



OFFICE OF AIR QUALITY PLANNING AND STANDARDS

RESEARCH TRIANGLE PARK, NC 27711

October 10, 2025

MEMORANDUM

SUBJECT: Alternative Demonstration Approach for the 1971 Secondary 3-Hour Sulfur Dioxide National Ambient Air Quality Standard under the Prevention of Significant Deterioration Program

FROM: Peter Tsirigotis, Director **PANAGIOTIS TSIRIGOTIS** Digitally signed by PANAGIOTIS TSIRIGOTIS Date: 2025.10.10 10:22:36 -04'00'

TO: Regional Air Division Directors, Regions 1-10

On December 10, 2024, the U.S. Environmental Protection Agency (EPA) revised the secondary sulfur dioxide (SO₂) National Ambient Air Quality Standard (NAAQS) to an annual average of 10 parts per billion (ppb), averaged over three consecutive years.¹ The 2024 rulemaking added a new annual secondary NAAQS in 40 CFR Part 50 without altering the 1971 secondary 3-hour SO₂ NAAQS, which remains in effect.² Under the Prevention of Significant Deterioration (PSD) program, any permit issued on or after the effective date of such SO₂ NAAQS for construction of or at a stationary source that increases SO₂ emissions in significant amounts needs to be supported by a demonstration that the increased emissions from the proposed major stationary source or major modification will not cause or contribute to violation of those standards. To help facilitate implementation of the 2024 secondary annual SO₂ NAAQS under the PSD program, the EPA developed a streamlined, alternative PSD demonstration approach, *Alternative Demonstration Approach for the 2024 Secondary Sulfur Dioxide National Ambient Air Quality Standard under the Prevention of Significant Deterioration Program*.³ Through the technical analysis conducted for the alternative PSD demonstration approach, the EPA determined that a demonstration that increased SO₂ emissions will not cause or contribute to a violation of the 2010 primary 1-hour SO₂ NAAQS can suffice to demonstrate that increased SO₂ emissions will also not cause or contribute to a violation of the 2024 secondary annual SO₂ NAAQS. Thus, permit applicants and reviewing authorities have relied on the demonstration for the 2010 primary 1-hour SO₂ NAAQS to also satisfy the demonstration requirement for the 2024 secondary annual SO₂ NAAQS, resulting in no additional burden on permit applicants.

¹ 89 FR 105692 (December 27, 2024).

² The 1971 and 2024 secondary SO₂ NAAQS and 2010 primary SO₂ NAAQS are in effect and are codified at 40 CFR 50.5, 50.21, and 50.17, respectively.

³ Memorandum from Peter Tsirigotis, EPA Office of Air Quality Planning and Standards, *Alternative Demonstration Approach for the 2024 Secondary Sulfur Dioxide National Ambient Air Quality Standard under the Prevention of Significant Deterioration Program*, December 10, 2024.

Recognizing the alternative PSD demonstration approach for the 2024 secondary annual SO₂ NAAQS and that the 1971 secondary 3-hour SO₂ NAAQS remains in effect,⁴ air permitting agencies have requested the EPA support a similar alternative PSD demonstration approach to demonstrate compliance with the 1971 secondary 3-hour SO₂ NAAQS to further streamline and reduce burden on permit applicants. To evaluate this request, the EPA conducted the attached technical analysis. Based on this technical analysis, the EPA has determined that a demonstration that increased SO₂ emissions will not cause or contribute to a violation of the 2010 primary 1-hour SO₂ NAAQS can suffice to demonstrate that increased SO₂ emissions will also not cause or contribute to a violation of the 1971 secondary 3-hour SO₂ NAAQS. Thus, permit applicants and reviewing authorities may rely on the demonstration for the 2010 primary 1-hour SO₂ NAAQS to also satisfy the demonstration requirement for the 1971 secondary 3-hour SO₂ NAAQS. This additional alternative PSD demonstration alleviates the need for permit applicants to conduct a separate PSD demonstration for the 1971 secondary 3-hour SO₂ NAAQS. Permit applicants may demonstrate compliance with the 2010 primary 1-hour SO₂ NAAQS to satisfy the demonstration requirement of all three current SO₂ NAAQS (1971 secondary 3-hour SO₂ NAAQS, 2010 primary 1-hour SO₂ NAAQS, and 2024 secondary annual SO₂ NAAQS).

Permit applicants and reviewing authorities are not required to follow this alternative PSD demonstration approach but may choose to do so based on this memorandum and the attached technical analysis. The alternative PSD demonstration approach for the 1971 secondary 3-hour SO₂ NAAQS described in this memorandum and the attached technical analysis is not final agency action and does not create any binding requirements on permitting authorities, permit applicants, or the public.

BACKGROUND

The statutory requirements for a PSD permit program set forth under part C of title I of the Clean Air Act (CAA) (sections 160 through 169) are implemented through the EPA's PSD regulations found at 40 CFR 51.166 (minimum requirements for an approvable PSD State Implementation Plan) and 40 CFR 52.21 (PSD permitting program for permits issued under the EPA's Federal permitting authority). Among other things, the PSD program requires that new or modified stationary sources complete a demonstration using air quality modeling or other methods to show that their proposed emissions increases will not cause or contribute to a violation of any NAAQS that is in effect at the time the final permit is issued. Accordingly, PSD permits require such a demonstration for the 2010 primary 1-hour SO₂ NAAQS, the 1971 secondary 3-hour SO₂ NAAQS, and the 2024 secondary annual SO₂ NAAQS if the proposed source or modification for which the permit is required is projected to increase SO₂ emissions by a significant amount.⁵ Under 40 CFR 51.166(l)(1) and 40 CFR 52.21(l)(1), all applications of air quality modeling for purposes of determining whether a new or modified source will cause or contribute to a NAAQS violation must be based upon air quality models specified in appendix W to 40 CFR part 51.

Under section 9.2.3 of appendix W, the EPA recommends a multi-stage approach to making the required demonstration that increased emissions will not cause or contribute to a violation of the

⁴ See 36 FR 8186 (April 30, 1971) and 40 CFR 50.5.

⁵ See CAA section 165(a)(3)(B), 40 CFR 51.166(k) and (m), and 40 CFR 52.21(k) and (m).

NAAQS. The first stage involves a source impact analysis in which only the impact of the new or modified source is considered and the second stage involves a cumulative impact analysis that considers all sources affecting the air quality in the area. A value representing the level of impact that would cause or contribute to a violation, often called a significant impact level (SIL), may be used in the first and second stages of the demonstration to determine whether the proposed emissions increase would cause or contribute to a violation.

The EPA's regulations specify air quality models and requirements for applying such models to make this demonstration for the 1971 secondary 3-hour SO₂ NAAQS. The EPA has also provided recommendations in regulations and guidance memoranda that permit applicants and reviewing authorities may follow to make this demonstration. The American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD), the required regulatory dispersion model, can generate outputs consistent with the form of the 1971 secondary 3-hour SO₂ NAAQS.⁶ When a cumulative impact analysis is necessary to make the required demonstration for the 1971 secondary 3-hour SO₂ NAAQS, permit applicants and reviewing authorities have also relied on existing monitoring data to adequately represent background concentrations of SO₂. Though existing resources are available for permit applicants and reviewing authorities to satisfy the requirement of demonstrating compliance with the 1971 secondary 3-hour SO₂ NAAQS, the EPA is providing an alternative PSD demonstration approach to streamline and reduce the burden of this required demonstration.

ALTERNATIVE PSD DEMONSTRATION APPROACH

This memorandum, with attached technical analysis, supports the use of an alternative demonstration approach that permit applicants and reviewing authorities may rely on to support PSD air quality demonstration requirements for the 1971 secondary 3-hour SO₂ NAAQS. As described in detail in the attachment, the EPA conducted a two-pronged technical analysis of the relationships between the 1971 secondary 3-hour SO₂ NAAQS and the 2010 primary 1-hour SO₂ NAAQS and determined that there is sufficient evidence that a demonstration in which increased emissions will not cause or contribute to a violation of the 2010 primary 1-hour SO₂ NAAQS serves as a suitable alternative for demonstrating those same emissions will not cause or contribute to a violation of the 1971 secondary 3-hour SO₂ NAAQS. As such, the EPA supports sources undergoing PSD review for SO₂ relying on their analysis demonstrating that increased emissions will not cause or contribute to a violation of the 2010 primary 1-hour SO₂ NAAQS to also demonstrate that those emissions will not cause or contribute to a violation of the 1971 secondary 3-hour SO₂ NAAQS. This technically-justified surrogate approach avoids the need for separate SO₂ impact analysis demonstrations for the primary and secondary SO₂ standards. This alternative PSD demonstration approach thus serves to streamline air quality analyses in a manner consistent with the CAA and PSD regulations.

If the recommended alternative demonstration approach is used to make a required demonstration for the 1971 secondary 3-hour SO₂ standard in PSD permit applications, this memorandum may be cited, and the findings associated with the alternative demonstration approach should be included as part of the permit record. Within parameters set forth in applicable regulations, permitting authorities have

⁶ The 1971 secondary 3-hour SO₂ NAAQS is 0.5 parts per million, not to be exceeded more than once per calendar year. See 40 CFR 50.5.

the discretion to accept different demonstration approaches in the review of individual permit applications, provided the reviewing authority is satisfied that such approach demonstrates that the proposed emissions increases will not cause or contribute to a violation of the NAAQS.

Please share this memorandum and the attached technical analysis with the PSD reviewing authorities in your Region. If you have questions regarding the memorandum, please contact Rochelle King at *king.rochelle@epa.gov* or (919) 541-1390. If you have questions regarding the technical demonstration document, please contact Tyler Fox at *fox.tyler@epa.gov* or (919) 541-5562.

Attachment

cc: Tyler Fox, Group Leader, Air Quality Modeling Group
Rochelle King, Group Leader, New Source Review Group
Scott Mathias, Division Director, Air Quality Policy Division
Karen Wesson, Division Director, Air Quality Assessment Division

Attachment

Technical Analysis to Support Alternative Demonstration Approach for the 1971 Secondary 3-Hour Sulfur Dioxide National Ambient Air Quality Standard under the Prevention of Significant Deterioration Program

BACKGROUND

To support consideration of an alternative demonstration approach that could be used by Prevention of Significant Deterioration (PSD) permit applicants to satisfy the requirement of demonstrating compliance with the 1971 secondary 3-hour sulfur dioxide (SO₂) National Ambient Air Quality Standard (NAAQS), the EPA conducted a two-pronged technical analysis of the relationships between the 1971 secondary 3-hour NAAQS and the 2010 primary 1-hour SO₂ NAAQS. The first prong of the analysis addresses aspects of a PSD source impact analysis by evaluating whether an individual source's impact resulting in a small increase in 1-hour SO₂ concentration, as defined by the significant impact level (SIL) for the 2010 primary 1-hour SO₂ NAAQS, would produce a comparably small increase in the 1971 secondary 3-hour SO₂ design concentration. This analysis includes modeled estimates of SO₂ for a range of source types and scenarios. The analysis indicates that small increases in 1-hour SO₂ concentrations caused by individual sources produce similarly small changes in the 3-hour SO₂ concentrations. The second prong of the analysis addresses aspects of a PSD cumulative impact analysis indicating that a demonstration showing attainment of the 2010 primary 1-hour SO₂ NAAQS is expected to also show attainment of the 1971 secondary 3-hour SO₂ NAAQS. The analysis is based on 2019 to 2024 air quality data and compares the 2010 primary 1-hour SO₂ NAAQS of 75 parts per billion (ppb), and the 1971 secondary 3-hour SO₂ NAAQS of 0.5 parts per million (ppm) (500 ppb).⁷ This analysis indicates that all monitoring sites meeting the 2010 primary 1-hour SO₂ NAAQS would also meet the 1971 secondary 3-hour SO₂ NAAQS.⁸

The EPA believes that the technical analysis described in this attachment is robust and has broad application across all areas in the U.S. The relationships shown in this attachment support relying on this alternative PSD demonstration approach because the EPA's analysis was based on the current monitoring network across the entire U.S. and a representative sample of modeled sources subject to PSD program requirements, *i.e.*, elevated and ground-level releases, urban and rural environments, and flat and complex terrain. Based on this technical analysis, there is sufficient evidence that a demonstration that increased emissions will not cause or contribute to a violation of the 2010 primary 1-hour SO₂ NAAQS serves as a suitable surrogate for demonstrating those emissions will not cause or contribute to violation of the 1971 secondary 3-hour SO₂ NAAQS under the PSD program. As such, the EPA supports sources undergoing PSD review for SO₂ relying on their analysis demonstrating that increased emissions will not cause or contribute to a violation of the 2010 primary 1-hour SO₂ NAAQS.

