A Proximity-Based Approach for Analyzing Distributional Impacts:

A Regulatory Case Study Based on the 2008 Review of the National Ambient Air Quality Standards for Lead

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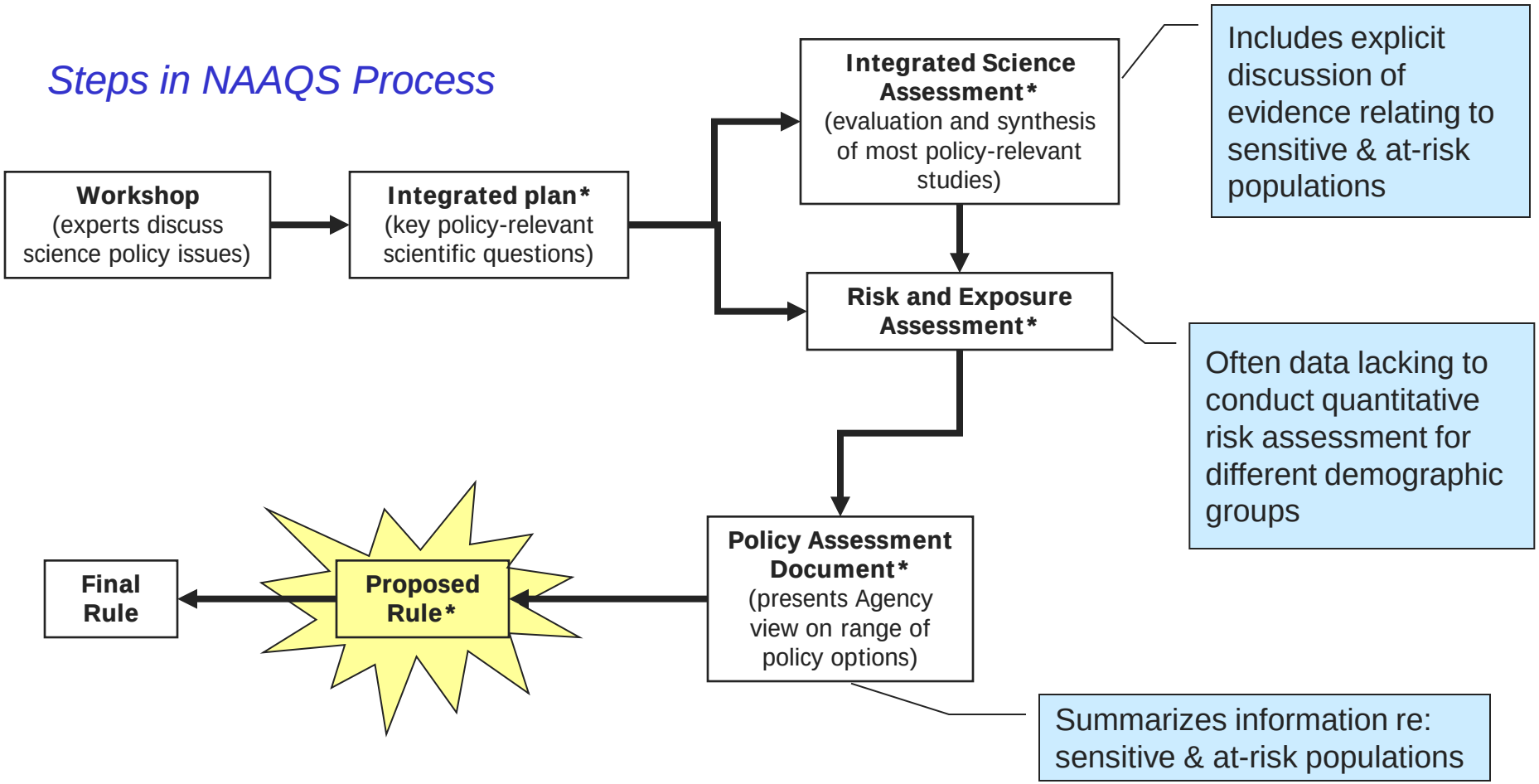
National Ambient Air Quality Standards (NAAQS)

