

DRAFT
Sulfur Dioxide Ongoing Data Requirements Rule
2021 Annual Report for Modeled Sources



**Prepared by the
Kentucky Division for Air Quality**

**Submitted by the
Kentucky Energy and Environment Cabinet**

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I. Introduction

The Kentucky Energy and Environment Cabinet (Cabinet) submits this report to the U.S. Environmental Protection Agency (EPA) for the Annual Ongoing Data Requirement Rule (DRR) for the 2010 1-hour Sulfur Dioxide (SO₂) Primary National Ambient Air Quality Standard (NAAQS). This report is intended to fulfill the annual reporting requirements of 40 CFR Part 51 Subpart BB.

On August 21, 2015, the EPA promulgated the DRR for the 2010 1-hour SO₂ Primary NAAQS of 75 parts per billion (ppb).¹ The DRR requires areas that are in attainment to characterize ambient air quality for facilities that emit more than 2,000 tons per year (tpy) of SO₂. Characterization of air quality can occur by choosing one of three methods: (1) ambient air monitoring; (2) air dispersion modeling of either actual or allowable emissions; or (3) demonstration of enforceable emissions limitations that are below the 2,000 tpy threshold.

On January 6, 2017, the Cabinet submitted a letter and air dispersion modeling analyses to EPA characterizing nine sources subject to the DRR. The letter also detailed Kentucky sources that chose the monitoring or federally enforceable limitation options, as well as sources that permanently shut down. Two of the nine sources are not included in this report: Big Rivers – D. B. Wilson and TVA – Paradise. D. B. Wilson was designated unclassifiable and is not subject to ongoing verification. TVA – Paradise was modeled using potential to emit (PTE) emissions and is not subject to ongoing verification.

In accordance with 40 CFR 51.1205(b), areas designated as attainment/unclassifiable and characterized using air dispersion modeling of actual SO₂ emissions are subject to ongoing data requirements. Annual emissions reports for those areas must be submitted to EPA by July 1 of each year.

II. Emissions Data Summary

On January 9, 2018, EPA designated seven Kentucky counties containing the sources characterized by modeled actual emissions as attainment/unclassifiable.² The seven Kentucky counties and their respective DRR sources subject to ongoing emissions data verification are identified in Table 1.

¹ 80 FR 51052

² 83 FR 1098

Table 1: Counties with Sources Subject to the DRR

Source	County
Century Aluminum - Hawesville	Hancock
Duke Energy - East Bend	Boone
EKPC - H. L. Spurlock	Mason
KU - Ghent	Carroll
LG&E - Trimble County	Trimble
OMU - Elmer Smith	Daviess
TVA – Shawnee	McCracken

The five electric generating units (EGUs) that chose to model actual SO₂ emissions for the model years 2012-2014 are displayed in Table 2. The SO₂ emissions modeled for 2012-2014 are compared to 2018-2020 actual SO₂ emissions. For three of the five facilities (Duke Energy – East Bend, LG&E – Trimble County, and TVA – Shawnee), emissions decreased from 2019 to 2020. SO₂ emissions at EKPC – H. L. Spurlock and KU – Ghent increased in 2020 when compared to the previous year (2019). KU – Ghent’s emissions increase was less than 1% and insignificant. Ghent’s 2020 emissions are still well below the emissions used in the modeled years. EKPC – H. L. Spurlock emissions also increased from 2019 to 2020. However, Spurlock’s SO₂ emissions have fluctuated annually, both increasing and decreasing over the past three years. As shown in Table 4, the average emissions for the three most recent years are lower than the average of the modeled years.

Table 2: Annual SO₂ Emissions for Sources Using MY 2012-2014 (tpy)

Source	Modeled Emissions			Actual Emissions		
	2012	2013	2014	2018	2019	2020
Duke Energy – East Bend	1,496.63	2,197.72	2,102.71	2,012.76	2,402.84	1,932.15
EKPC – H. L. Spurlock	5,131.11	4,468.75	4,689.09	3,737.76	2,972.66	3,831.41
KU – Ghent	10,772.18	13,421.85	14,851.28	10,620.65	8,546.38	8,600.66
LG&E – Trimble County	2,895.83	3,521.39	3,056.20	4,008.35	3,966.34	3,747.99
TVA – Shawnee	27,114.87	27,210.73	29,834.54	15,149.46	16,345.72	9,024.44

Emissions data acquired from the Air Markets Program Data database - <https://ampd.epa.gov/ampd/>

Listed in Table 3 are the two facilities that chose to model actual SO₂ emissions for the model years 2014-2016. The SO₂ emissions for Century Aluminum – Hawesville slightly increased in 2020 when compared to 2019. The difference is insignificant and does not necessitate additional modeling at this time. OMU – Elmer Smith had a large drop in emissions from 2019 to 2020. On August 12, 2020, OMU notified the Cabinet that Units 1 and 2 were effectively retired on June 1, 2020. OMU submitted the Retired Unit Exemption for Units 1 and 2 to the Cabinet and EPA on July 23, 2020. The Cabinet plans to work with EPA to allow OMU – Elmer Smith to discontinue the SO₂ DRR annual reporting requirement.