⁷ The 1971 secondary 3-hour SO₂ NAAQS is 0.5 ppm. Much of the technical analysis is shown in terms of ppb for purposes of comparison.

⁸ Since our focus was on anthropogenic emissions, for this analysis, we did not include monitoring sites located in Hawaii due to influences from nonanthropogenic volcanic emissions. Yet had we included those sites where there is a notable contribution of nonanthropogenic volcanic emissions, our results and overall conclusions would not have changed.

to also demonstrate that those emissions will not cause or contribute to a violation of the 1971 secondary 3-hour SO₂ NAAQS.

TECHNICAL ANALYSIS

This section examines use of a demonstration that increased emissions will not cause or contribute to a violation of the 2010 primary 1-hour SO₂ NAAQS as a surrogate for demonstrating such emissions will not cause or contribute to a violation of the 1971 secondary 3-hour SO₂ NAAQS of 0.5 ppm (500 ppb) in the context of two aspects of the PSD program. First, in context of a source impact analysis, we examine whether an air quality impact at the SIL for the 2010 primary 1-hour SO₂ NAAQS would correspond to a comparably small value for 3-hour SO₂ concentrations. A SIL may be used in PSD applications for determining whether a proposed source's impact on air quality is considered significant. If a proposed source's impact exceeds the SIL, then a cumulative impact analysis would be needed for that proposed source to determine if its emissions will cause or contribute to potential NAAQS violations. The second aspect of the technical basis, in context of a cumulative impact analysis, focuses on whether area-specific NAAQS compliance would be similar under the 1971 secondary 3-hour SO₂ NAAQS as under the 2010 primary 1-hour SO₂ NAAQS.

A Small Increase in 1-hour SO₂ Concentration Produces a Comparably Small Increase in 3-hour SO₂ Concentration

For a source impact analysis under the 2010 primary 1-hour SO₂ NAAQS to be suitable for demonstrating emissions will not cause a violation of the 1971 secondary 3-hour SO₂ NAAQS, a small increase in a modeled 1-hour SO₂ concentration, as defined by the applicable SIL value, should produce a comparably small increase in a modeled 3-hour averaged SO₂ concentration. In this analysis, the small increase in a 3-hour SO₂ design concentration is determined by the increase in emissions that would correspond to the level of the 1-hour SO₂ SIL of 3 ppb as recommended in EPA guidance.⁹ This 1-hour SO₂ SIL of 3 ppb or 7.86 micrograms per cubic meter (µg/m³) is equal to 4 percent of the primary 1-hour SO₂ NAAQS of 75 ppb. The EPA's view is that a PSD permit applicant that demonstrates the increase in the 1-hour SO₂ design concentration resulting from an increase in that new or modifying source's emissions will be less than or equal to the 1-hour SIL value can conclude, in most cases, that this increase in emissions will not cause or contribute to a violation of the 2010 primary 1-hour SO₂ NAAQS.¹⁰

To demonstrate the association between the 2010 primary 1-hour SO₂ NAAQS and the 1971 secondary 3-hour SO₂ NAAQS of 0.5 ppm (500 ppb), dispersion modeling was performed using the EPA's American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD). AERMOD is the EPA's preferred dispersion model for predicting ground-level pollutant concentrations in the nearfield (≤ 50 km) since its promulgation in 2005 into the EPA's *Guideline on Air Quality Models*, commonly referred to as the *Guideline* (appendix W to 40 CFR Part 51). AERMOD is the primary air

⁹ Memorandum from Stephen D. Page, EPA OAQPS, to EPA Regional Air Division Directors, *Guidance Concerning the Implementation of the 1-hour SO₂ NAAQS for the Prevention of Significant Deterioration Program*, August 23, 2010.

¹⁰ *Id.*

quality model used in the PSD program for new or modifying sources and has been used extensively in the implementation of the 2010 primary 1-hour SO₂ NAAQS.

To demonstrate the association of a small increase in the 1-hour SO₂ design concentration with a small increase in the 3-hour SO₂ design concentration, existing AERMOD dispersion modeling performed for the Risk and Exposure Assessment (REA)¹¹ during the most recent review of the 2010 primary 1-hour SO₂ NAAQS was adapted. The REA modeling assessment includes a variety of industrial source types in different areas across the U.S. Three sites were modeled that include a total of 11 industrial facilities within the following industrial sectors: electric generation, wastewater treatment, engine manufacturing, chemical manufacturing, battery recycling, glass manufacturing, and oil and gas refinement. Table 1 lists the study areas and the industrial sources in each area that were included in the REA modeling. The REA modeling for each source listed in Table 1 was adapted and remodeled for the technical analysis herein over the 3-year period of 2011-2013.¹² Adaptations to the REA modeling are discussed later in this section. Figure 1 through Figure 3, taken from the referenced REA, show the locations of the modeling domains for each study area and the location of each facility.

Table 1. Study Areas and Industrial Sources (Types) Modeled

Study Area	Facility Name	NEI ID
Fall River, MA	Brayton Point Energy (EGU ¹³)	5058411
Indianapolis, IN	Belmont Advanced Wastewater Treatment Plant (water treatment)	4885211
	Citizens Thermal (EGU)	4885311
	Indianapolis Power & Light Co. (IPL) – Harding Street Generation Station (EGU)	7255211
		7972011
	Rolls Royce Corporation (combustion engine manufacture)	7972111
	Vertellus Specialties (chemical manufacturing)	8235411
Tulsa, OK	Quemetco (lead battery recycling)	
	Public Service Co. of Oklahoma (PSO) – Northeastern Power Station (EGU)	8212411
	Sapulpa Glass Plant (glass manufacturing)	7320611
	Tulsa Refinery West (oil/gas refinery)	8402711
	Tulsa Refinery East (oil/gas refinery)	8003911

¹¹ Risk and Exposure Assessment for the Review of the Primary National Ambient Air Quality Standard for Sulfur Oxides. EPA-452/R-18-003. May 2018.

¹² Refer to the referenced REA for descriptions of the areas, sources, and model setup performed for the REA, such as the emissions and meteorological data that were used.

¹³ EGU = Electric generating unit.

Fall River, MA

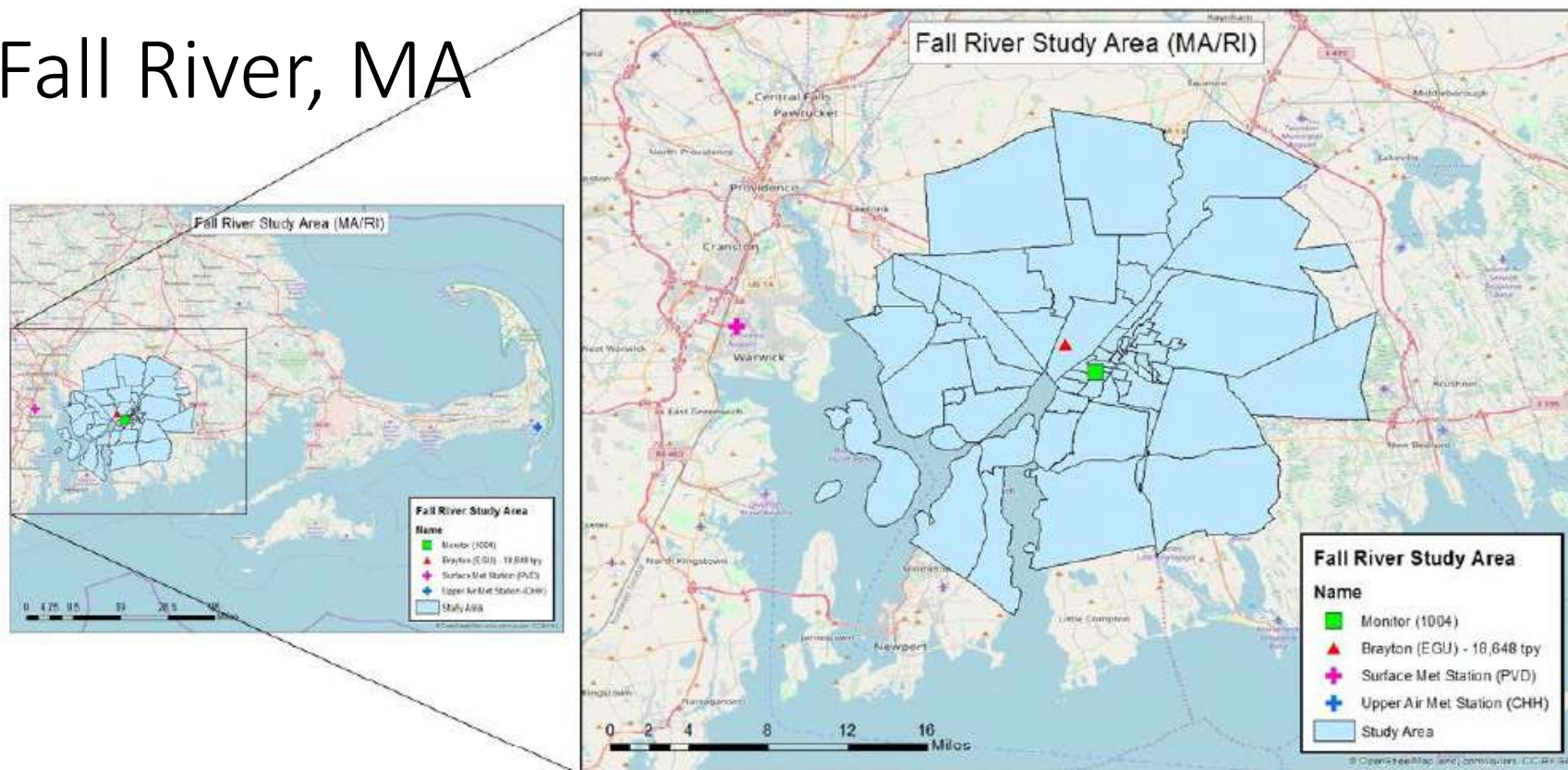


Figure 1. Fall River, MA Study Area and Modeling Domain

From Risk and Exposure Assessment for the Review of the Primary National Ambient Air Quality Standard for Sulfur Oxides, EPA-452/R-18-003, May 2018.