- The Clean Air Act requires EPA to set public health and welfare (environmental) standards for common air pollutants, including lead, and to review/revise these standards every 5 years as needed

- Clean Air Act requires that in setting these standards:
  - EPA may not consider cost of attainment
  - The primary (health-based) standards must be, in the Administrator's judgment, "requisite" to protect public health with an "adequate margin of safety"
    - Includes consideration of the nature and extent of health risks, and the degree of scientific certainty
    - Includes consideration of adverse impacts in sensitive subpopulations – i.e., representative at-risk groups, but not the single highest-risk individual

Considering Disproportionate Impacts in the NAAQS Regulatory Context



* Includes opportunity for review by Clean Air Scientific Advisory Committee and the public

Lead NAAQS:
Importance of Distributional Issues

- In May 2008 proposal to revise the lead NAAQS from 1.5 micrograms per cubic meter of air (µg/m3) to within the range of 0.10 to 0.30 µg/m3, the Agency stated:
  - "This proposed rule will establish uniform national standards for lead in ambient air. The proposed revisions would improve public health protection for at-risk groups, especially children. Therefore…this proposed rule will not have disproportionately high and adverse human health or environmental effects on …any population."
- However, CDC data on blood lead levels among children also clearly indicated that the overall burden of lead exposure falls most heavily on minority and low-income children. Thus, EPA judged it important to consider distributional implications of regulatory decisions involving lead (including regulatory baseline)
- For lead NAAQS, EPA did conduct a limited demographic analysis to determine whether the distributional impacts of current concentrations of lead <u>in ambient air</u> were potentially EJ relevant

