

Public Health Benefits of Draft 2016 AQMP: Preliminary Estimates

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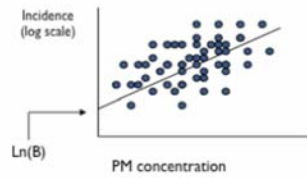
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Introduction

- Implementation of the Draft 2016 Air Quality Management Plan (AQMP) will result in improved air quality, including lower ozone and PM_{2.5} concentrations in the South Coast Air Basin.
- Epidemiological research has shown that improved air quality will result in reduced incidences of mortality and morbidity endpoints.
- As part of the Socioeconomic Analysis of the Draft 2016 AQMP, we quantify the effect of these air quality improvements on the number of incidences of these endpoints and then use valuation methods to monetize these quantified public health benefits.

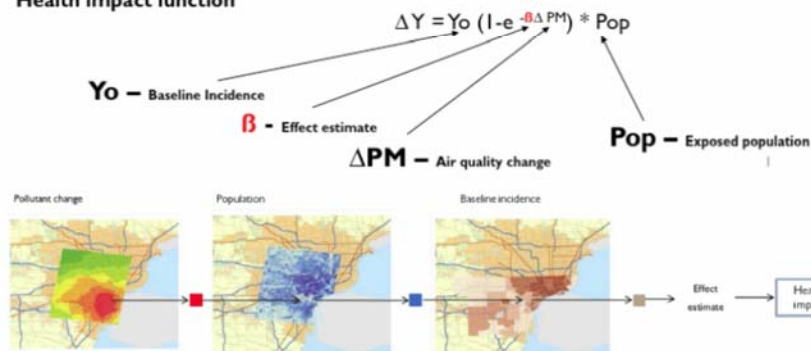
Health Impact Methodology

Epidemiology study



$$\ln(y) = \ln(B) + \beta(\text{PM})$$

Health impact function



Source: BenMAP-CE User's Manual 2015, U.S. EPA

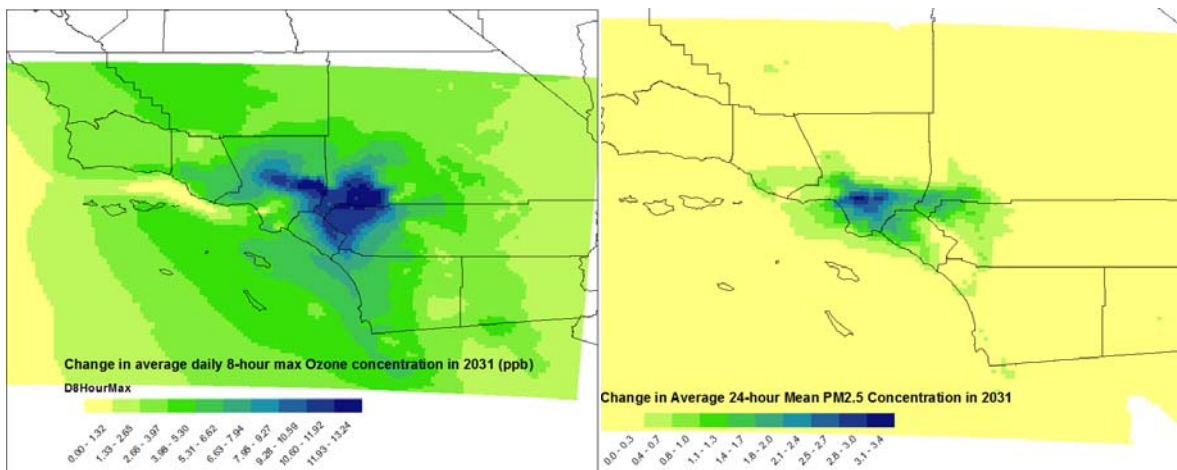
Local Data and Functions

- Projected baseline and control concentrations of PM_{2.5} and ozone for 2023 and 2031 for the South Coast Basin at 4km x 4km grid-level.
- Population forecast by age group at the 4km x 4km grid-level (from SCAG's 2016 RTP/SCS Growth Forecast)
- Baseline mortality and morbidity incidence rates by age group, by county.
- California or LA-specific C-R functions are used where feasible.
- California real income growth projections (from CA DOF).