Table 3: Annual SO₂ Emissions for Source Using MY 2014-2016 (tpy)

Source	Modeled Emissions			Actual Emissions		
	2014	2015	2016	2018	2019	2020
Century Aluminum – Hawesville*	2,223.56	1,604.46	507.04	875.67	1,574.57	1,575.96
OMU – Elmer Smith**	5,741.38	3,901.59	2,448.69	2,088.27	1,977.34	586.94

*Emissions data acquired from the Kentucky Division for Air Quality Emissions Inventory

** Emissions data acquired from the Air Markets Program Data database - <https://ampd.epa.gov/ampd/>

The averaged actual emissions from the most recent three years of data, the averaged emissions of the modeled years, and the percent change between the two are compared in Table 4. Five of the seven facilities show a decrease in actual emissions when compared to the modeled year’s emissions. Two facilities have an increase in emissions (Duke Energy – East Bend and LG&E – Trimble County). Duke Energy – East Bend emissions increased by 9% and LG&E – Trimble County emissions increased by 24%

Table 4: SO₂ Emissions Comparisons (tpy)

Source	Modeled Emissions Average	Actual Emissions Average	Percent Change
	2012-2014	2018-2020	
Duke Energy – East Bend**	1,932.35	2,115.92	9%
EKPC – H. L. Spurlock**	4,762.98	3,513.95	-26%
KU – Ghent**	13,015.10	9,255.90	-29%
LG&E – Trimble County**	3,157.81	3,907.56	24%
TVA – Shawnee**	28,053.38	13,506.54	-52%
Source	Modeled Emissions Average	Actual Emissions Average	Percent Change
	2014-2016	2018-2020	
Century Aluminum – Hawesville*	1,445.02	1,342.07	-7%
OMU – Elmer Smith**	4,030.55	1,550.85	-62%

*Emissions data acquired from the Kentucky Division for Air Quality Emissions Inventory

** Emissions data acquired from the Air Markets Program Data database - <https://ampd.epa.gov/ampd/>

As part of the ongoing reporting, Kentucky must perform an annual review of SO₂ emissions for facilities and, if necessary, provide a recommendation for updated modeling due to increases in SO₂ emissions. As mentioned, EKPC - H.L. Spurlock and KU - Ghent SO₂ emissions increased from 2019 to 2020. SO₂ emissions at EKPC – H.L. Spurlock increased by 859 tpy while KU – Ghent had an increase of 54 tpy. The emissions increase is not significant for either facility. Additionally, the percent change between the 2018-2020 actual emissions and the 2012-2014 modeled emissions has decreased for both facilities.

The percent change between the 2018-2020 actual emissions and the 2012-2014 modeled emissions increased for Duke Energy – East Bend and LG&E – Trimble County. However, as demonstrated in the following sections, the total SO₂ emissions in the modeled areas have decreased.

Duke Energy – East Bend

The initial modeling characterization for Duke Energy – East Bend includes KU – Ghent in Kentucky, and Dynegy – Miami Fort in Ohio. The resulting modeled emissions and actual emissions of SO₂ for the three facilities are shown in Table 5 and Figure 1. Since the modeling analysis, Duke Energy – East Bend has seen a fluctuation in SO₂ emissions. Although the averaged most recent three-year data shows SO₂ emissions higher than the modeled emissions, actual SO₂ emissions decreased from 2019 to 2020.