Distributional Analysis for Lead NAAQS: Proximity-Based Design

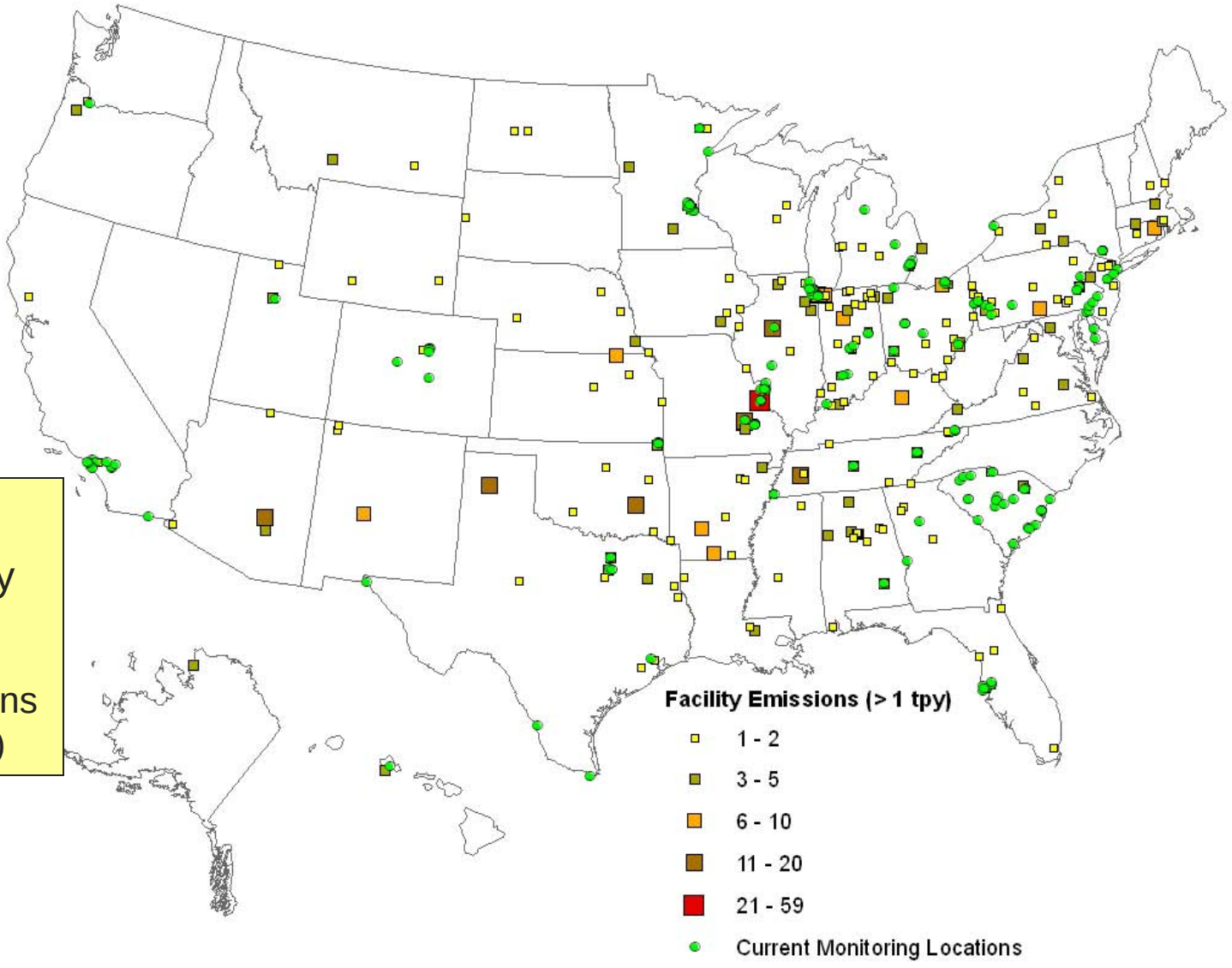
- Focused on populations living near lead monitors or near stationary sources emitting ≥ 1 ton of lead per year
- Both ambient monitoring data and emissions inventories for lead were limited, making full scale quantitative analysis difficult
- Evaluated census data within 1 km, 2 km, and 10 km rings around monitor/facility and compare to county and national trends
  - Looked at socio-demographics of these populations to determine whether any population sub-groups were *potentially* more highly exposed
  - Variables considered:
    -- Race
    -- Ethnicity
    -- Income
    -- Age
    -- Poverty status
    -- Education level
    -- Housing vintage

Map Of Lead Sources and Monitoring Sites

Total:

- 124 sources > 1 tpy
- 144 monitors

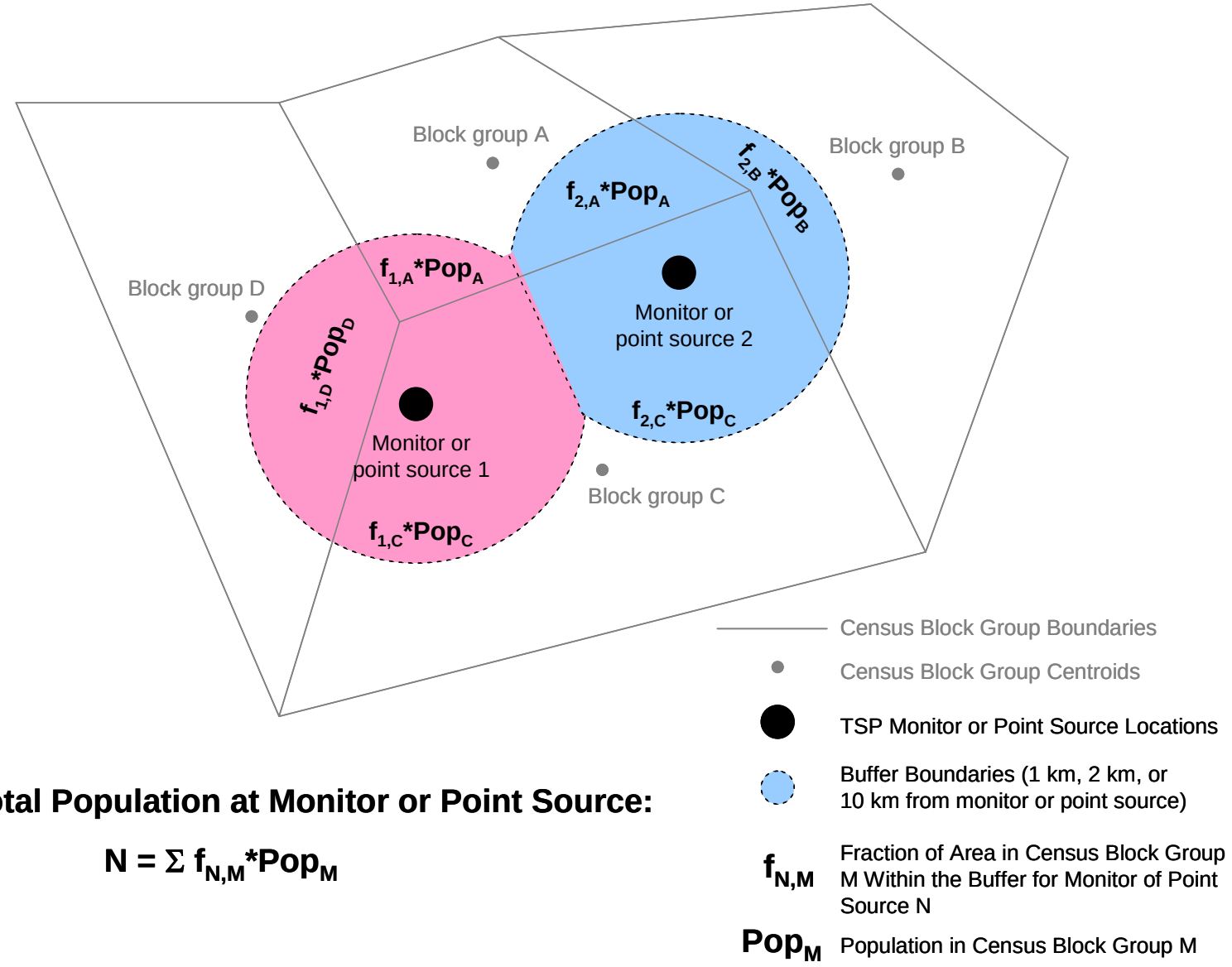
(~50 with concentrations exceeding 0.10 ug/m^3)



3-Pronged Analytical Approach

- *Monitor-based demographic analysis*: Characterization of populations within 1 km, 2 km, or 10 km of ambient air lead monitoring sites with lead measurements exceeding levels within the proposed range for the revised lead NAAQS (> 0.10 µg/m^3, > 0.20 µg/m^3 or > 0.30 µg/m^3), as compared to county or national averages
- *Population-weighted monitor-based analysis:* Calculation of population-weighted average monitor values (ambient concentrations) for populations within 1 km or 2 km of all 144 monitors
- *Lead point source-based demographic analysis*: Characterization of populations within specified distances of 124 point sources with annual lead emissions of one ton or more (populations within 1 km or 2 km compared to populations within 10 km and to county/national averages)

Figure 1. GIS-based approach used to apportion block group population counts to distance rings around monitors and point sources