Indianapolis, IN

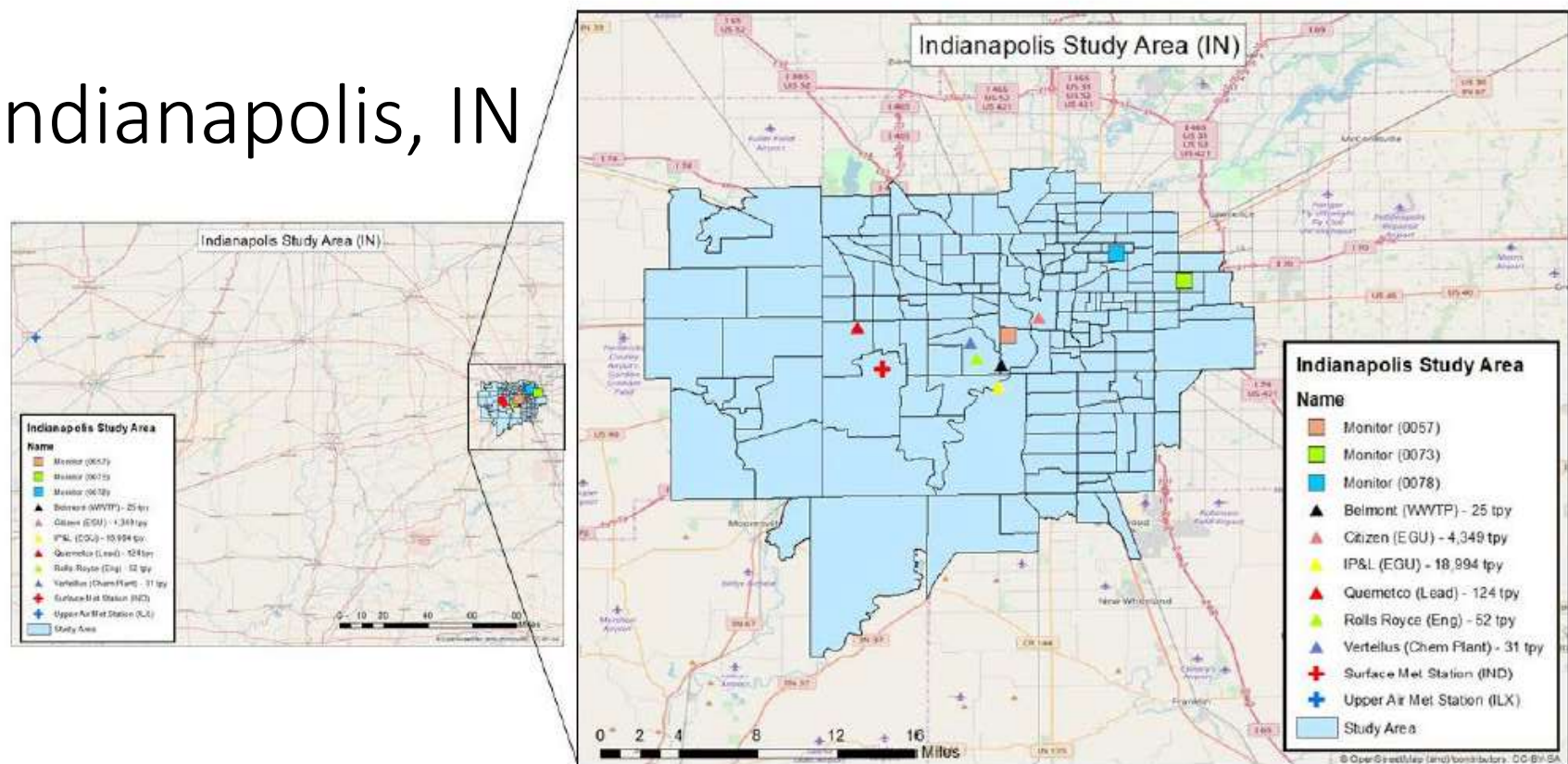


Figure 2. Indianapolis, IN Study Area and Modeling Domain

From Risk and Exposure Assessment for the Review of the Primary National Ambient Air Quality Standard for Sulfur Oxides, EPA-452/R-18-003, May 2018.

Tulsa, OK

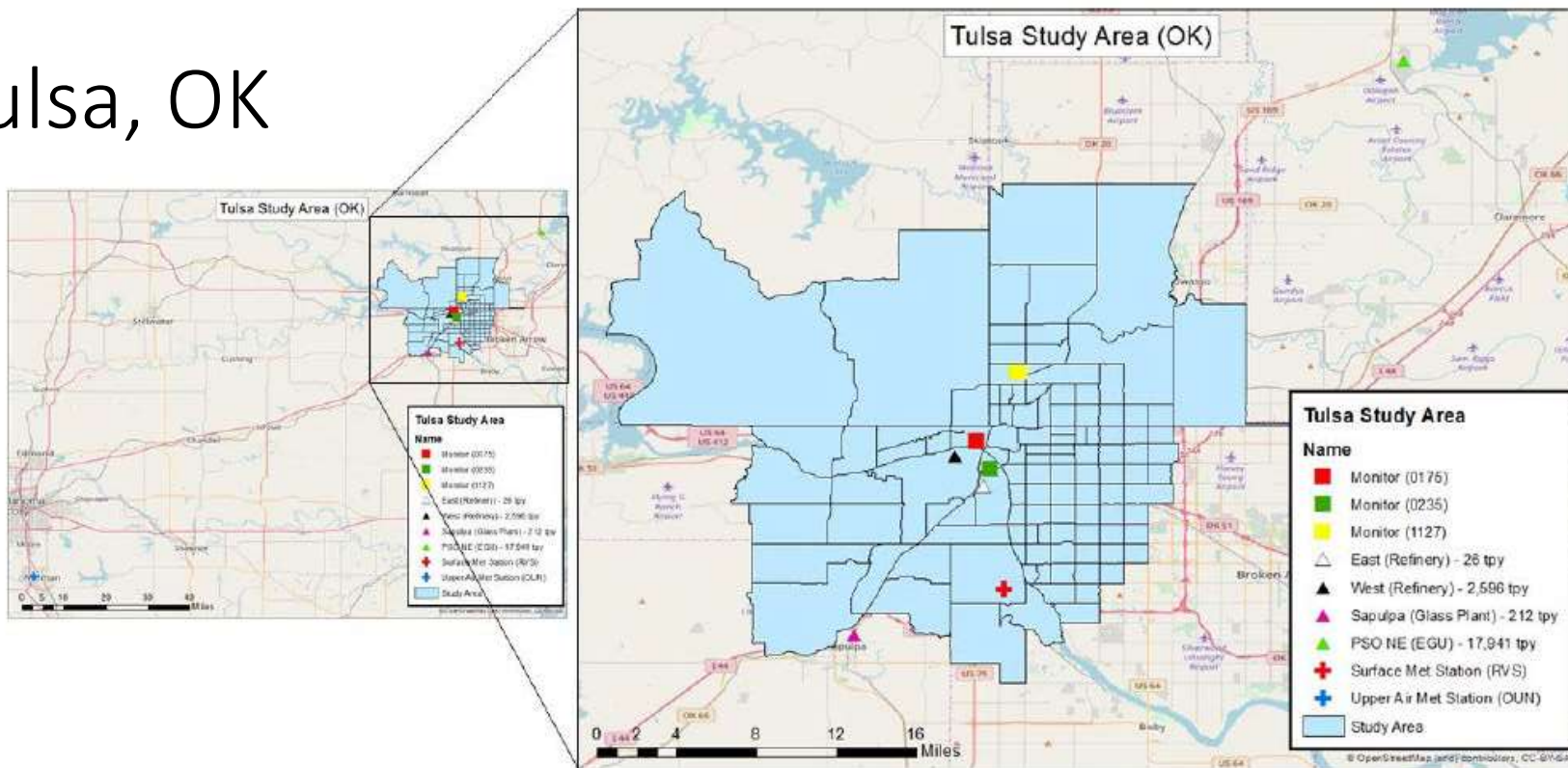


Figure 3. Tulsa, OK Study Area and Modeling Domain

From Risk and Exposure Assessment for the Review of the Primary National Ambient Air Quality Standard for Sulfur Oxides, EPA-452/R-18-003, May 2018.

For the technical analysis herein, each facility in Table 1 was modeled separately from all others to observe the increase in ground-level 3-hour SO₂ concentrations associated with that facility's emissions increase that yields a small increase in the 1-hour concentrations. In addition, three of the sources within the Indianapolis area—IPL Harding Street Generating Station, Vertellus Specialties, and Quemetco—were also modeled as though they were in the Fall River area to observe the change in the 3-hour design concentrations in a different topographical and meteorological environment. Note that the relative locations of the release points of these three facilities when modeled in the Fall River environment were not maintained. Rather, the source characteristics of the Fall River Brayton facility were replaced with the source characteristics of the Indianapolis sources. Because Vertellus and Quemetco are relatively small sources, they were modeled together as a single source in the Fall River area while the IPL facility was modeled separately. Background concentrations were not included in this modeling demonstration so that emission rates and concentrations could be scaled as needed. Two of the sources in Tulsa, OK—PSO Northeastern Power Station and the Sapulpa Glass Plant—are located outside of the receptor grid used for the REA modeling. For the technical analysis herein, the receptor grid for each of these sources was extended to ensure the area of maximum concentration would be captured in the modeling for these sources.

The original REA modeling for each facility listed in Table 1 was adapted and modeled as follows:

1. Variable emissions rates (*e.g.*, hourly, monthly) used in the REA modeling were averaged for each emission point separately for each year, resulting in a single constant year-specific emission rate for each emission point within each source (*i.e.*, a constant emission rate was used each year for each emission point, and emission rates only varied by emission point and year).
2. Each facility was modeled for each of the three years to get a base 3-hour design concentration in the form of the 1971 secondary 3-hour SO₂ NAAQS of 0.5 ppm (500 ppb) not to be exceeded more than once per year. The 3-hour design concentration used for comparison is the maximum of the second highest 3-hour average from each of the three years modeled (*i.e.*, the maximum of the individual design concentrations from each year modeled).
3. Each facility was modeled to get a 1-hour concentration to compare to the EPA-recommended 1-hour SO₂ SIL value of 3 ppb (7.86 µg/m³). The 1-hour concentration for comparison to the SIL was computed as the maximum of the 3-year average of the highest 1-hour concentrations, across all receptors.
4. For each facility, the ratio of the 1-hour result from #3 to the EPA-recommended SIL concentration was computed and used to scale the 3-hour concentrations from #2 at each receptor to get the increase in the 3-hour concentrations based on the increase in emissions that would result in a modeled concentration equal to the 1-hour SIL value.
5. The increase in the 3-hour concentrations at each receptor from #4 was added to the corresponding original 3-hour concentrations to get a new 3-hour average concentration based on the emission increase.
6. An updated maximum 3-hour design concentration was then computed based on the 3-hour average concentrations computed in #5, and the difference was computed between the updated 3-hour design concentration and the original modeled design concentration from #2.

Table 2 shows the modeling results for each facility, including the average annual emissions before and after the emissions increase, the amount of the emissions increase, the maximum 3-hour design concentration before and after the emissions increase, and the amount of increase in the 3-hour design concentration as a percentage of the 1971 secondary 3-hour NAAQS (last column on the right). For all but two facilities, the amount of increase in the 3-hour design concentration is less than one-half of one percent ($< 0.5\%$) of the 1971 secondary 3-hour NAAQS of 0.5 ppm (500 ppb). The two facilities with an increase of more than 0.5% had an increase of less than one percent ($< 1\%$).

The contour plots in Figure A1 through Figure A13 in the Appendix to this document show the locations of the emission releases for each facility modeled and the amount of the increase in the 3-hour SO_2 modeled design concentration based on a small increase in the 1-hour SO_2 modeled design concentration, reflective of the 1-hour SIL value. For each facility modeled, the areas of the peak ground-level SO_2 concentrations and where the increase in the modeled 3-hour design concentrations are the greatest occurs very near to the facility, within about 2-3 kilometers (km) for all facilities, and less than 1 km, at or near the fence line, for many of the facilities. Thus, similar to the 2010 primary 1-hour SO_2 NAAQS, the greatest increases in the modeled 3-hour design concentrations are localized near the facility rather than some distance downwind of the facility. Overall, results in Table 2 and Figure A1 through Figure A13 in the Appendix suggest that a small increase in 1-hour SO_2 concentration produces a comparably small increase in the 3-hour SO_2 design concentration, and thereby provides support that demonstrating that increased emissions will not cause or contribute to a violation of the 2010 primary 1-hour SO_2 NAAQS is suitable also for making this demonstration for the 1971 secondary 3-hour SO_2 NAAQS under the PSD program.