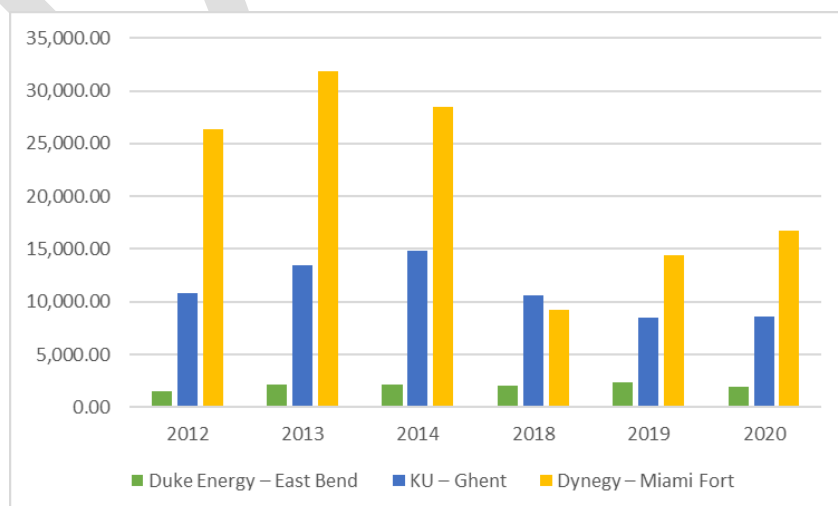
The Cabinet’s 2020 SO₂ DRR Annual Report for 2019 emissions data, submitted to EPA on October 5, 2020, assessed the most recent SO₂ emissions for Duke Energy – East Bend, comparing the averaged 2017-2019 actual emissions to the averaged model years. The average percent change in 2020 was higher (21.54%) than the 2021 emissions comparison (9%). The Cabinet reached out to Duke Energy while compiling the 2020 annual report and requested that they identify the reason for the increase. Duke Energy’s response identified an increase in utilization at the East Bend facility as the cause for the increase in SO₂ emissions. Appendix A contains Duke Energy’s explanation for the increase, which was submitted to the Cabinet for review.

Table 5: Duke Energy – East Bend, KU – Ghent, Dynegy – Miami Fort Annual SO₂ Emissions (tpy)

Facility	Modeled Emissions			Actual Emissions		
	2012	2013	2014	2018	2019	2020
Duke Energy – East Bend	1,496.63	2,197.72	2,102.71	2,012.76	2,402.84	1,932.15
KU – Ghent	10,772.18	13,421.85	14,851.28	10,620.65	8,546.38	8,600.66
Dynegy – Miami Fort	26,406.88	31,843.92	28,478.67	9,275.50	14,396.51	16,729.51
Area Total	38,675.69	47,463.49	45,432.66	21,908.91	25,345.73	27,262.32

Emissions data acquired from the Air Markets Program Data database - <https://ampd.epa.gov/ampd/>

Figure 1: Duke Energy – East Bend; KU – Ghent; Dynegy – Miami Fort Annual SO₂ Emissions (tpy)



The KU – Ghent and Dynegy – Miami Fort facilities had decreases in emissions in the years following the initial modeling analysis. As seen in Table 6, although Duke Energy – East Bend’s current emissions are higher than the modeled emissions, there was a 43% overall decrease of SO₂ emissions in the area from these two nearby facilities, which greatly offset the increase at East Bend.

Table 6: Duke Energy – East Bend Modeled Area Percent Change in SO₂ Emissions (tpy)

Facility	Total Emissions	Total Emissions	Percent Change
	2012-2014	2018-2020	
Duke Energy – East Bend	5,797.06	6,347.75	9%
KU – Ghent	39,045.31	27,767.69	-29%
Dynegy – Miami Fort	86,729.47	40,401.52	-53%
Area Total	131,571.84	74,516.96	-43%

Emissions data acquired from the Air Markets Program Data database - <https://ampd.epa.gov/ampd/>

The initial modeled inputs generated by the Cabinet indicated that the highest predicted 99th percentile daily maximum 1-hour concentration within the chosen modeling domain was 170 µg/m³, equivalent to 65 ppb. The modeled concentrations include the actual emissions from the facilities and the background concentrations of SO₂. The model shows the highest concentrations occurred near the KU – Ghent facility. The concentrations modeled near Duke Energy - East Bend were well below the 1-hour SO₂ NAAQS.³

The reduction in SO₂ concentrations in the area around Duke Energy – East Bend is demonstrated in Table 7. Data from the NKU monitor (site ID 21-037-3002) was used to calculate background concentrations for East Bend. The latest complete three-year design value (2018-2020) shows an 88% decrease since the three-year design value from 2012-2014. The 2018-2020 SO₂ design value for the East Bend background monitor is 9 ppb, which is well below 75 ppb.

The significant reduction of SO₂ from the facilities near Duke Energy – East Bend is far greater than the slight increase in emissions at East Bend. Additionally, the performed modeling results indicate that SO₂ concentrations around East Bend are well below the 1-hour SO₂ NAAQS. The slight increase in SO₂ emissions at East Bend are not of concern considering the significant decrease in emissions from the KU – Ghent facility; therefore, the Cabinet does not recommend updated modeling.

