AGENDA: 4

BAY AREA AIR QUALITY MANAGEMENT DISTRICT

Advisory Council Meeting
December 11, 2017

Regulation 11, Rule 18 Reduction of Risk from Air Toxic Emissions at Existing Facilities

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(Anda Chu/Bay Area News Group)

Overview

- Background
- Toxic Air Contaminants overview
- Rule 11-18 requirements and implementation
- Key Points

Background

- 2010: Clean Air Act includes plan to update “Toxics Hot Spots” program.
- 2015: Office of Environmental Health Hazard Assessment (OEHHA) updates the statewide guidance on Health Risk Assessments.
- 2016: Air District updates Rule 2-5 to strengthen permit reviews on new/modified sources of toxic air contaminants.
- 2016-2017: Outreach to impacted stakeholders, presentations to the Board and Stationary Source Committee.
- 2017: Board of Directors approves new Rule 11-18 for existing sources of toxic air contaminants.

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What are Toxic Air Contaminants?

- Compounds defined as toxic air contaminants (TACs) in the California Health and Safety Code
- More than 200 compounds
- Hazards to human health
  - Cancer
  - Non-cancer, chronic health impacts
  - Acute health impacts

Example TACs and Health Impacts

	Toxic Air Contaminant	Cancer	Chronic	Acute
	Diesel Exhaust	• Lung	• Respiratory system	
Organic Compounds	**Benzene**	• Leukemia • Myeloma • Lymphoma	• Blood cells	• Development • Immune system • Blood cells
Organic Compounds	**1,3-Butadiene**	• Leukemia • Lymphoma • Other types	• Reproductive system	• Low birth weight
Metals	**Chromium (VI)**	• Lung	• Respiratory system	
Metals	**Mercury**		• Development • Nervous system • Kidney	• Development • Nervous system • Kidney