BenMAP Tool

- The Environmental Benefits Mapping and Analysis Program (BenMAP) is a software application published by the U.S. EPA that implements a systematic method of evaluating health impacts, pooling results, and economic valuation.
- Used for 2007 & 2012 AQMPs.
- 2016 AQMP uses BenMAP-Community Edition, which is publicly available and open-source.
- A list of articles and presentations where BenMAP has been applied can be found here:
<https://www.epa.gov/benmap/benmap-ce-applications-articles-and-presentations>

Projected Air Quality Changes in 2031



Preliminary Health Impacts - Mortality

- Health impacts for mortality are based on the previous data and:
 - Ozone: Pooling of L.A.-specific NMMAPS and meta-analysis estimates from Bell et al. (2005).
 - PM_{2.5}: Pooling of Jerrett et al. (2005), Jerrett et al. (2013), and Kriging and LUR estimates from Krewski et al. (2009).
- No threshold effects assumed for either pollutant
 - IEC recommendation based on latest scientific evidence
 - U.S. EPA's practice

In the absence of substantial information in the scientific literature on alternative forms of C-R functions at low O₃ concentrations, the best estimate of the C-R function is a linear, no-threshold function.

U.S. EPA, 2014 Health Risk and Exposure Assessment for Ozone

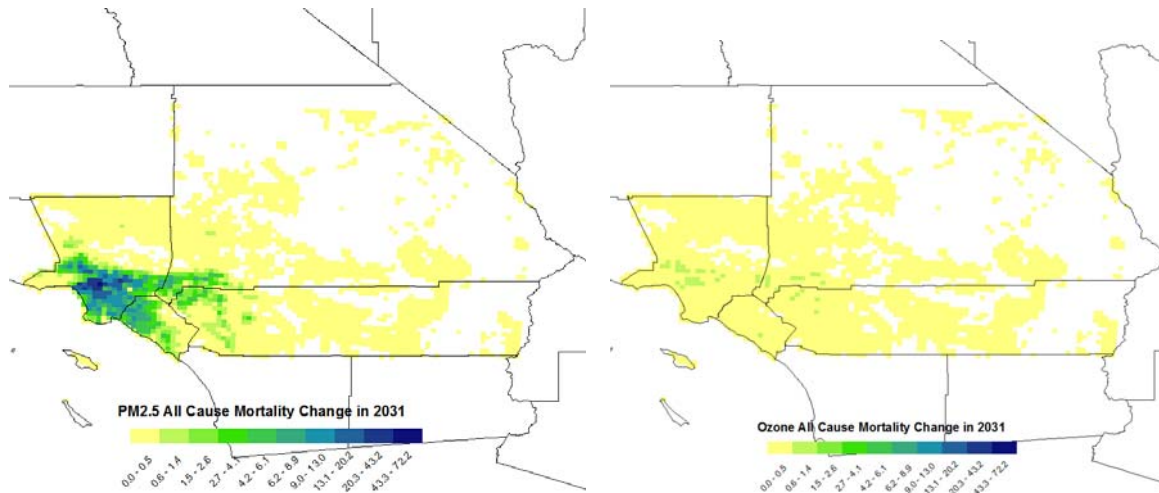
Note: Confidence intervals provided on supplementary handout.

Preliminary Health Impacts – Mortality (cont'd)

Premature Mortalities Avoided		
	2023	2031
Mortality, All Cause	2193	2563
Short-term Ozone Exposure	51	87
Los Angeles	22	40
Orange	10	14
Riverside	11	16
San Bernardino	9	15
Long-term PM_{2.5} Exposure	2111	2425
Los Angeles	1481	1707
Orange	321	356
Riverside	141	166
San Bernardino	169	197

Note: Confidence intervals provided on supplementary handout.

Preliminary Health Impacts – Mortality (cont'd)



Preliminary Health Impacts – Morbidity

Morbidity Incidence Avoided	Incidences avoided per year	
	2023	2031
Short-term Ozone Exposure		
School Loss Days, All Cause	129,616	209,276
Hospital Admissions (HA), All Respiratory	89	167
Minor Restricted Activity Days	427,964	690,235
Emergency Room Visits, Asthma	1,401	2,296
Short-term PM_{2.5} Exposure		
Minor Restricted Activity Days	908,234	984,397
Acute Bronchitis	1,766	1,941
Lower Respiratory Symptoms	20,897	22,959
Upper Respiratory Symptoms	41,730	45,953
HA, All Cardiovascular (less Myocardial Infarctions)	283	346
HA, All Respiratory HA Chronic Lung Disease (less Asthma)	234	297
HA, Ischemic Stroke	136	175
Asthma Exacerbation (Wheeze, Cough, Shortness of Breath)	39,953	43,932
HA and ED Visits Asthma	244	268
Asthma, New Onset (Wheeze)*	5,027	5,699
Work Loss Days	157,623	170,896
Acute Myocardial Infarction, Nonfatal	57	73

*Health Impact is quantified, but not valued monetarily.