Table 7: NKU SO₂ Monitor 99th Percentile (ppb)

2012	2013	2014	2012-2014 Design Value	2018	2019	2020	2018-2020 Design Value	Percent Change
85	71	61	72	9	8	10	9	-88%

Data retrieved from EPA Outdoor Air Quality Monitor Values Report

³ https://www.epa.gov/sites/default/files/2017-08/documents/19_ky_so2_rd3-final.pdf. TSD: Proposed Round 3 Area Designations for the 2010 1-Hour SO₂ Primary National Ambient Air Quality Standard for Kentucky

LG&E - Trimble County

The initial modeling characterization for LG&E – Trimble County included Indiana-Kentucky Electric Corporation (IKEC) – Clifty Creek station and KU – Ghent. Table 8 contains the area emissions from the modeled years and the recent three-year actual emissions of SO₂ for the three facilities. Figure 2 contains actual emissions of SO₂ for the three facilities. For 2018-2020, LG&E – Trimble County had an average increase in SO₂ emissions compared to the modeled years.

The Cabinet’s 2020 SO₂ DRR Annual Report, submitted to EPA on October 5, 2020, assessed the most recent SO₂ emissions for LG&E – Trimble County, comparing the averaged 2017-2019 actual emissions to the averaged model years. The average percent change in 2020 actual emissions was lower (20%) than the 2021 SO₂ DRR Annual Report emissions comparison (24%) for LG&E – Trimble County. However, the most recent three-year emissions average (2018-2020) shows a 59% decrease for the total area, compared to the three-year modeled average emissions from 2012-2014, as shown in Table 9. The Cabinet reached out to LG&E while compiling the 2020 SO₂ DRR Annual Report and requested that they identify the reason for the increase. LG&E’s response identified an increase in utilization at the Trimble County facility as the cause for the increase in SO₂ emissions. Appendix B contains LG&E’s explanation for the increase, which was submitted to the Cabinet for review.

On February 1, 2016, Indiana issued Commissioner’s Order 2016-02 to establish a combined emission limit for the six coal-fired boilers at Clifty Creek, which have reduced SO₂ concentrations in the area. The boilers were limited to a total of “2,624.5 lbs. of SO₂ per hour as a 720 operating hour rolling average when any of Units No.1 through No. 6, or any combination thereof, is operating.”⁴ In 2016, Clifty Creek took a limit of 11,495 tpy allowable emissions of SO₂. The most recent actual emissions at Clifty Creek are significantly lower than the modeled PTE emissions.

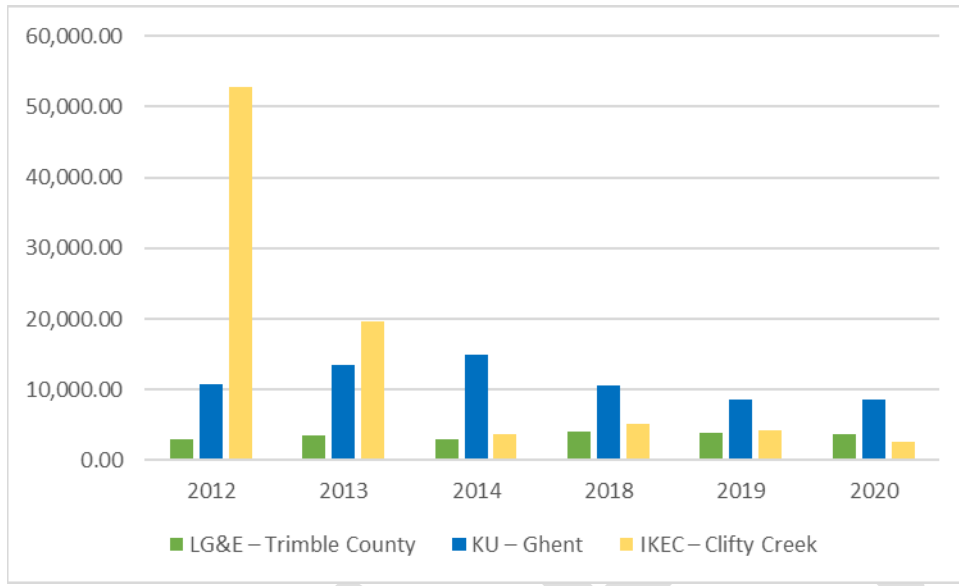
Table 8: LG&E – Trimble County, KU – Ghent, IKEC – Clifty Creek Annual SO₂ Emissions (tpy)

