

4.d: Modeled Attainment Test

Introduction

For attainment demonstration, we use sophisticated air-quality modeling and present-day observations to make future-year projections. An attainment projection consists of constructing a future design value (FDV) for each monitor and projection (future) year, which we compare to the NAAQS ($150 \mu\text{g}/\text{m}^3$). If a particular FDV is smaller than the NAAQS, this would demonstrate attainment for that specific monitor and future year.

Constructing an FDV consists of calculating a baseline design value (BDV) and a relative response factor (RRF). The RRF is a function of modeling output that quantifies how much emissions are expected to increase or decrease in the future. To generate an FDV, we use the RRF as a scale factor of the BDV. In other words, the FDV is simply the product of the RRF and BDV.

PM10 Baseline Design Values

Hourly PM10 observations are taken from FRM filters spanning five monitors in three maintenance areas. These three maintenance areas essentially consist of: Salt Lake County, Utah County, and the city of Ogden. The five monitors contained therein are Ogden, Magna, Hawthorne, Lindon, and North Provo.

In the memorandum formulated by Richard M. Payton at EPA Region 8, entitled *Revised Utah PM₁₀ 24-hour Design Concentrations*, baseline design values were calculated using a top 10% distribution fit. In Table 1 (referenced as Table 6 in the memo), baseline design values are given for Ogden, Hawthorne, Magna, Lindon, and North Provo using the 2011-2014 time period.

Table 4.d.1: Baseline design values listed for each monitor.

Site	Maintenance Area	2011-2014 BDV
Ogden	Ogden City	$88.2 \mu\text{g}/\text{m}^3$
Hawthorne	Salt Lake County	$100.9 \mu\text{g}/\text{m}^3$
Magna	Salt Lake County	$70.5 \mu\text{g}/\text{m}^3$
Lindon	Utah County	$111.4 \mu\text{g}/\text{m}^3$
North Provo	Utah County	$124.4 \mu\text{g}/\text{m}^3$

Relative Response Factors

Using output from the CMAQ 4.7.1 model, we compare our base year (2011) to four future years: 2019, 2024, 2028, and 2030. These comparisons are quantified by computing RRF's. We calculate RRF's as following:

Modeled PM10 concentrations are calculated for each grid cell in our modeling domain over the 39-day wintertime 2009-2010 episode. We are interested in the nine grid cells (3x3 window) collocated with each monitor. The monitor is located in the nine-cell window's center cell. Each 3x3 window

encompasses a 144 km² area. The nine grid cell windows corresponding to each monitor are shown below:

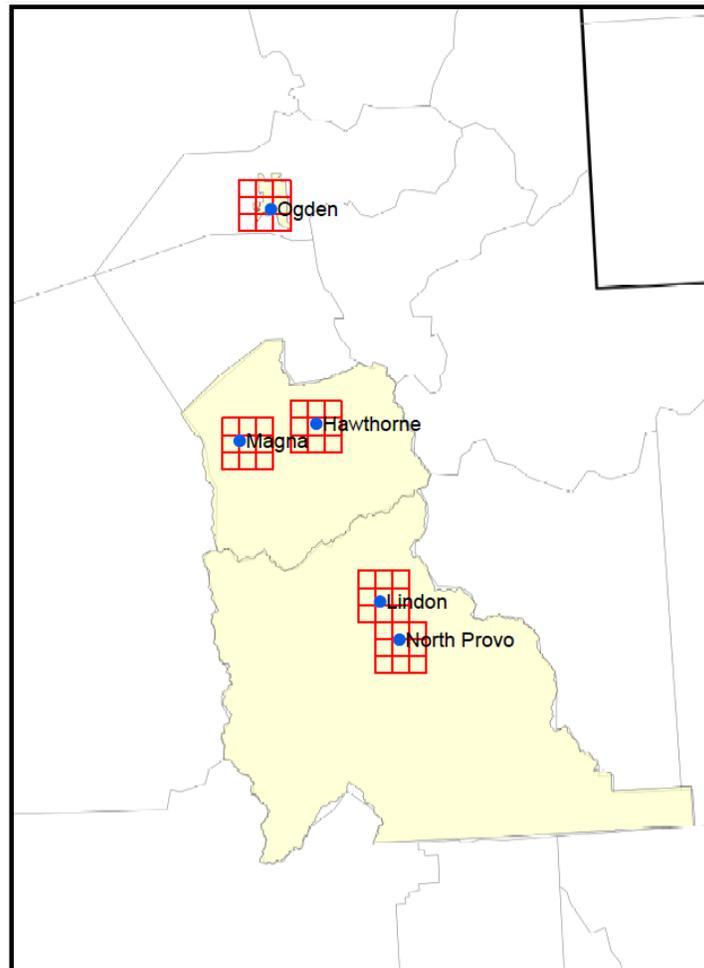


Figure 4.d.1: *PM₁₀ maintenance areas and grid-cell windows used for monitored attainment test. Beige shading illustrates PM₁₀ maintenance areas. Red lines show the nine-cell window collocated with PM₁₀ monitors. Blue dots represent location of PM₁₀ monitors.*

For every day in our 39-day episode, we take the maximum daily PM10 concentration over each nine-cell window. Then, for each monitor, we average the top 20% of these 39 values at each monitor location to formulate a modeled PM10 peak concentration value (PCV).

To calculate our RRF at each monitor, we take the ratio between future-year PCV and base-year PCV:

$$RRF = FPCV / BPCV$$

Future Design Values and Results

For each monitor, the FDV is calculated as: **FDV = RRF * BDV**. We compare these FDV's to the NAAQS in order to demonstrate attainment. The results for each monitor are shown below in Table 2.

Table 4.d.2: Baseline design values, future design values, and relative response factors (in parenthesis), for all monitors and future years. Units of design values are $\mu\text{g}/\text{m}^3$, while RRF's are dimensionless.

Monitor	NA Area	2011 BDV	2019 FDV	2024 FDV	2028 FDV	2030 FDV
Ogden	Ogden City	88.2	92.6 (1.05)	91.7 (1.04)	91.7 (1.04)	92.6 (1.05)
Hawthorne	Salt Lake County	100.9	110.0 (1.09)	110.0 (1.09)	112.0 (1.11)	113.0 (1.12)
Magna	Salt Lake County	70.5	80.4 (1.14)	79.7 (1.13)	80.4 (1.14)	81.1 (1.15)
Lindon	Utah County	111.4	129.2 (1.16)	124.8 (1.12)	127.0 (1.14)	129.2 (1.16)
North Provo	Utah County	124.4	143.1 (1.15)	139.3 (1.12)	140.6 (1.13)	143.1 (1.15)

For all future-years and monitors, no FDV exceeds the NAAQS. Therefore, we demonstrate attainment for all three maintenance areas.