Table 2. AERMOD Modeling Results for 1971 Secondary 3-hour SO₂ Design Concentration Changes by Study Area and Source Type*

Site - Facility	Annual Emissions (before increase) TPY	Emissions Increase TPY	Annual Emissions (after increase) TPY	3-hour Design Concentration (before increase) $\mu\text{g}/\text{m}^3$ (ppb)	3-hour Design Concentration (after increase) $\mu\text{g}/\text{m}^3$ (ppb)	Increase in Design Concentration $\mu\text{g}/\text{m}^3$ (ppb)	Increase as % of 3-hour Std of 0.5 ppm = 500 ppb
Fall River, MA							
- Brayton Point Energy	8,733	483	9,216	108.32 (41.36)	114.31 (43.65)	5.99 (2.29)	0.46%
- Vertellus Specialties and Quemetco**	142	9	151	149.16 (56.95)	152.50 (58.23)	3.34 (1.27)	0.25%
- Citizen's Thermal**	4,009	90	4,099	94.68 (36.15)	100.68 (38.44)	6.00 (2.29)	0.46%
Indianapolis, IN							
- Belmont Advanced Wastewater Treatment Plant	23	2	25	49.44 (18.88)	49.96 (19.07)	0.52 (0.20)	0.04%
- Citizen's Thermal	4,009	158	4,167	162.96 (62.22)	164.66 (62.87)	1.71 (0.65)	0.13%
- IPL - Harding Street Generating Station	22,837	239	23,076	812.36 (310.18)	820.88 (313.43)	8.52 (3.25)	0.65%
- Rolls Royce Corporation	42	2	44	92.31 (35.25)	93.28 (35.61)	0.97 (0.37)	0.07%
- Vertellus Specialties	27	3	30	65.18 (24.89)	65.86 (25.15)	0.68 (0.26)	0.05%
- Quemetco	115	30	145	24.33 (9.29)	24.59 (9.39)	0.26 (0.10)	0.02%
Tulsa, OK							
- PSO Northeastern Power Station	17,941	5,63	17,846	108.61 (41.47)	112.15 (42.82)	3.54 (1.35)	0.27%
- Sapulpa Gas Plant	222	41	263	33.69 (12.86)	39.88 (15.23)	6.19 (2.36)	0.47%
- Tulsa Refinery West	1,892	79	1,971	230.71 (88.09)	240.36 (91.77)	9.65 (3.69)	0.74%
- Tulsa Refinery East	24	97	121	1.36 (0.52)	6.96 (2.66)	5.59 (2.14)	0.43%
** Indianapolis, IN source releases also modeled at the Fall River, MA site.							

*The 1971 secondary 3-hour SO₂ NAAQS is 0.5 ppm while AERMOD's default output units for concentrations are in $\mu\text{g}/\text{m}^3$. To be consistent with AERMOD output, concentrations in the table above are displayed in $\mu\text{g}/\text{m}^3$ and converted to ppb rather than ppm due to the small magnitude of the values when expressed in ppm.

Monitoring Sites that Meet the 2010 Primary 1-hour SO₂ NAAQS of 75 ppb Also Meet the 1971 Secondary 3-hour SO₂ NAAQS of 0.5 ppm (500 ppb)

For a cumulative impact analysis under the 2010 primary 1-hour SO₂ NAAQS to be suitable for the 1971 secondary 3-hour SO₂ NAAQS, the areas that meet the 2010 primary 1-hour SO₂ NAAQS should also meet 3-hour concentration levels for the 1971 secondary SO₂ NAAQS. In this section, we describe an ambient data analysis for monitored areas across the U.S. that evaluates the relationship between the 2010 primary 1-hour SO₂ NAAQS of 75 ppb and the 1971 secondary 3-hour SO₂ NAAQS of 0.5 ppm (500 ppb). The analysis demonstrates that all monitoring sites that meet the 2010 primary 1-hour SO₂ NAAQS of 75 ppb also meet the 1971 secondary 3-hour SO₂ NAAQS of 0.5 ppm (500 ppb).

The analysis is summarized in the scatter plot shown in Figure 4 that compares site-level ambient SO₂ concentrations based on the 2010 primary 1-hour SO₂ NAAQS of 75 ppb and the concentration levels for the 1971 secondary 3-hour SO₂ NAAQS of 0.5 ppm (500 ppb). This figure shows that all monitoring sites that meet the 2010 primary 1-hour SO₂ NAAQS of 75 ppb also meet the 1971 secondary 3-hour SO₂ NAAQS of 0.5 ppm (500 ppb).

1971 Secondary SO₂ NAAQS vs. Current Primary SO₂ NAAQS

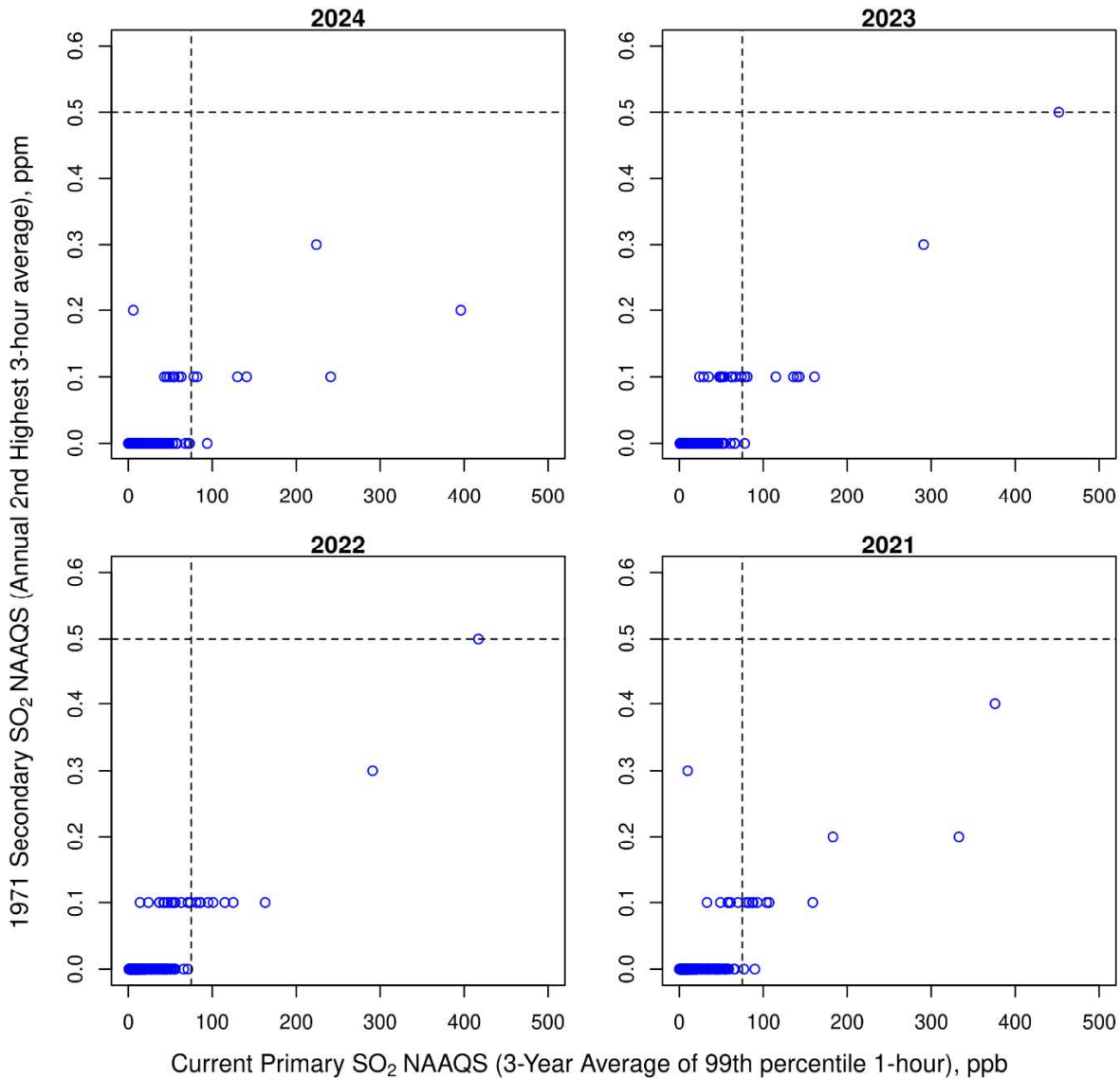


Figure 4. Scatter plots of site-level concentrations (after rounding to one decimal place) for the 1971 secondary 3-hour SO₂ NAAQS of 0.5 ppm compared to the 2010 primary 1-hour SO₂ NAAQS of 75 ppb: 2021-2024 Design Values. Year label indicates the design value period for the 1971 secondary 3-hour SO₂ NAAQS and last year in the 3-year design value period for the 2010 primary 1-hour SO₂ NAAQS, respectively.

Overall, design values based on 2019-2021 and 2022-2024 monitoring data show that sites meeting the 2010 primary 1-hour SO₂ NAAQS would also meet the 1971 secondary 3-hour SO₂ NAAQS of 0.5 ppm. Therefore, the results indicate that a cumulative impact analysis that demonstrates compliance with the 2010 primary 1-hour SO₂ NAAQS of 75 ppb is generally suitable for demonstrating compliance with the 1971 secondary 3-hour SO₂ NAAQS of 0.5 ppm for PSD applications.

APPENDIX

Contour Plots Showing Amount of Increase in Modeled Design Concentration for 1971 Secondary 3-hour SO₂ NAAQS

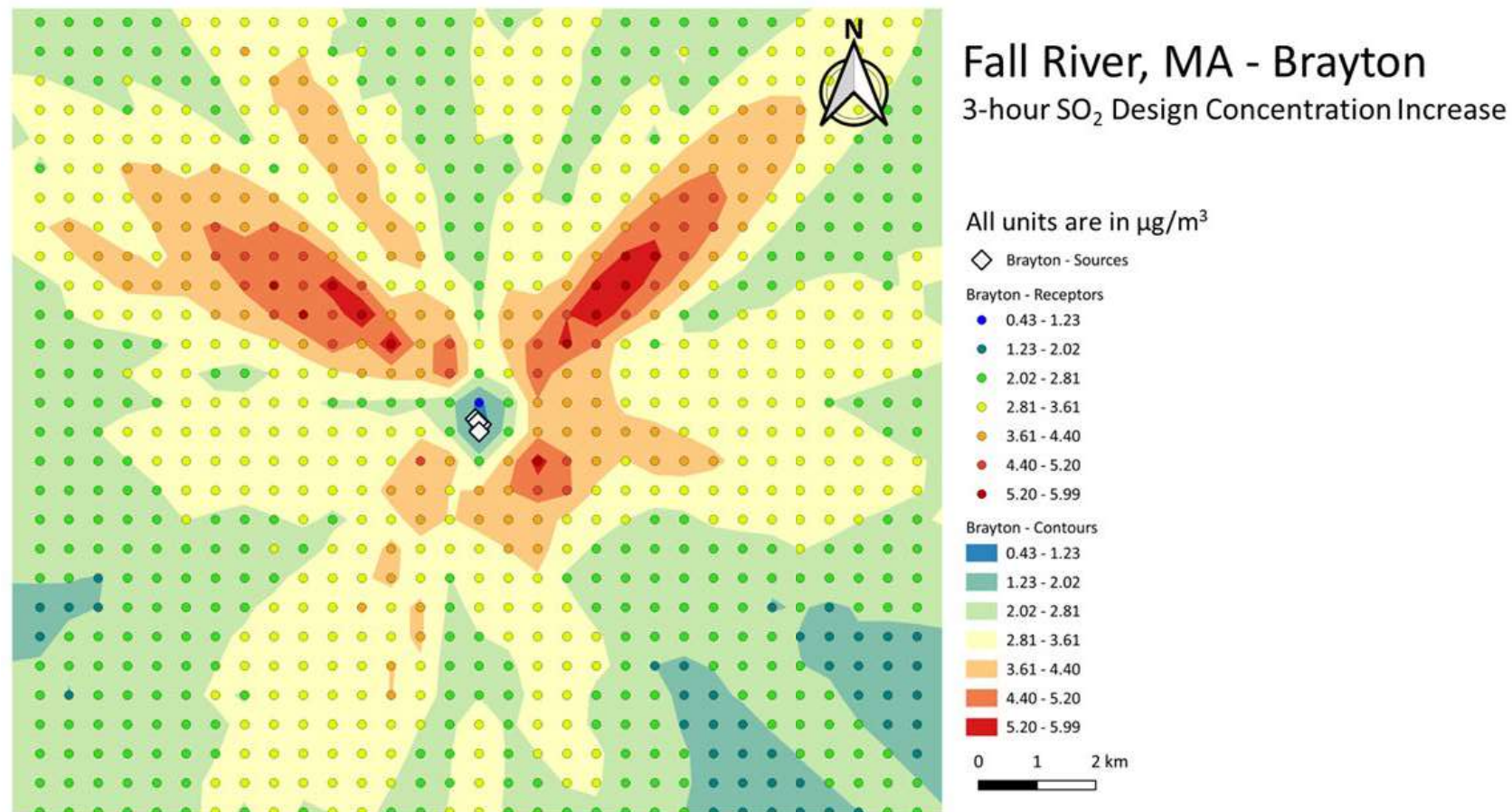


Figure A1. Increase in 1971 Secondary 3-hour SO₂ Design Concentration for Brayton Facility at Fall River, MA.