Facility	Modeled Emissions			Actual Emissions		
	2012	2013	2014	2018	2019	2020
LG&E – Trimble County	2,895.83	3,521.39	3,056.20	4,008.35	3,966.34	3,747.99
KU – Ghent	10,772.18	13,421.85	14,851.28	10,620.65	8,546.38	8,600.66
IKEC – Clifty Creek	52,838.92	19,562.58	3,731.23	5,126.57	4,191.13	2,537.01
Area Total	66,506.93	36,505.82	29,402.48	19,755.57	16,703.85	14,885.66

Emissions data acquired from the Air Markets Program Data database - <https://ampd.epa.gov/ampd/>

⁴ 81 FR 27331

Figure 2: LG&E – Trimble, KU – Ghent, and IKEC – Clifty Creek Annual SO₂ (tpy)



The KU – Ghent and IKEC – Clifty Creek facilities had decreases in emissions in the years following the initial modeling analysis. As seen in Table 9, although LG&E – Trimble County’s current emissions are higher than the modeled emissions, there was a 59% overall decrease of SO₂ emissions in the area from these two nearby facilities, which greatly offset the increase at Trimble.

The initial modeled inputs generated by the Cabinet indicated that the highest predicted 99th percentile daily maximum 1-hour concentration within the chosen modeling domain was 170 µg/m³, equivalent to 65 ppb. The modeled concentrations include the actual emissions from the facilities and the background concentration of SO₂. The model shows the highest concentrations occurred near the IKEC – Clifty Creek facility. The concentrations modeled near LG&E Trimble County were well below the 1-hour SO₂ NAAQS.⁵

Table 9: LG&E – Trimble County Modeled Area Percent Change in SO₂ Emissions

Facility	2012-2014 Area Emissions (Tons)	2018-2020 Area Emissions (Tons)	Percent Change
LG&E - Trimble County	9,473.42	11,722.68	24%
KU – Ghent	39,045.31	27,767.69	-29%
IKEC – Clifty Creek	76,132.73	11,854.71	-84%
Area Total	124,651.46	51,345.08	-59%

Emissions data acquired from the Air Markets Program Data database - <https://ampd.epa.gov/ampd/>

⁵ https://www.epa.gov/sites/default/files/2017-08/documents/19_ky_so2_rd3-final.pdf. TSD: Proposed Round 3 Area Designations for the 2010 1-Hour SO₂ Primary National Ambient Air Quality Standard for Kentucky

The original modeling characterization used Indiana’s Green Valley Rd/Green Valley Elementary School monitor (site ID 18-043-1004). Table 10 demonstrates the significant reduction of emissions in the area. Between the 2012-2014 design value and the 2018-2020 design value, there is an 81% percent decrease at the Green Valley monitor.

Table 10: Green Valley SO₂ Monitor 99th Percentile (ppb)

2012	2013	2014	2012-2014 Design Value	2018	2019	2020	2018-2020 Design Value	Percent Change
32	21	44	32	9	5	5	6	-81%

Data retrieved from EPA Outdoor Air Quality Monitor Values Report

The design value for the LG&E – Trimble County cumulative modeling analysis was 188 µg/m³ (Trimble’s contribution was 0.3 µg/m³), which was below the NAAQS value of 196 µg/m³. The ambient air data from the Green Valley monitor indicates a 2018-2020 design value of 6 ppb, which is well below 75 ppb.

The significant reduction of SO₂ from the facilities near LG&E – Trimble County are far greater than the slight increase in emissions at the Trimble County facility. Additionally, the modeling results indicate that SO₂ concentrations around LG&E – Trimble County are well below the 1-hour SO₂ NAAQS. The slight increase in SO₂ emissions at LG&E – Trimble County are not of concern considering the significant decrease in emissions from the KU – Ghent facility. Additionally the design value at the Green Valley SO₂ monitor has significantly decreased since the area was initially modeled. Therefore, the Cabinet does not recommend updated modeling.

III. Conclusion

The Cabinet determines that five of the seven sources requiring evaluation for the annual report have decreased SO₂ emissions since the original modeling characterization, and do not require additional modeling to characterize ambient air quality. Although SO₂ emissions at Duke Energy – East Bend and LG&E – Trimble County have increased since the initial modeling characterization, those increases are offset by the significant SO₂ emissions reductions of the other modeled sources. Additionally, the ambient air monitoring data design values for the nearby air monitoring stations have also dropped significantly. Therefore, the Cabinet recommends no additional modeling for the remaining two sources.

IV. Public Notice

In accordance with 40 CFR 51.102, the Cabinet made this report available for public inspection and provided the opportunity for comments. The comment period was from November 22, 2021 through December 21, 2021. A copy of the public notice is available in Appendix C.