Exposure and Toxicity Determine Health Impacts

Emission to air

Ambient concentration

Breathed in

Damage to health

Exposure

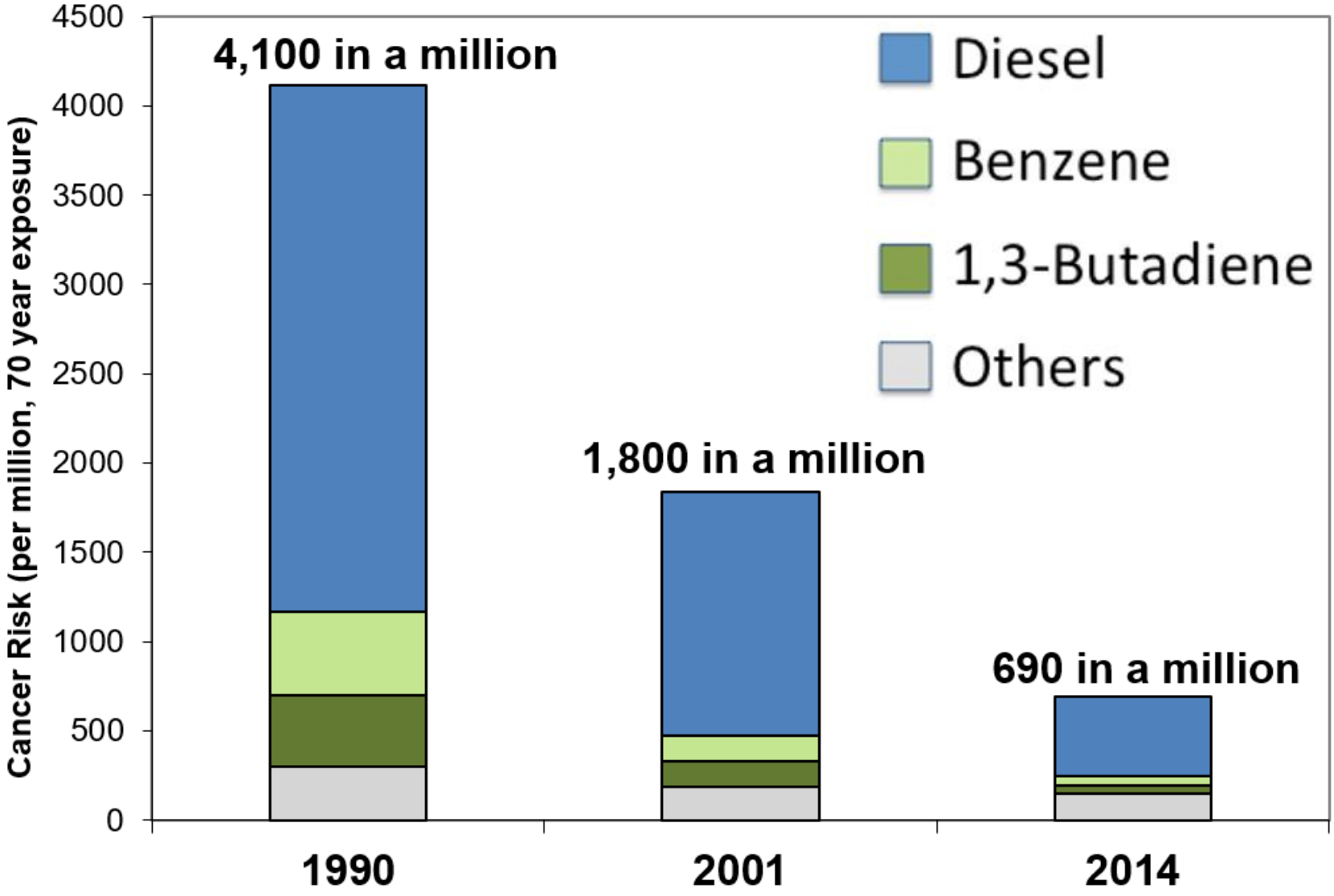
Toxicity

Office of Environmental Health Hazard Assessment (OEHHA) develops guidelines

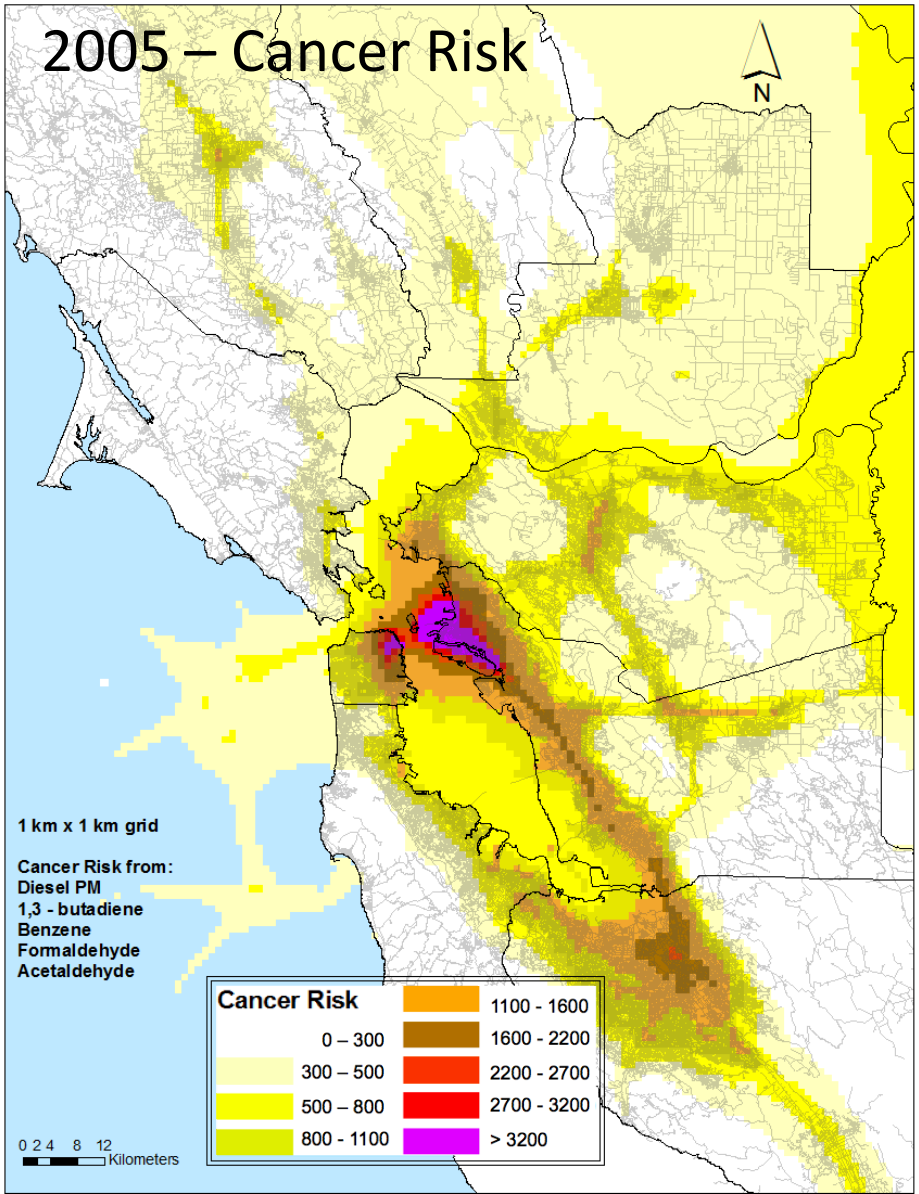
How Do We Measure Impacts?