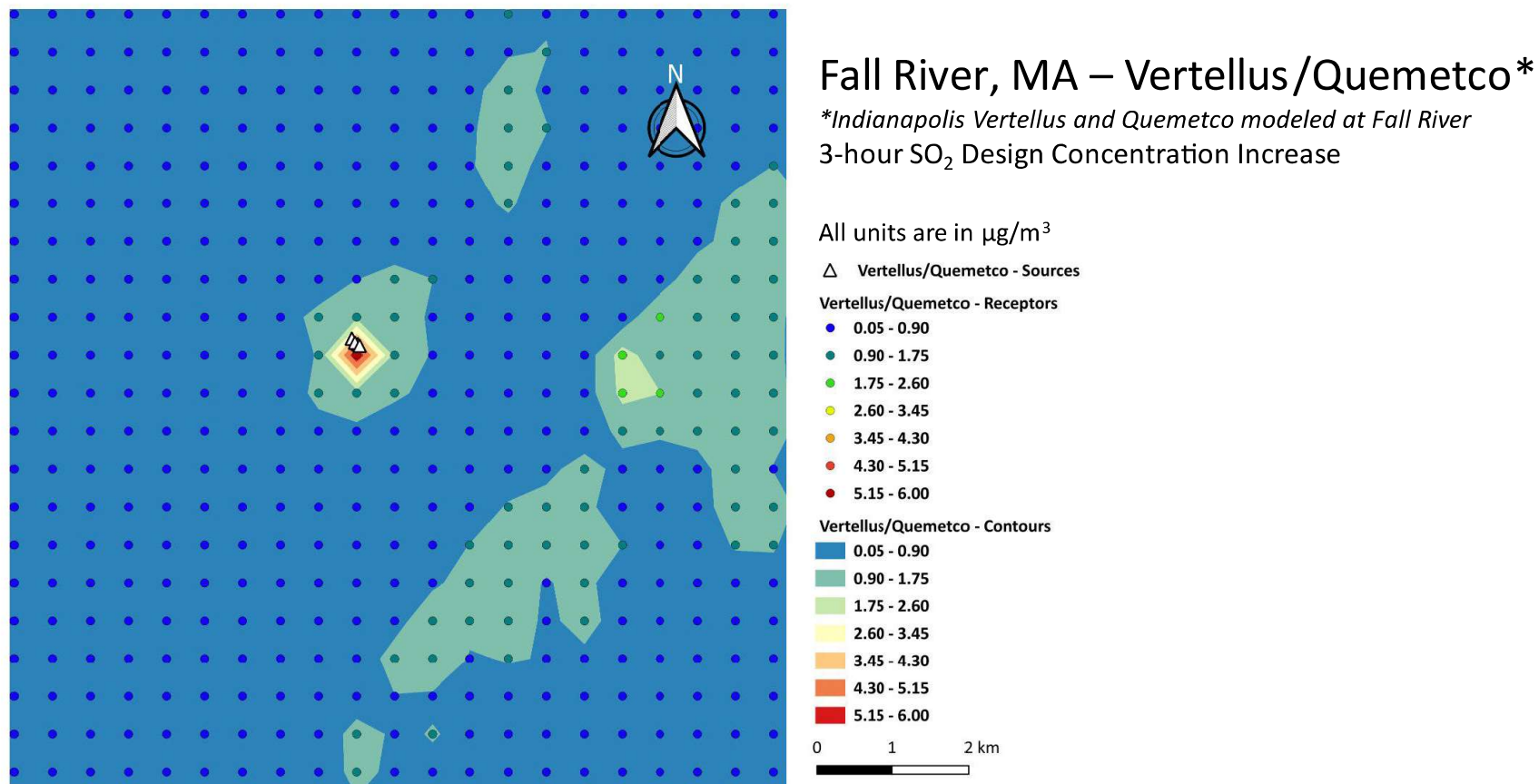
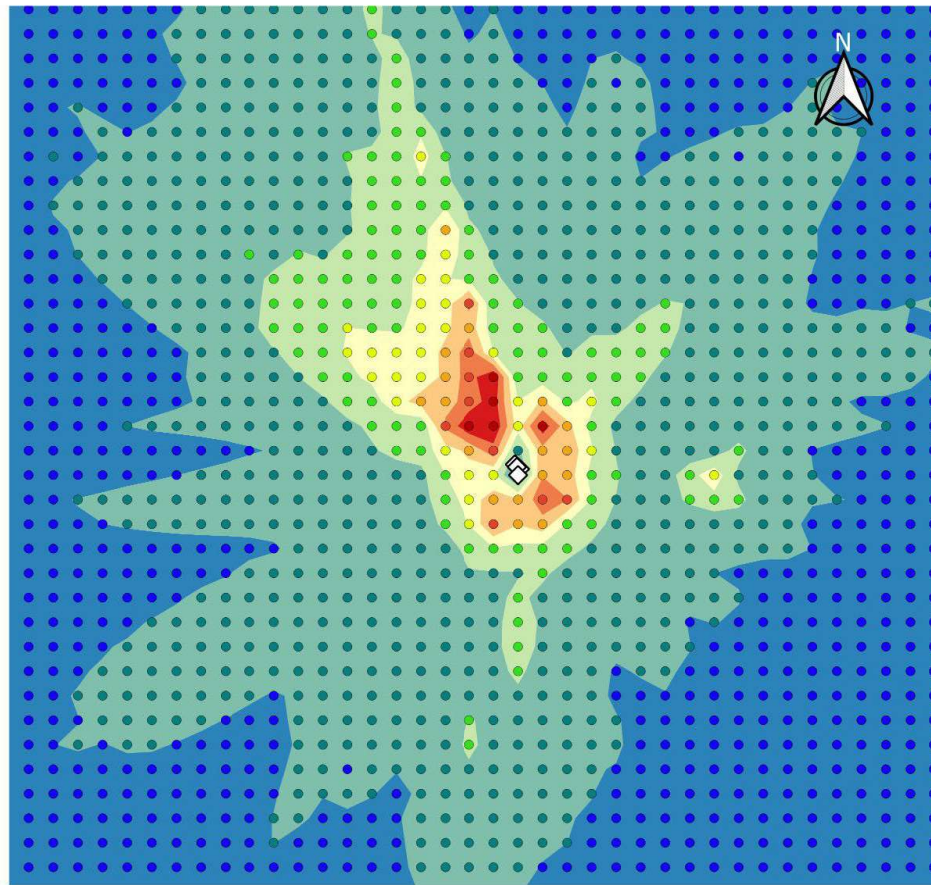


Figure A2. Increase in 1971 Secondary 3-hour SO₂ Design Concentration for Vertellus and Quemetco Sources Modeled with Fall River, MA, Terrain and Meteorology.



Fall River, MA – Citizens Thermal*

**Indianapolis Citizens Thermal modeled at Fall River*
3-hour SO₂ Design Concentration Increase

All units are in $\mu\text{g}/\text{m}^3$

◇ Citizens - Sources

Citizens - Receptors

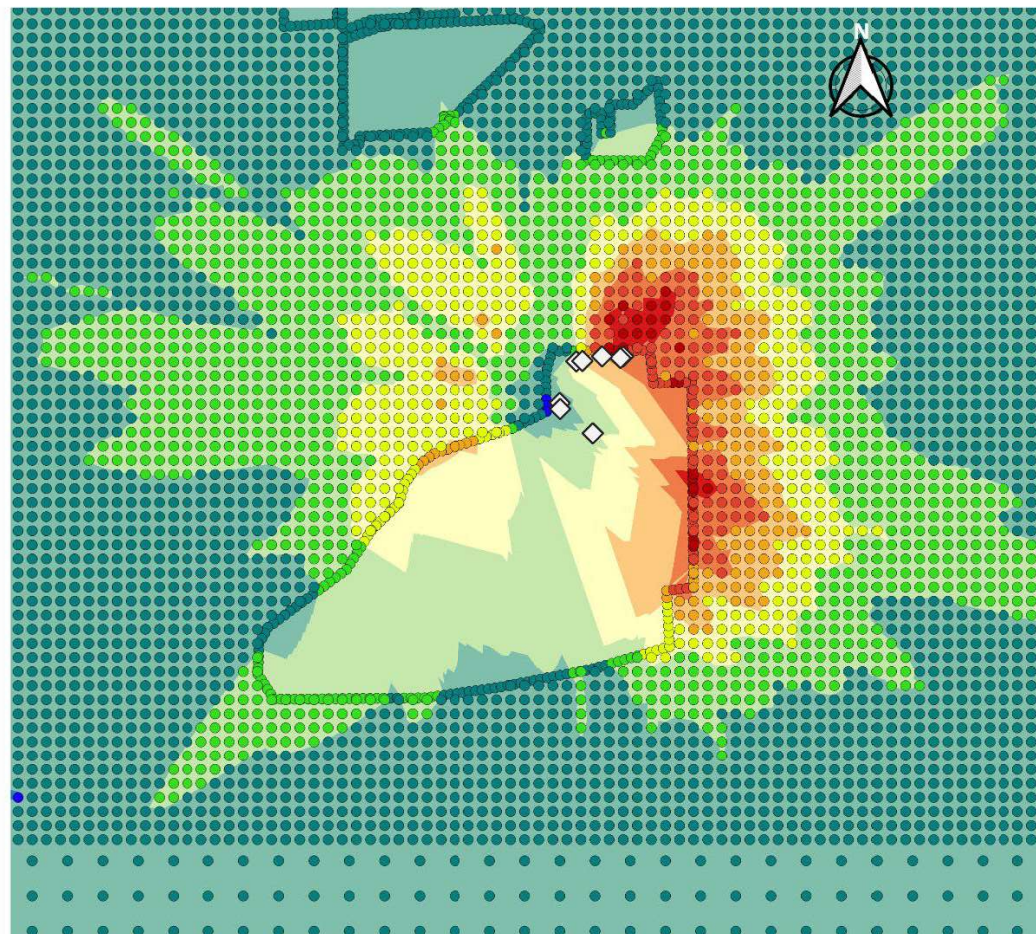
- 0.17 - 0.62
- 0.62 - 1.07
- 1.07 - 1.53
- 1.53 - 1.98
- 1.98 - 2.43
- 2.43 - 2.88
- 2.88 - 3.34

Citizens - Contours

- 0.17 - 0.62
- 0.62 - 1.07
- 1.07 - 1.53
- 1.53 - 1.98
- 1.98 - 2.43
- 2.43 - 2.88
- 2.88 - 3.34

0 1 2 km

Figure A3. Increase in 1971 Secondary 3-hour SO₂ Design Concentration for Citizens Thermal Sources Modeled with Fall River, MA, Terrain and Meteorology.