Total Population at Monitor or Point Source:

$$N = \Sigma f_{N,M} * Pop_M$$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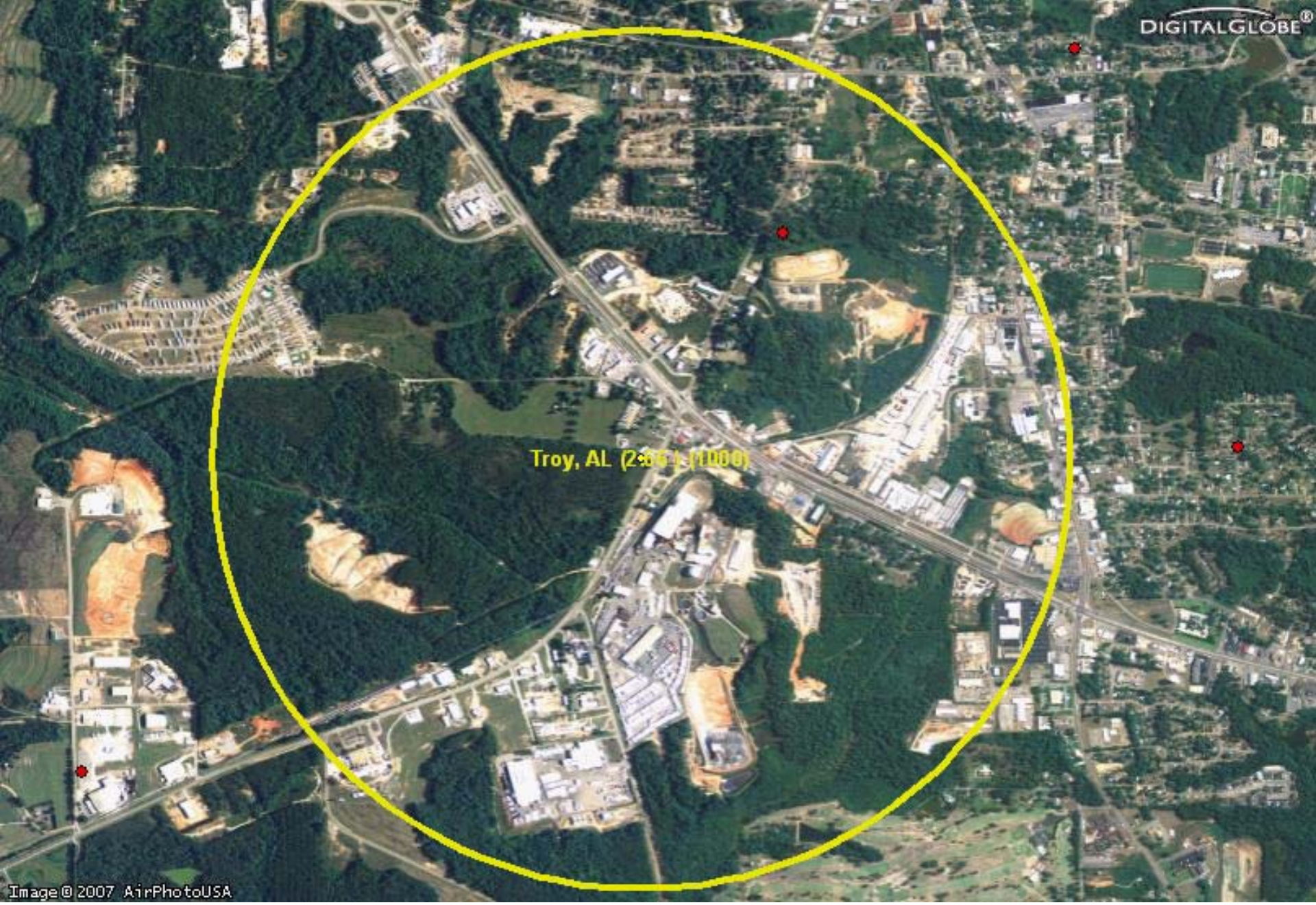
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Table 5. Demographics of Populations within Specified Distances of Stationary Sources with Emissions ≥ 1 TPY or > 5 TPY