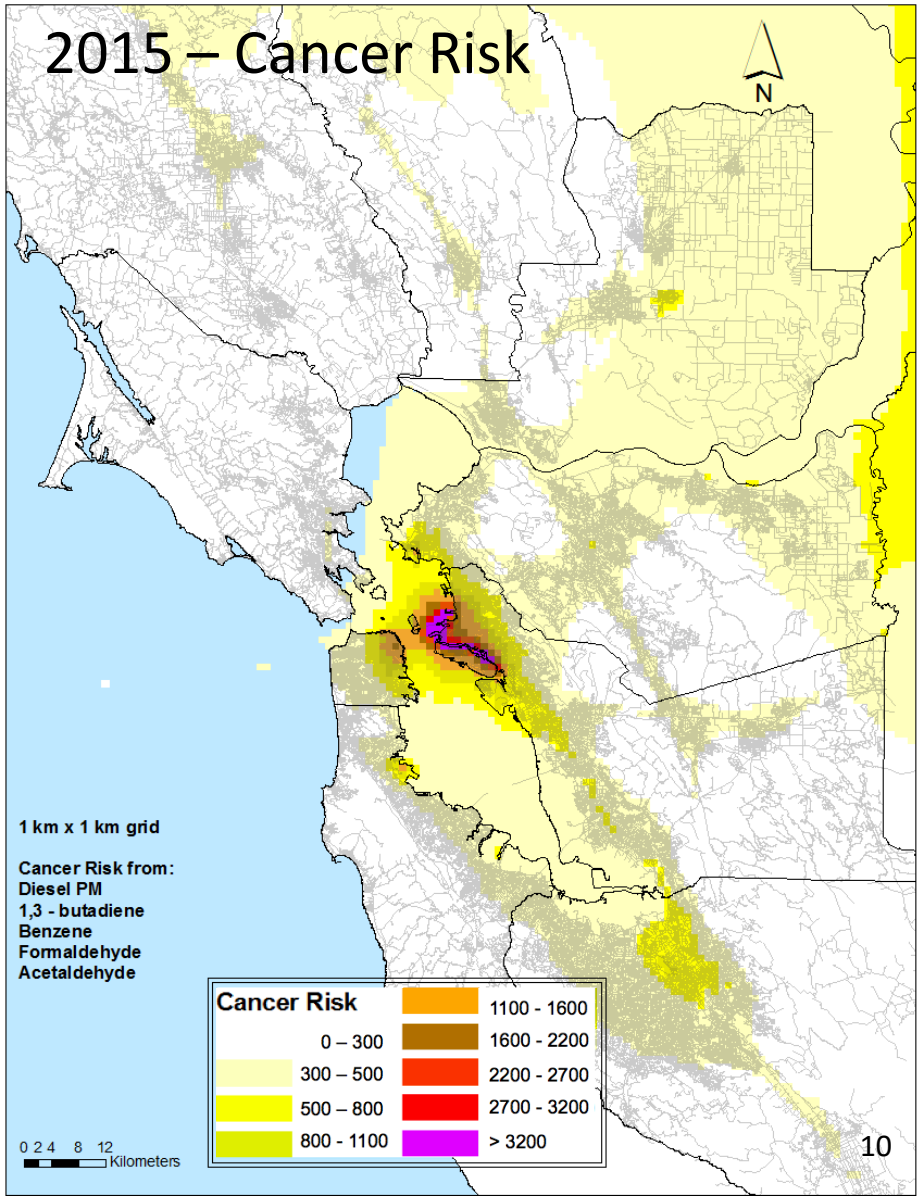
- **Cancer Risk** – The theoretical probability of contracting cancer when continually exposed for a lifetime (30 years) to a given concentration of a substance. Presented as the number of chances in a million of contracting cancer.
- **Acute Hazard Index** - The potential non-cancer health impacts resulting from a one-hour exposure to toxic substances.
- **Chronic Hazard Index** - The potential non-cancer health impacts resulting from exposure to toxic substances usually lasting from one year to a lifetime.

Bay Area Lifetime Cancer Risk from TAC Exposure



Overall Air Pollution Down, but High Risks in Some Communities Remain





Regulatory Authority

- Bay Area Air District
  - **Primary regulatory authority over stationary sources**
- State Air Resources Board
  - Intrastate mobile sources—cars, trucks, cargo handling equipment
- U.S. EPA
  - Interstate mobile sources—trains, aircraft & ocean going vessels