Preliminary Health Benefits - Mortality

- Monetized premature mortalities avoided with Value of Statistical Life (VSL): used the recommended range of \$4.2-\$13.7 million, with a midpoint of \$9 million (2013\$).
- Applied income elasticity (ϵ_I) to VSL, a value of 1.1 is recommended, with 0 and 1.4 for sensitivity analysis.
- Included a 20-year cessation lag of PM_{2.5} mortality effects

Monetized Public Health Benefits (Billions 2015\$ per year)						
	2023			2031		
	Lower Bound (\$4.2M, $\epsilon_I=0$)	Midpoint (\$9M, $\epsilon_I=1.1$)	Upper Bound (\$13.7M, $\epsilon_I=1.4$)	Lower Bound (\$4.2M, $\epsilon_I=0$)	Midpoint (\$9M, $\epsilon_I=1.1$)	Upper Bound (\$13.7M, $\epsilon_I=1.4$)
Mortality, All Cause	\$9.1	\$26.8	\$49.4	\$10.6	\$36.7	\$70.9
Mortality - Short-term Ozone Exposure	\$0.2	\$0.6	\$1.2	\$0.4	\$1.3	\$2.4
Los Angeles	\$0.1	\$0.3	\$0.5	\$0.2	\$0.6	\$1.1
Orange	\$0.0	\$0.1	\$0.2	\$0.1	\$0.2	\$0.4
Riverside	\$0.0	\$0.1	\$0.2	\$0.1	\$0.2	\$0.5
San Bernardino	\$0.0	\$0.1	\$0.2	\$0.1	\$0.2	\$0.4
Mortality - Long-term PM_{2.5} Exposure	\$8.9	\$26.1	\$48.3	\$10.2	\$35.4	\$68.4
Los Angeles	\$6.2	\$18.3	\$33.9	\$7.2	\$24.9	\$48.2
Orange	\$1.3	\$4.0	\$7.3	\$1.5	\$5.2	\$10.0
Riverside	\$0.6	\$1.7	\$3.2	\$0.7	\$2.4	\$4.7
San Bernardino	\$0.7	\$2.1	\$3.9	\$0.8	\$2.9	\$5.5

Preliminary Health Benefits – Morbidity

- Benefits of morbidity endpoints avoided are monetized primarily based on the Cost of Illness (COI) avoided.

Monetized Morbidity Benefits (Millions of 2015\$ per year)		
Morbidity Endpoint	2023	2031
Short-term Ozone Exposure	39.3	65.0
Emergency Room Visits, Asthma	0.6	1.0
Hospital Admissions (HA), All Respiratory	1.4	2.7
Minor Restricted Activity Days	9.2	15.9
School Loss Days	28.1	45.3
Short-term PM_{2.5} Exposure	84.2	97.7
Acute Bronchitis	6.1	7.2
Acute Myocardial Infarction, Nonfatal	1.2	1.6
Asthma Exacerbation (Wheeze, Cough, Shortness of Breath)	1.0	1.2
HA and Emergency Department Visits, Asthma	0.4	0.5
HA, All Cardiovascular (less Myocardial Infarctions)	6.9	8.6
HA, All Respiratory	5.3	6.8
HA, Ischemic Stroke	7.9	10.1
Lower Respiratory Symptoms	0.4	0.5
Minor Restricted Activity Days	19.5	22.8
Upper Respiratory Symptoms	0.9	1.1
Work Loss Days	34.6	37.5
Total Morbidity Benefits	123.5	162.7

Preliminary Health Benefits - Total

- The preliminary total value of quantified public health benefits:

Monetized Public Health Benefits (Billions 2015\$ per year)		
	2023	2031
Mortality	\$26.8	\$36.7
Morbidity	\$0.1	\$0.2
Total	\$26.9	\$36.9

- The Draft Socioeconomic Analysis will include
 - Health impacts and monetized health benefits for all years (2017-2031), allowing for calculation of the PWV and the annual average.
 - Sensitivity tests using alternative mortality C-R functions