Indianapolis, IN - IPL

3-hour SO_2 Design Concentration Increase

All units are in $\mu\text{g}/\text{m}^3$

◇ IPL - Sources

IPL - Receptors

● 0.26 - 1.44

● 1.44 - 2.62

● 2.62 - 3.80

● 3.80 - 4.98

● 4.98 - 6.16

● 6.16 - 7.34

● 7.34 - 8.52

IPL - Contours

■ 0.26 - 1.44

■ 1.44 - 2.62

■ 2.62 - 3.80

■ 3.80 - 4.98

■ 4.98 - 6.16

■ 6.16 - 7.34

■ 7.34 - 8.52

0 0.5 1 km

Figure A4. Increase in 1971 Secondary 3-hour SO_2 Design Concentration for IPL – Harding Street Generating Station in Indianapolis, IN.

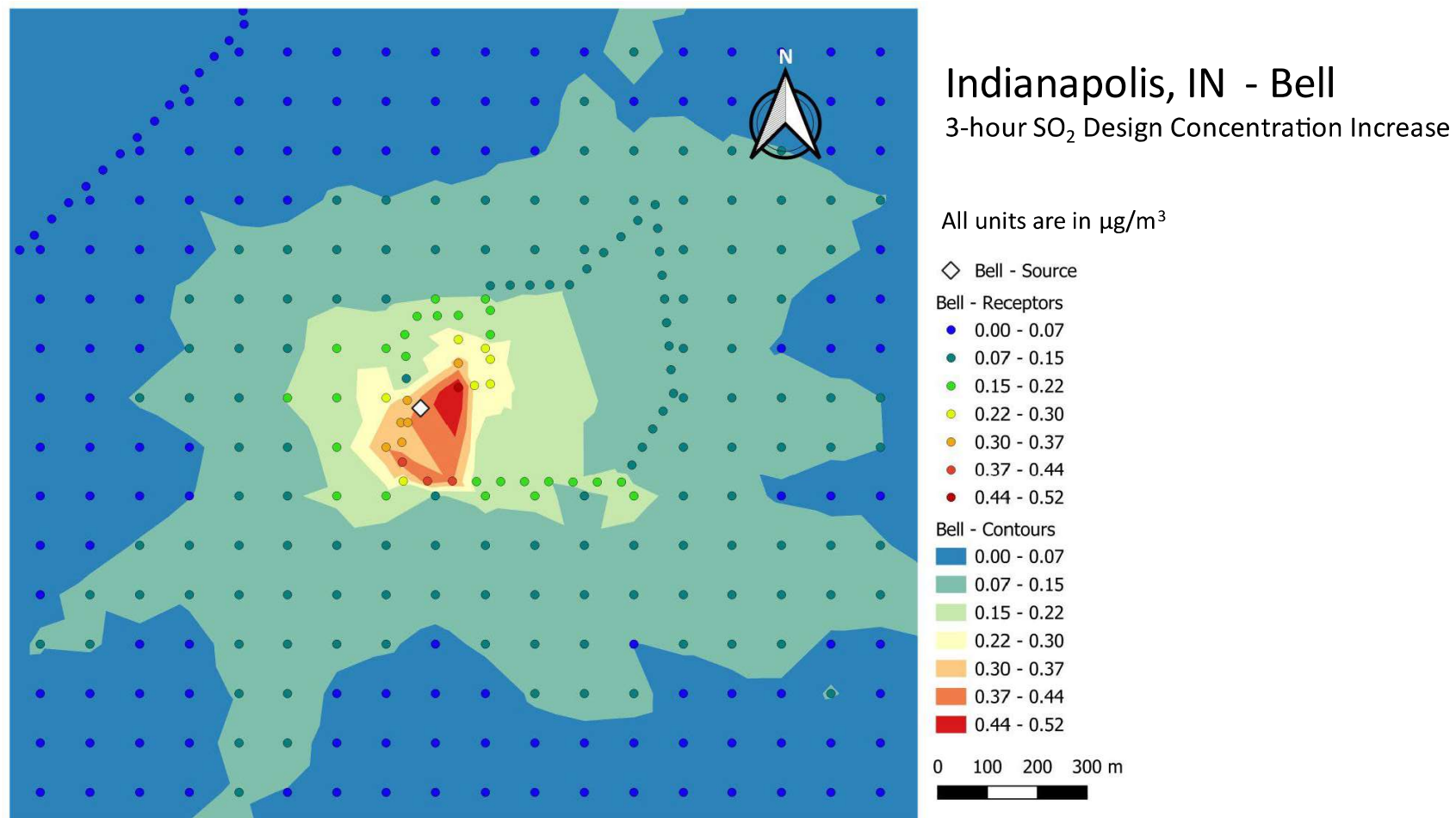


Figure A5. Increase in 1971 Secondary 3-hour SO₂ Design Concentration for Belmont Advanced Wastewater Treatment Facility in Indianapolis, IN.

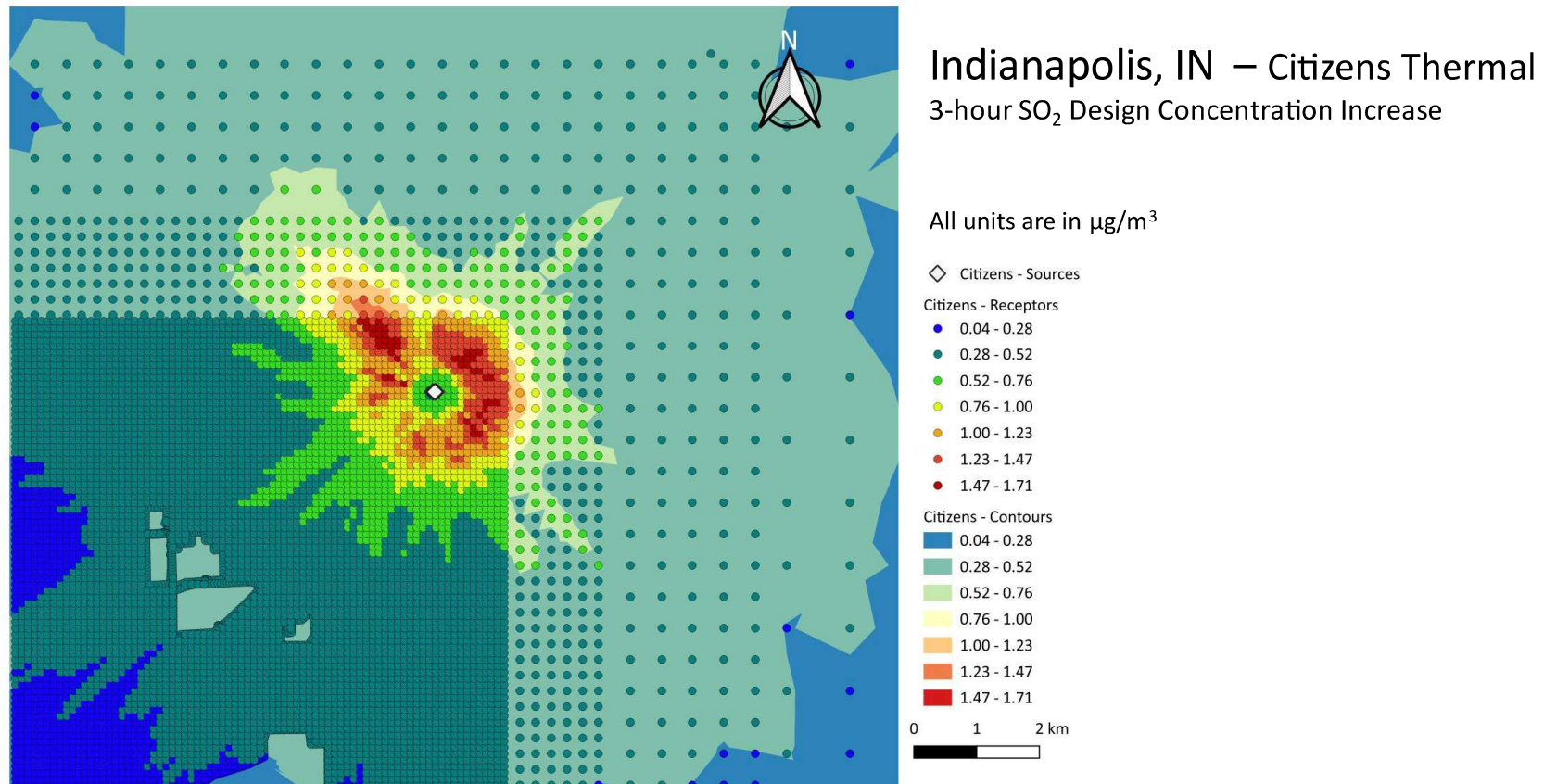


Figure A6. Increase in 1971 Secondary 3-hour SO₂ Design Concentration for Citizens Thermal Facility in Indianapolis, IN.

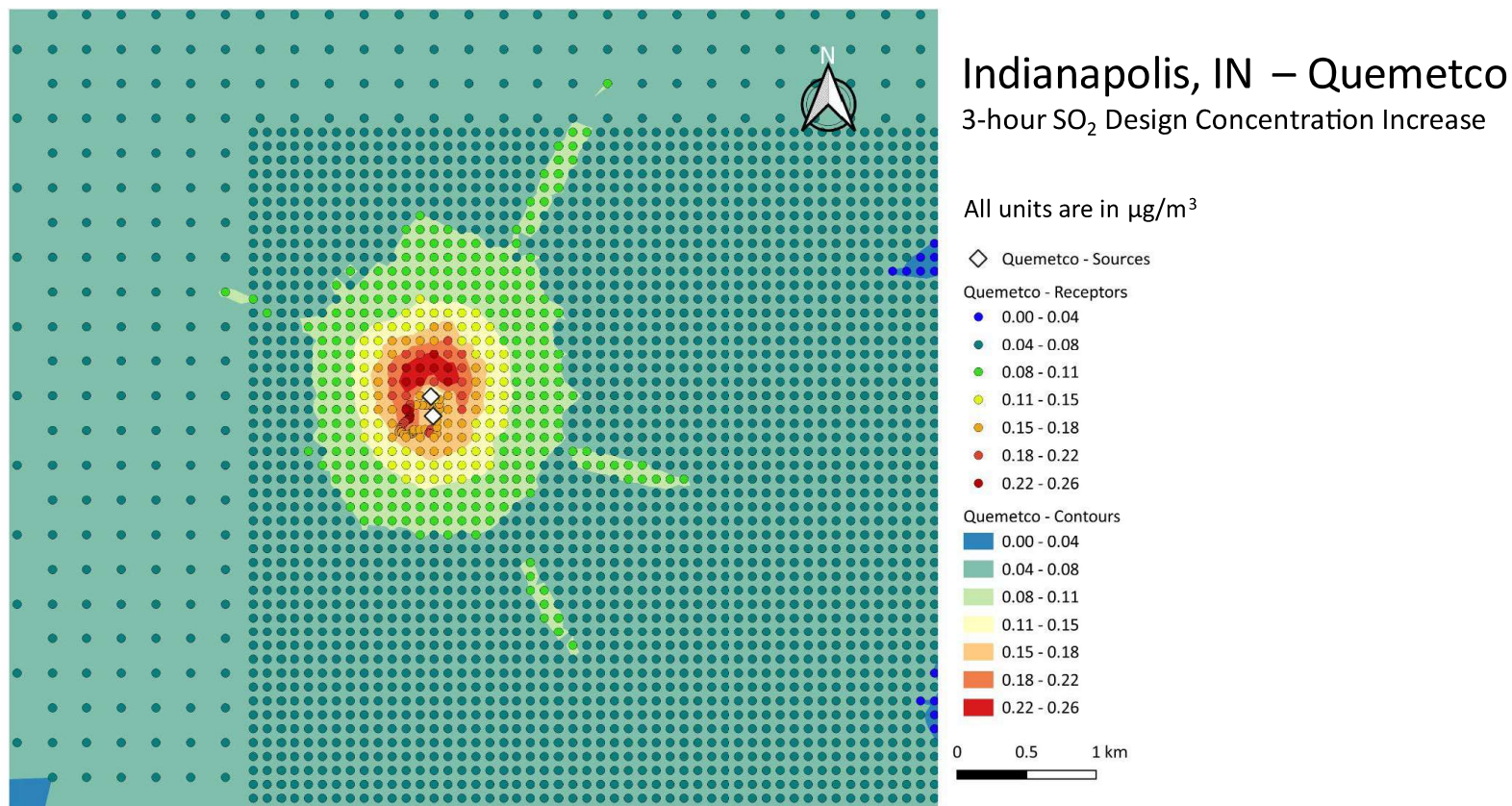


Figure A7. Increase in 1971 Secondary 3-hour SO₂ Design Concentration for Quemetco Facility in Indianapolis, IN.