CALIFORNIA AIR RESOURCES BOARD

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

TAC Impact Mitigation Programs

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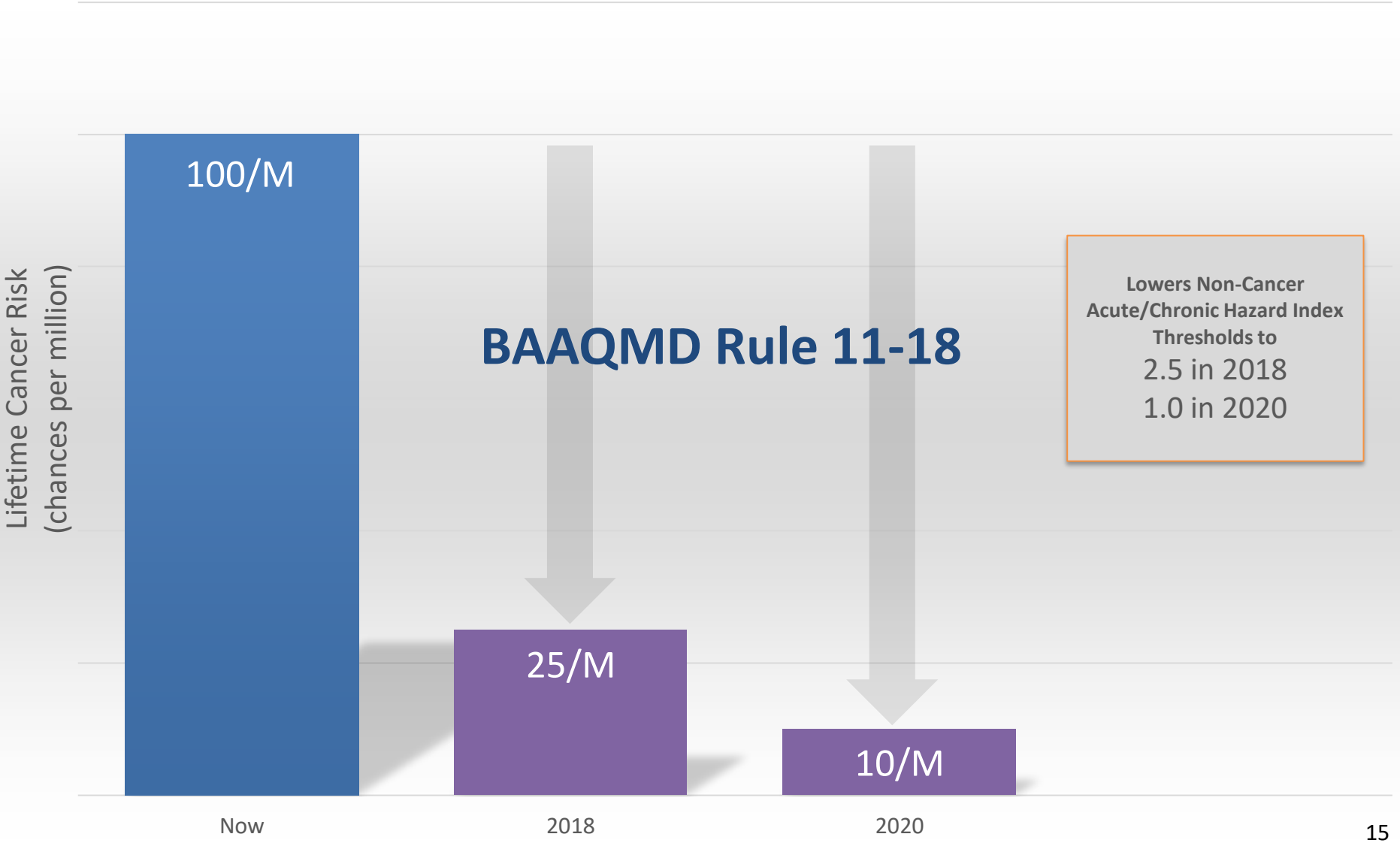
Rule 11-18 – Key Policy Components

- Reduces toxic risk in overburdened communities
- Important step in AB 617 implementation
- Reduces toxic risk to the lowest levels
- Facility selects compliance path

Risk Action Thresholds



Rule 11-18: Requirements

- Facilities above risk action level must
  - Develop a risk reduction plan for Air District approval
  - Execute plan according to plan schedule

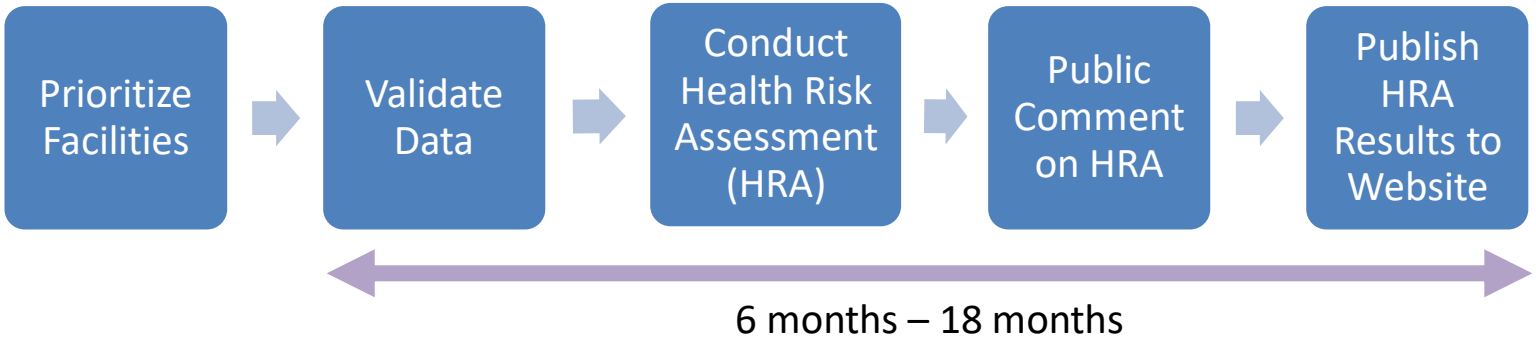
- Potential Risk Reduction Measures
  - Reduction of emissions, including installation of Best Available Retrofit Control Technologies for Toxics (TBARCT)
  - Modification of operating hours and activity levels
  - Modification of emissions stacks

- Exemptions
  - Retail gas stations
  - Sites that have **only** emergency backup generators and have risk screening level < 250

Potential Risk Reduction Measures

- Install Control Technology
- Operating Time Restrictions
- Limit Throughput
- Use Alternate Fuels/Materials
- Increase Stack Height
- Change Stack Orientation
- Relocate Source

Implementation: Overview



2018 - 2019	Complete HRAs for high priority facilities
2019 – 2021	Complete remaining HRAs

Implementation: Facility Risk Reduction

Overview

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Rule 11-18: Key Points

1. Health Protective Standards
2. Flexible Methods of Compliance
3. Implementation Approach

Health Protective Standards

Why 10/Million?