		Percent of Total in Each Category								
		124 Sources with Emissions ≥ 1 TPY				12 Sources with Emissions ≥ 5 TPY				
Demographic Variable		1 km Ring	2 km Ring	10 km Ring	Counties	1 km Ring	2 km Ring	10 km Ring	Counties	**US Total**
Race	White alone	69%	69%	67%	64%	84%	82%	71%	78%	75%
	Black or African American alone	20%	17%	17%	15%	9%	13%	19%	15%	12%
	American Indian and Alaska Native alone	0%	1%	0%	1%	1%	0%	0%	1%	1%
	Asian alone	1%	1%	3%	6%	1%	1%	1%	1%	4%
	Native Hawaiian and Other Pacific Islander alone	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Some other race alone	7%	10%	10%	12%	4%	3%	7%	4%	5%
	Two or more races	2%	2%	3%	3%	1%	1%	2%	2%	3%
Ethnicity	Not Hispanic	85%	79%	77%	76%	95%	96%	87%	92%	87%
	Hispanic	15%	21%	23%	24%	5%	4%	13%	8%	13%
Age	0-7	13%	12%	12%	12%	9%	10%	12%	11%	11%
	8-18	17%	17%	16%	16%	18%	17%	16%	16%	16%
	19-64	57%	58%	59%	60%	59%	56%	59%	60%	61%
	65 and over	13%	13%	13%	12%	14%	16%	13%	13%	12%
Median Income	(in $)	$32,454	$33,932	$39,800	$42,243	$42,563	$38,769	$37,471	$39,722	$41,994
Poverty Status	Above Poverty Level, Families with Children < 5	15%	15%	15%	16%	11%	12%	16%	16%	16%
	Above Poverty Level, Families with Children < 5 and 5 to 17	15%	15%	16%	17%	16%	14%	16%	16%	16%
	Above Poverty Level, Families with Children 5 to 17 only	44%	46%	49%	51%	59%	53%	51%	54%	54%
	Below Poverty Level, Families with Children < 5	6%	5%	4%	3%	3%	5%	4%	3%	3%
	Below Poverty Level, Families with Children < 5 and 5 to 17	8%	7%	6%	5%	3%	5%	5%	4%	4%
	Below Poverty Level, Families with Children 5 to 17 only	13%	11%	9%	8%	8%	11%	8%	7%	7%
Education	Less Than High School	30%	30%	27%	24%	20%	23%	23%	21%	20%
	High School Graduation	35%	33%	29%	25%	35%	35%	35%	36%	29%
	Some College	17%	18%	19%	20%	19%	19%	22%	22%	21%
	Completed College	15%	15%	18%	22%	18%	16%	16%	16%	22%
	Higher Degree	4%	5%	7%	9%	8%	7%	5%	5%	9%
Housing Vintage	< 1940	29%	28%	21%	16%	15%	15%	20%	14%	15%
	1940-1949	12%	13%	12%	10%	7%	8%	11%	10%	7%
	1950-1959	18%	18%	19%	18%	15%	15%	18%	17%	13%
	1960-1979	14%	14%	15%	16%	21%	19%	16%	16%	14%
	> 1979	27%	28%	34%	40%	43%	43%	35%	43%	51%

Results: Summary

- Generally, there were no notable differences in terms of race, ethnicity, or age among populations living near large point sources or ambient monitors > 0.10 µg/m^3 as compared to county/national averages
- Some differences in terms of median income, families with children living below poverty level, and housing vintage, with those living closer to the point sources or monitors generally having lower incomes and older housing
- In general, population-weighted averages were quite low across all demographic variables examined
- Full memo available at: http://www.epa.gov/air/ej/pubs.html

Results: Discussion

- Analysis provided characterization of populations living in vicinity of lead monitors and lead point sources – **did NOT provide any form of exposure or risk estimates**
- Difficult to draw a clear set of conclusions due to limitations of analysis, and range and complexity of demographic variables involved
- The final decision (10-fold reduction in level from 1.5 $\mu g/m^3$ to 0.15 $\mu g/m^3$) involved substantial strengthening of the national standard
  - In making this decision, Administrator pointed clearly to impacts on children and to Clean Air Act requirements that the NAAQS be set at a level that protects public health, including the health of sensitive groups like children, with an adequate margin of safety