTBE and BTEX in Drinking-Water Samples



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Population Served by Sampled CWSs with Detections (in million people)

	at any conc.	at 1.0 µg/L	MCL/HA/DWA
VOCs	8.8	8.7	2.6
THMs	8.6	8.4	0.9
Non-THMs	5.3	4.5	1.7
MTBE	2.3	2.0	0.05

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Estimated Population Served in 12-State Area Potentially Exposed

(in million people)

	at any conc.	at 1.0 µg/L
VOCs	52.5 – 53.6	51.7 – 52.8
THMs	53.2 – 53.6	51.8 – 52.6
Non-THMs	31.1 – 32.0	26.5 – 27.4
MTBE	18.6 – 19.8	17.1 – 18.7

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Conclusions

- 64 of 84 VOC analytes detected in drinking water
  - THMs>>MTBE>1,1,1-TCA, TCE, PCE> BTEX
- 45 % of CWSs reported one or more VOC
  - detections 2X more often in urban areas
- 70 % of all detections < 10 µg/L
- Population exposed to VOCs: ~9 million by sampled CWSs, ~52 -54 million projected

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Conclusions (continued)

- MTBE detected: 8.9 % of CWSs @ any conc.
  7.8 % of CWSs @ 1.0 µg/L
  0.8 % of CWSs @ 20 µg/L
- MTBE detected 5X more often in RFG/OXY areas
- MTBE detected in ground & surface water
  - most often in larger CWSs with both sources (urban)
- MTBE does not co-occur with BTEX
- Population exposed: ~2.3 million sampled,
  ~19 million projected

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