- Most health protective
- Technically achievable
- Addresses smaller sources which can be cumulatively significant in CARE areas
- Benefits at least **10 times** more people
  - ~50 facilities reviewed at 25/M, ~400 facilities reviewed at 10/M
  - Preliminary HRA for one refinery shows **thousands** of people benefit from 10/M, but only **hundreds** benefit from 25/M

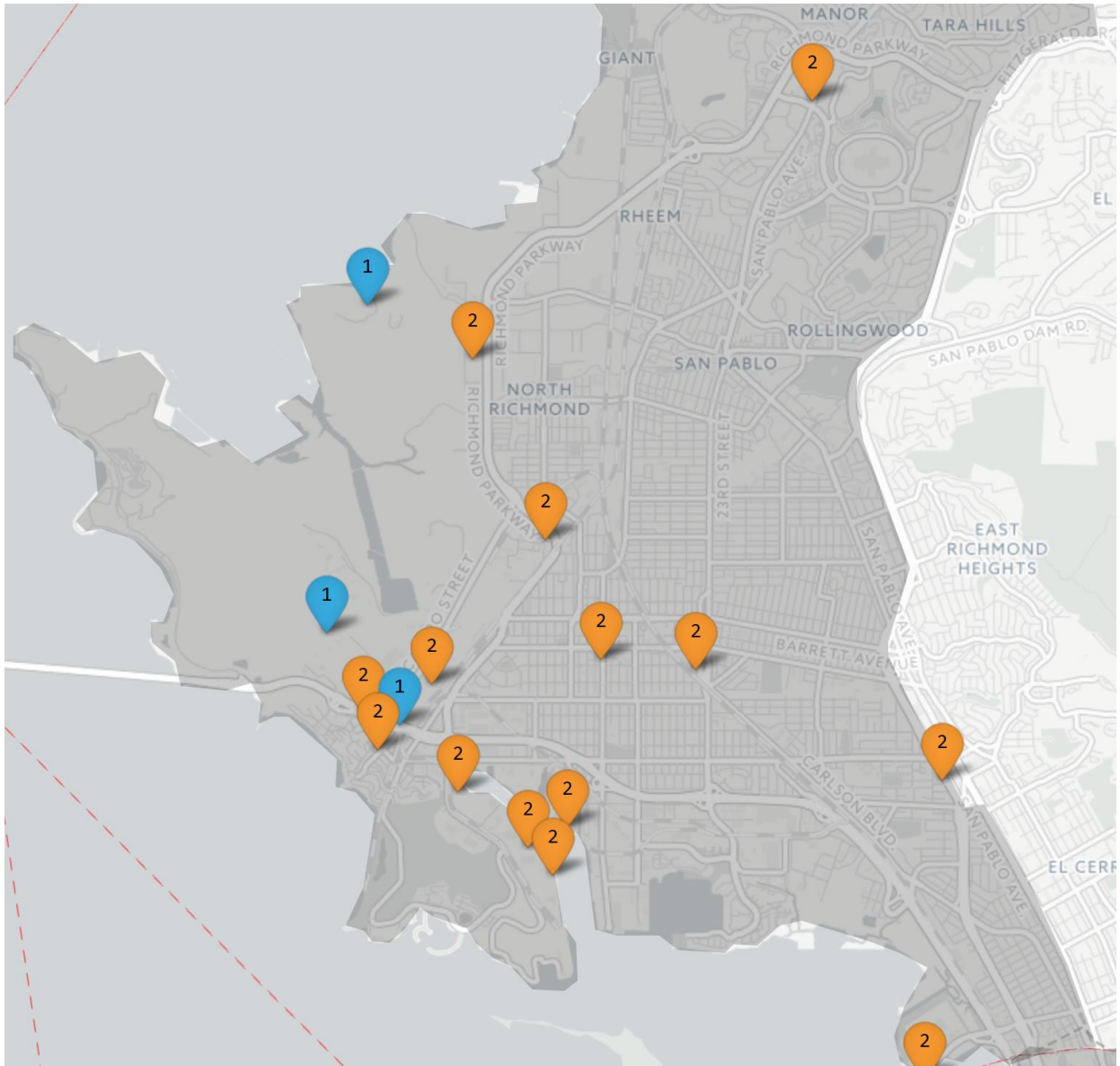
Health Protective Standards

10/Million is feasible for nearly all facilities

Facility Type	Estimated Risk
Refineries	13 - 56
Cement Manufacturing	9 - 40
Crematoria	10 – 14
Landfills	11 – 23
Foundries/Metal Melting	17 – 40
Sewage Treatment Facilities	9 - 40

If 10/M is not feasible, facilities must install TBARCT

Case Study: Richmond CARE Area - 25/M vs 10/M



At 10/M, all of the facilities on the map would be impacted by Rule 11-18 (orange and blue pins).