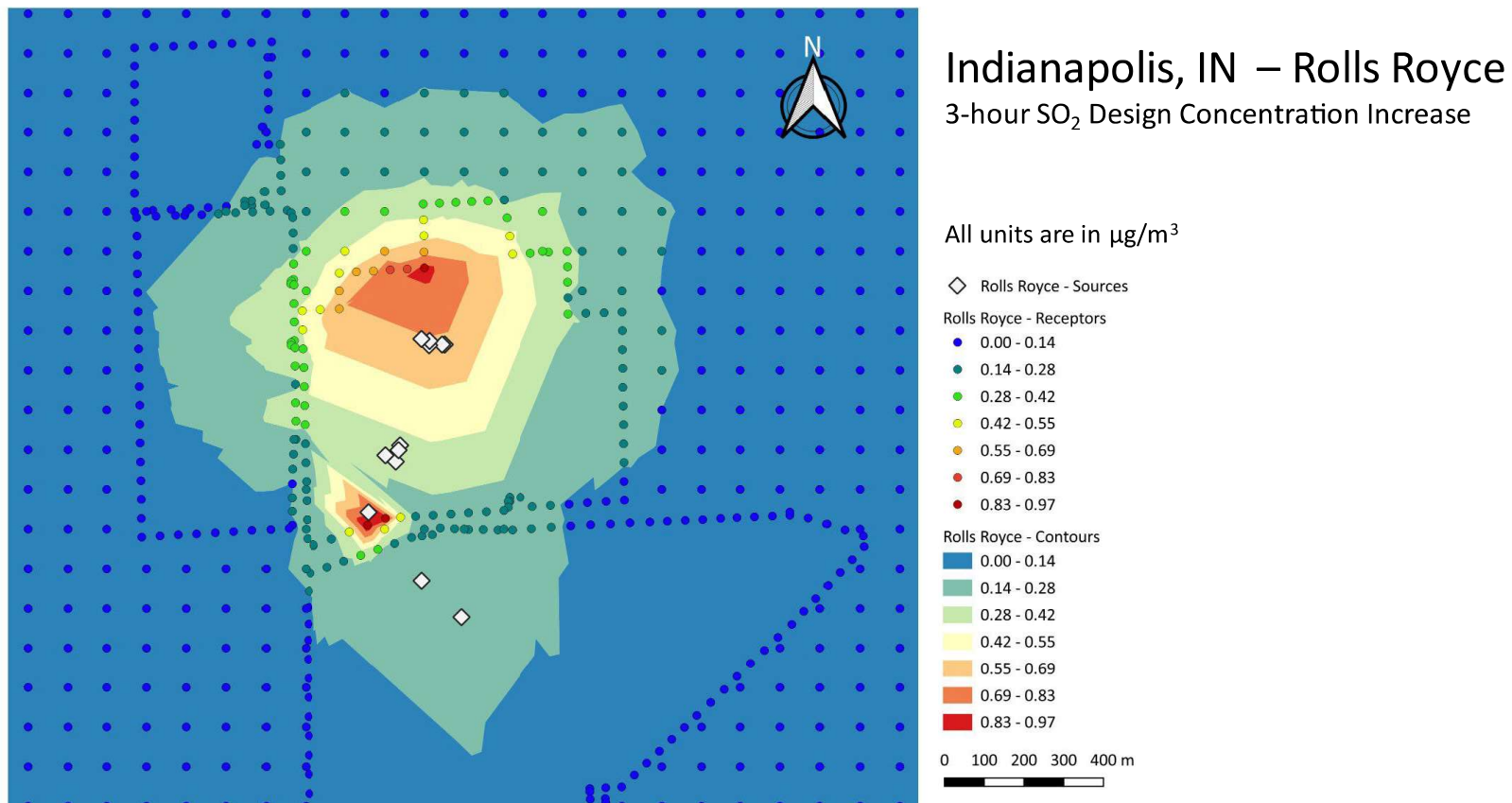


Figure A8. Increase in 1971 Secondary 3-hour SO₂ Design Concentration for Rolls Royce Facility in Indianapolis, IN.

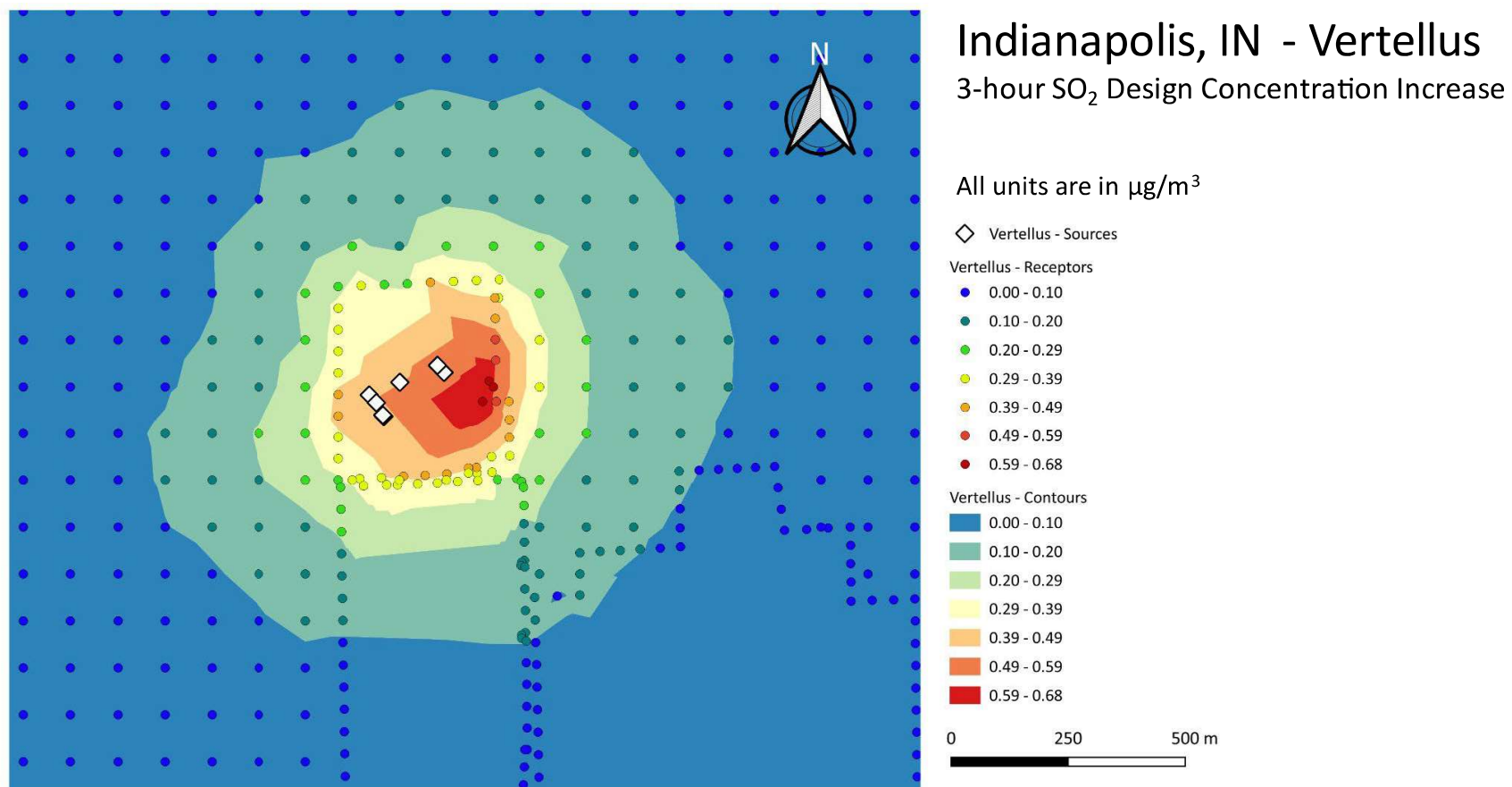


Figure A9. Increase in 1971 Secondary 3-hour SO₂ Design Concentration for Vertellus Facility in Indianapolis, IN.

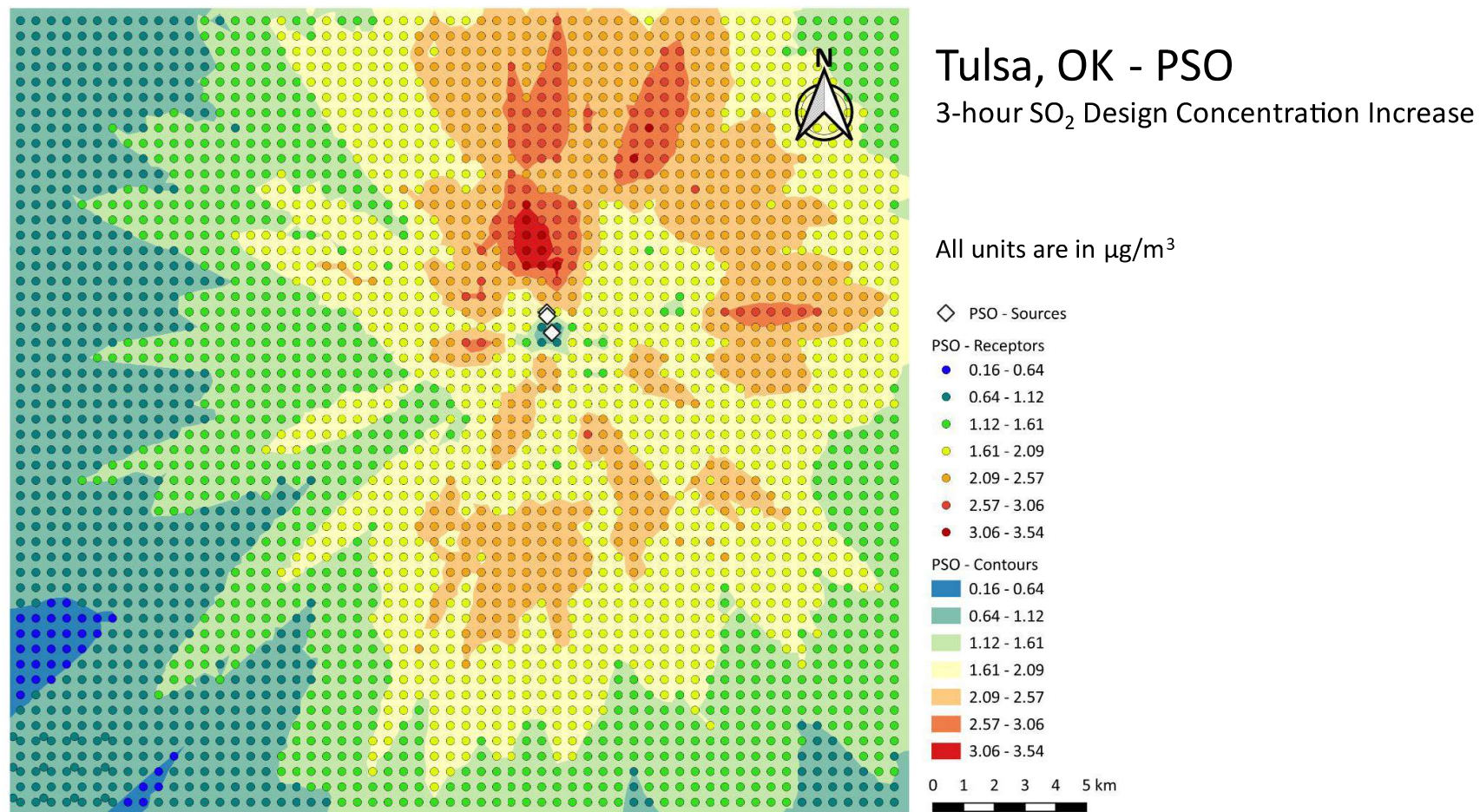
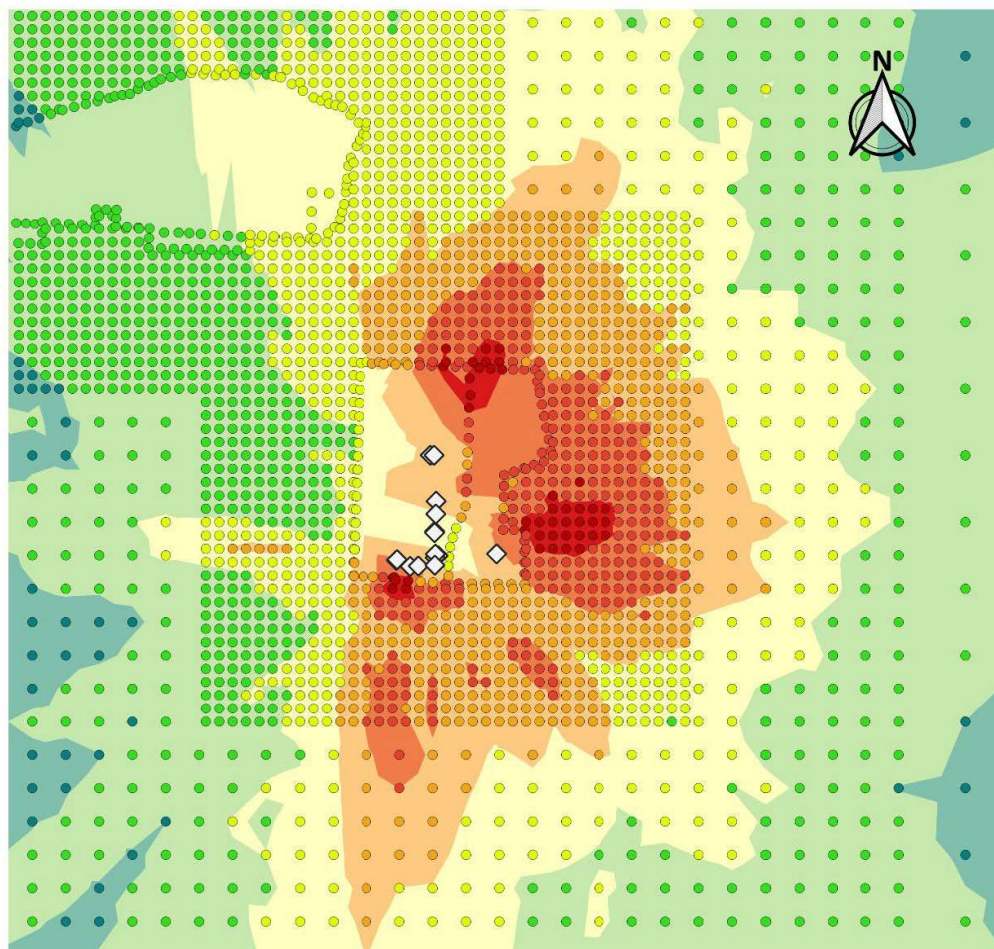