At 25/M, only the blue pins would be impacted

Case Study: Oil Refinery 25/M vs 10/M

- Preliminary HRA
- 10/M – about 8,500 people benefit (orange and blue)
- 25/M – about 600 people benefit (blue only)
- Green icons indicate day care centers

Case Study: Cement Kiln – 25/M vs 10/M

- Preliminary HRA
- 10/M – about 1,500 people benefit (orange shaded area)
- 25/M – No changes at facility

Flexible Methods of Compliance

- Facilities can choose lowest-cost approach to get below 10/M
  - Change processes
  - Move, raise emission stacks
  - Reduce engine testing hours
- Facilities can receive more time to install controls
- TBARCT option if not feasible to get below 10/M
  - Cost considered in all TBARCT determinations
- Major sources addressed first

Comparing Health Impacts of Air Pollutants[1]

Annual Incidences from 2015 Ambient Concentrations

	Diesel $PM_{2.5}$	Ozone	Other $PM_{2.5}$	Other Toxics
Mortality	169	29	2,307	8
Cancer Onset	13	n/a	n/a	9
Hospital Admissions[2]	36	94	482	0
Nonfatal Heart Attacks	95	0	1,181	0
Asthma Emergency Room Visits	64	42	885	0

1. Analysis based on the Multi-Pollutant Evaluation Method (MPEM). More details on the analysis may be found in Appendix C of the Bay Area Air Quality Management District's 2017 Clean Air Plan, http://www.baaqmd.gov/plans-and-climate/air-quality-plans/current-plans.

2. Combines respiratory and cardiovascular hospital admissions.

Next Steps

- Implement Rule 11-18
  - Start with largest, highest-polluting facilities
  - Focus on CARE areas
- Work toward a neighborhood-scale understanding of ambient $PM_{2.5}$ levels and impacts.
- Identify opportunities to reduce $PM_{2.5}$ through direct regulation and mobile source grant programs.
- Evaluate possibility of rule analogous to Rule 11-18 for $PM_{2.5}$.

AGENDA: 5

A summary of short-term $PM_{2.5}$ and adverse health outcome studies in California

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Office of Environmental Health Hazard Assessment

December 11, 2017

Outline: Short-term PM2.5 and Health Outcomes

- Cardiovascular and respiratory mortality
- Hospital/emergency room (ER) visits
- PM2.5 constituents/sources and health outcomes
- National studies including CA data
- Meta-analysis

Common Methodology

- Study designs
  - Time-series, case-crossover
- Data sources
  - California Air Resources Board, sources from USC based on emissions data
  - California Department of Public Health for health outcome data
- Analytical approach
  - Poisson regression, conditional logistic regression

Percent Change in $PM_{2.5}$ and Respiratory or Cardiovascular Mortality in CA

Study Period	Mean per ug/m³ or (Mean Range)	Disease Outcome/ Mortality	Exposure Lag Days	Results per 10 µg/m³ increase
1999 - 2002	(14-29)	Respiratory	2	**1.30 (0.10, 2.60)**
			Avg 01	**2.20 (0.60, 3.90)**
2000 – 03	18.6	Cardiovascular	0	**0.55 (0.14, 0.96)**
			1	**0.55 (0.17, 0.92)**
			2	0.30 (-0.08, 0.67)
			3	0.26 (-0.12, 0.65)
2000 – 03	19.28	Cardiovascular	0	White: -0.14 (-1.48, 1.22) Hispanic: 1.70 (-4.28, 8.05)
			3	White: 1.23 (-0.31, 2.78) **Hispanic: 4.73 (0.72, 8.91)**
			0	HS Graduate: -1.23 (-2.78, 0.34) **non-HS Graduate: 2.72 (0.36, 5.13)**
			3	HS Graduate: 0.27 (-1.46, 2.04) **non-HS Graduate: 4.06 (0.84, 7.39)**

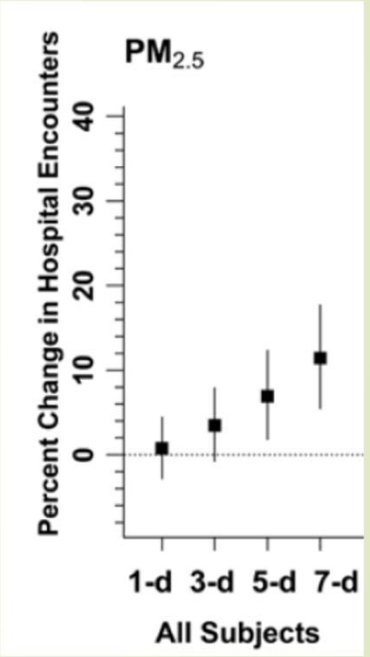
Sources: Ostro et al. 2006, 2007, 2008, including 9, 9 and 6 counties, respectively

Short-term $PM_{2.5}$ Exposure and Respiratory Hospital/ER Visits in CA

Author	Study Period	Mean or (Mean Range)	Health Outcome	Lag Days	Effect Estimate	Result per 10 µg/m³ increase
Malig 2013	2005 – 08	(5.2 - 19.8) ug/m ^{3}	ER visits	0	Percent Change	0.90 (0.05, 1.60)
				1		1.60 (0.95, 2.25)
				2		0.95 (0.37, 1.58)
Ostro 2016	2005 – 09	16.5	ER visits	0	Percent Change	0.88 (0.18, 1.58)
				1		**1.05 (0.01, 2.10)**
				2		0.44 (-0.26, 1.14)
Yap 2013	2000 – 05	(12.75 - 24.61)	Hospital Admissions	3	Relative Risk	**South Coast: 1.072 (1.068, 1.076)** Central Valley 1.00 (0.99, 1.01)