Figure A10. Increase in 1971 Secondary 3-hour SO₂ Design Concentration for PSO – Northeastern Power Station in Tulsa, OK.



Tulsa, OK - Refinery East

3-hour SO₂ Design Concentration Increase

All units are in $\mu\text{g}/\text{m}^3$

◇ Refinery East - Sources

Refinery East - Receptors

- 0.99 - 1.75
- 1.75 - 2.52
- 2.52 - 3.29
- 3.29 - 4.06
- 4.06 - 4.82
- 4.82 - 5.59

Refinery East - Contours

- 0.99 - 1.75
- 1.75 - 2.52
- 2.52 - 3.29
- 3.29 - 4.06
- 4.06 - 4.82
- 4.82 - 5.59

0 0.5 1 km

Figure A11. Increase in 1971 Secondary 3-hour SO₂ Design Concentration for Refinery East Facility in Tulsa, OK.

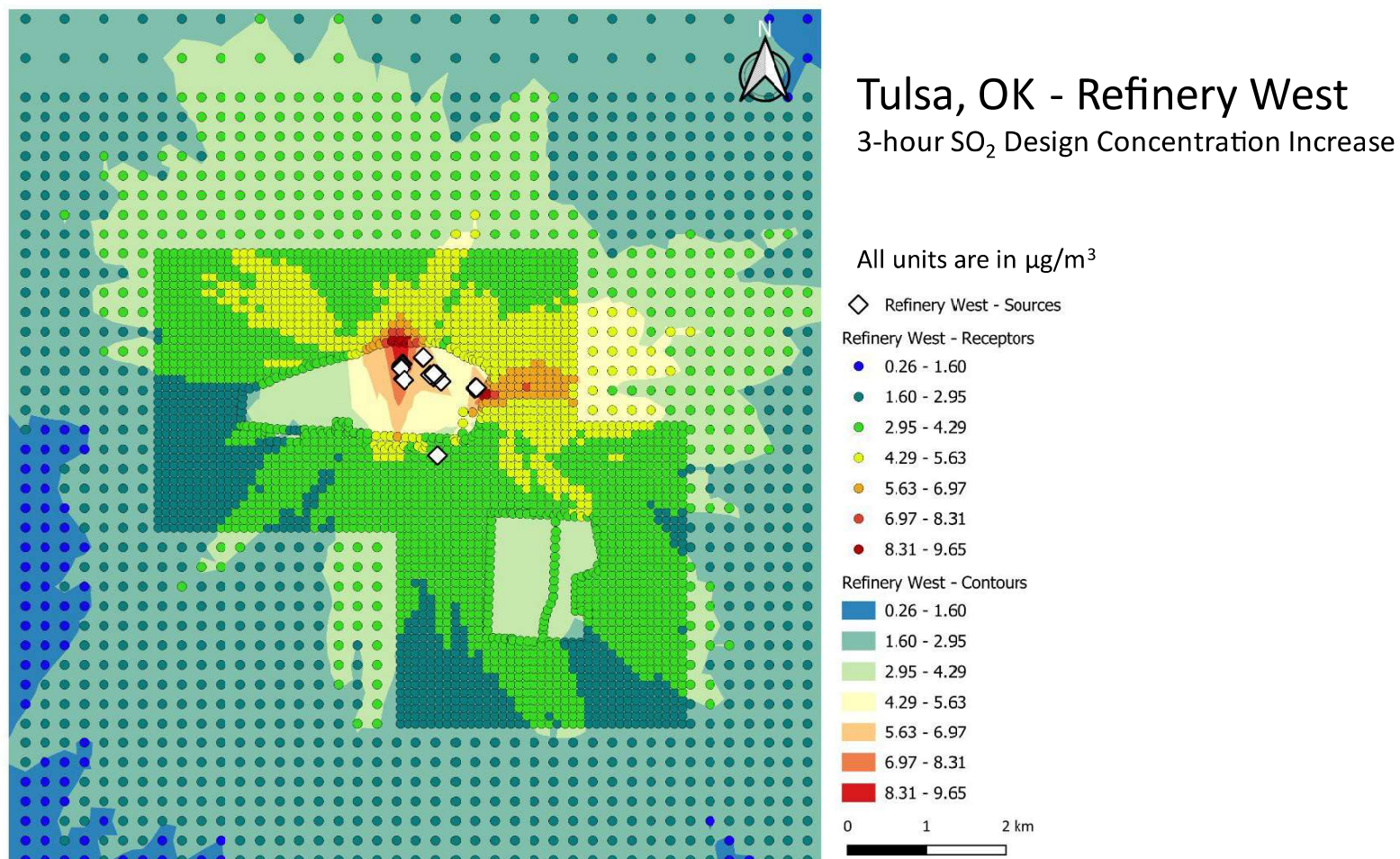


Figure A12. Increase in 1971 Secondary 3-hour SO₂ Design Concentration for Refinery West Facility in Tulsa, OK

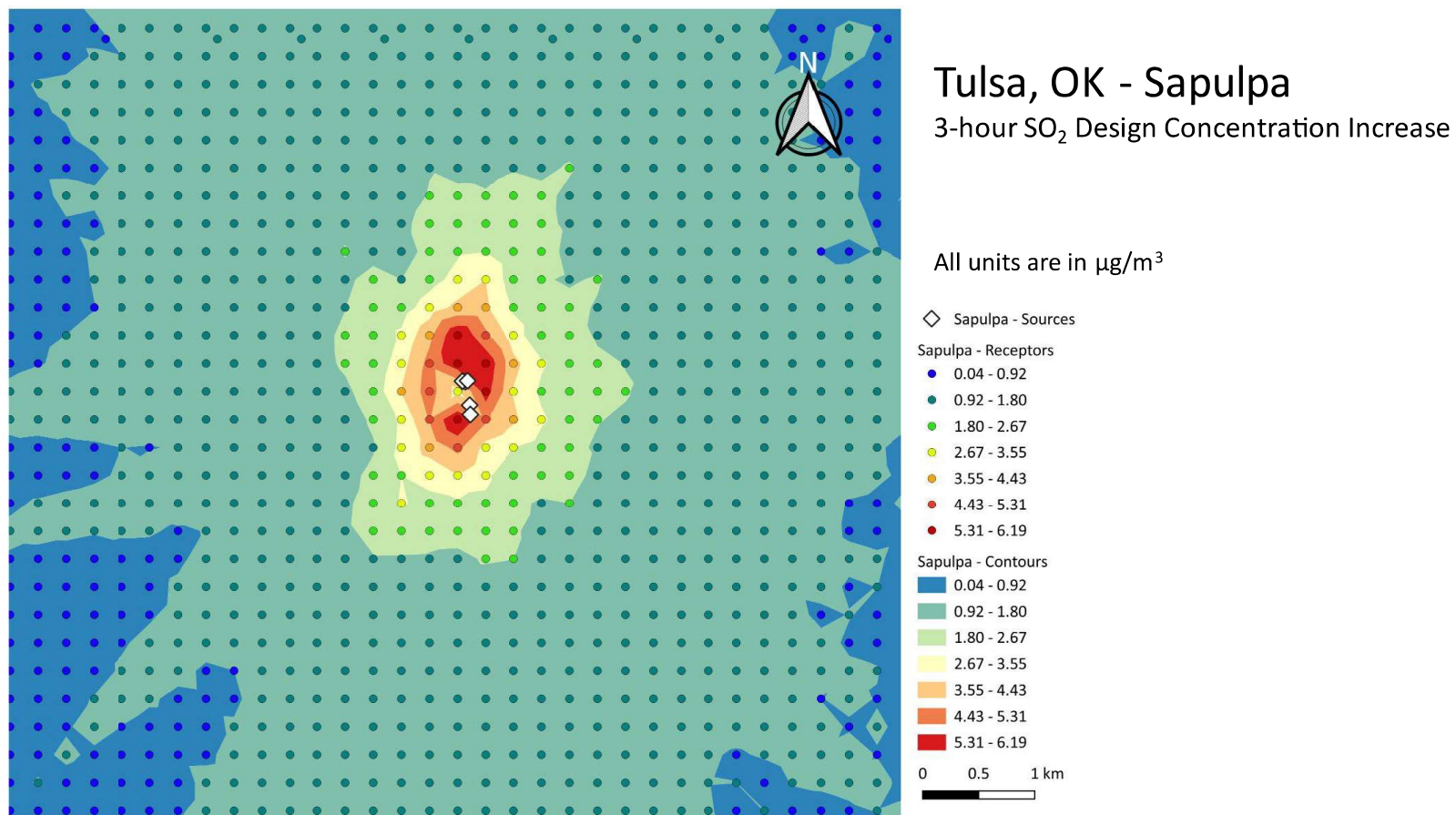


Figure A13. Increase in 1971 Secondary 3-hour SO₂ Design Concentration for Sapulpa Facility in Tulsa, OK