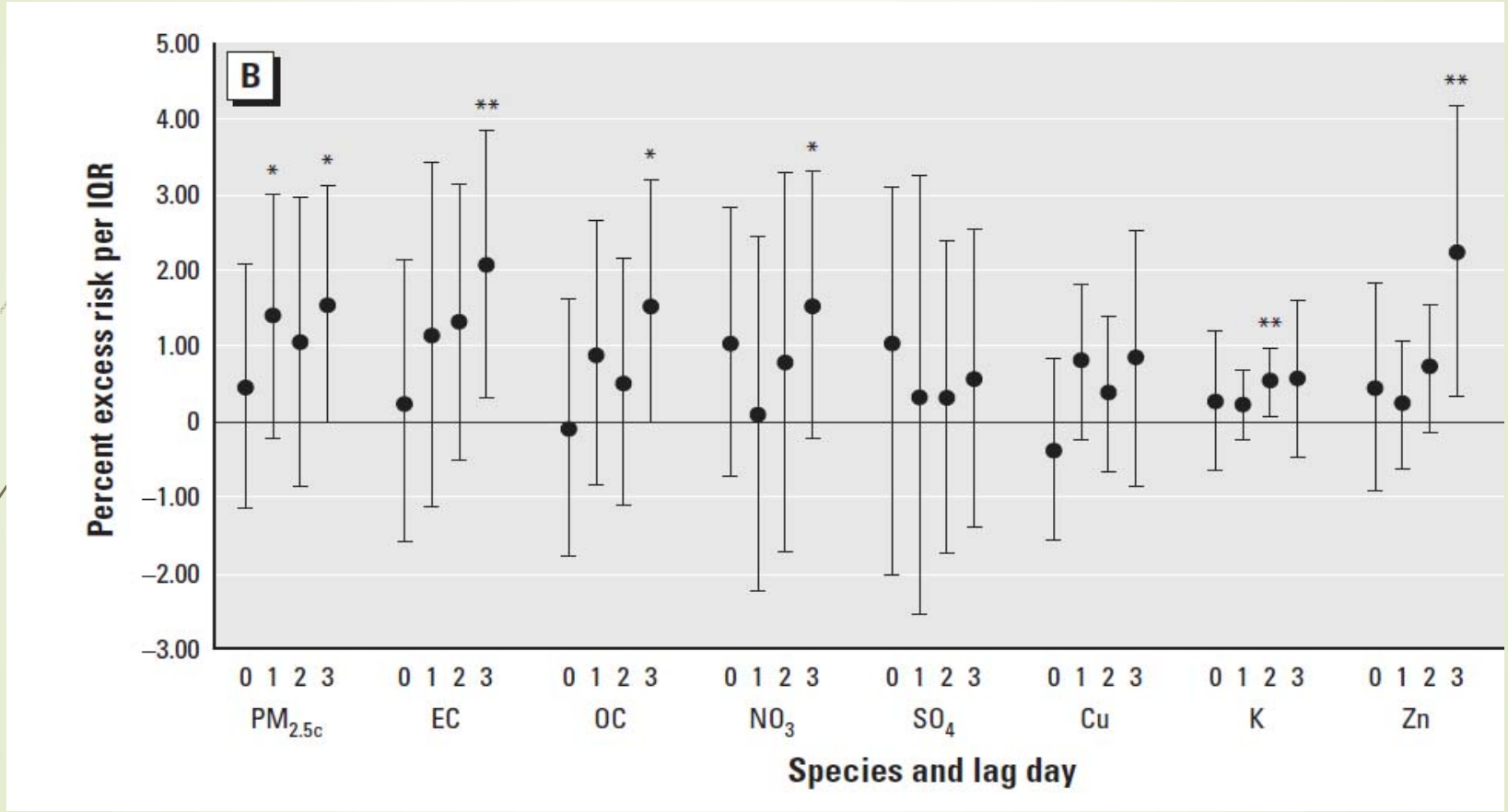
35, 8 and 12 CA counties, respectively

Asthma hospital visits for children in Orange County



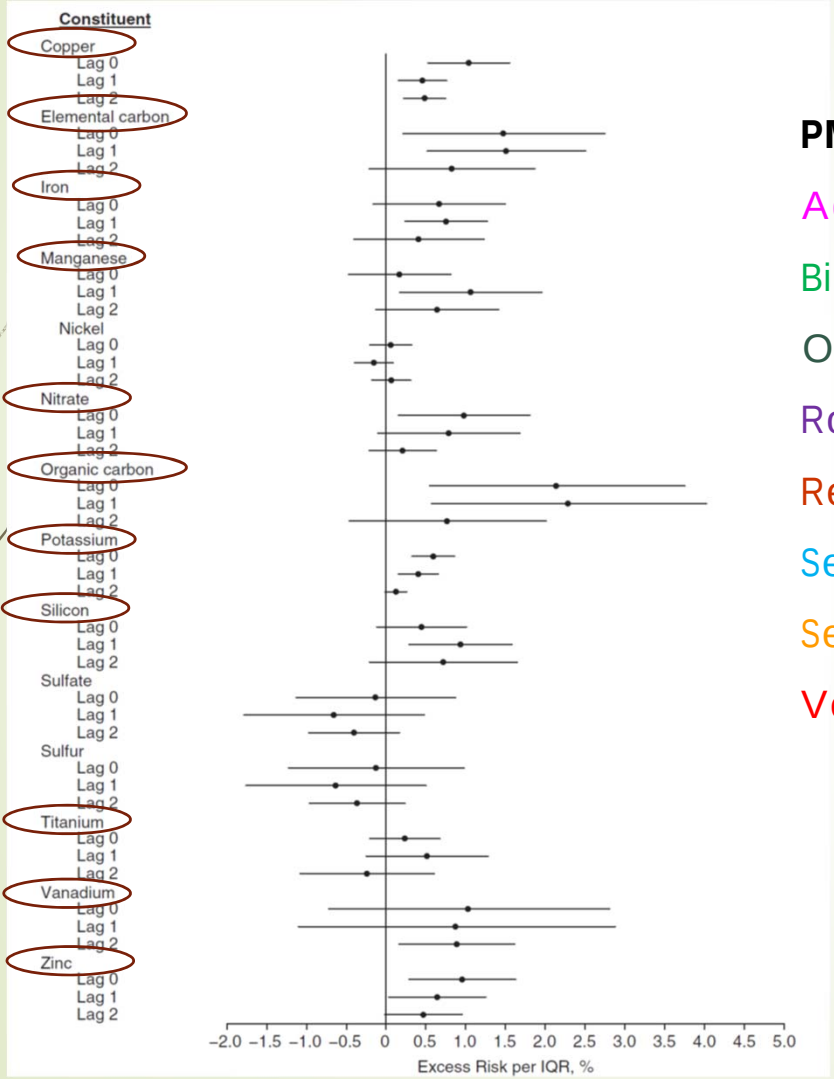
Source: Delfino et al. 2014

Short-term $PM_{2.5}$ Constituent Exposure and Cardiovascular Mortality in CA



Source: Ostro et al. 2007

Short-term $PM_{2.5}$ Constituent Exposure and Respiratory ER Visits



$PM_{2.5}$ constituents come from multiple sources:

Aged Sea Salt: Na^+, NO_3^-, $SO_4^=$

Biomass Burning: EC, OC, Na^+

Oil Combustion: EC, Na^+, OC,

Road Dust: Al, Si, Zn

Resuspended Soil: Al, Si, Fe

Secondary Ammonium Nitrate: NH_4^+, NO_3^- , $SO_4^=$

Secondary Ammonium Sulfate: NH_4^+, NO_3^-, $SO_4^=$

Vehicular Emissions: EC, OC, Zn

Source: Ostro et al. 2016

National Studies Including Results from CA

- 25 counties in US Southwest (Bell et al. 2008)
- 33 counties in US West (Bell et al. 2015)
- 75 cities across the US (Dai et al. 2014)
- 16 counties in western US (Dominici et al. 2006)
- 27 US communities throughout US (Franklin et al. 2007)
- 12 US communities in the Southwest (Krall et al. 2013)
- 108 counties in the US (Peng et al. 2008)
- 20 communities throughout the US (Zanobetti et al. 2009)
- 15 cities in the Mediterranean region of the US (Zanobetti et al. 2009)
- 121 communities throughout the US (Zanobetti et al. 2014)

* Contact each of the co-authors to attempt to get CA-specific estimates

Meta-Analysis

- Meta-Analysis is the process of combining the results from several studies examining the same association to produce an overall estimate.
  - % change, relative risk, population attributable risk, years life lost
  - Not economic evaluation (Ben MAP)

- Dependent on various aspects of the study:
  - Same type of exposure ($PM_{2.5}$, $PM_{2.5}$ constituents, etc)
  - Exposure metric (daily, lag days, etc)
  - Outcome (Mortality, Morbidity, Disease-specific, etc)
  - Effect estimate (Percent change, Relative Risk, etc)
  - Vulnerable subgroups (race/ethnicity, age, urban/rural, etc)

Summary

- Many studies found associations between background ambient short-term $PM_{2.5}$ and adverse health outcomes.
- Studies also on chemical constituents to identify toxic sources.
- Less educated, minority populations, age groups greater risks of exposure and outcomes.
- Further studies are warranted for:
  - Critical time of exposure could be more acute (i.e., peak exposures)
  - Associations outside range of observed level
- Long-term $PM_{2.5}$ health studies, including adverse birth outcomes, in CA and animal studies (not good for "real world" settings) not included here.

Acknowledgments

Director, Lauren Zeise

ACERB Branch Chief, John Faust

Air and Climate Epidemiology Section
Rachel Broadwin
Keita Ebisu
Brian Malig
Dharshani Pearson
Xiangmei (May) Wu
Shelley Green (retired)
Bart Ostro (retired)