

5. Environmental Compliance

Highlights

- *Since the 2017 Integrated Resource Plan ("IRP") filing, the U.S. Environmental Protection Agency ("EPA") has issued a number of new or updated regulations for power plant air, water, and solid waste emissions.*
- *Such environmental regulations affect the operations of Ameren Missouri's Energy Centers; in particular, its coal-fired units.*
- *Ameren Missouri has identified mitigation steps and costs for complying with current and probable future environmental regulations to be used in its evaluation of alternative resource plans.*

Ameren Missouri has made significant investments to comply with existing environmental regulations and maintain a sufficient compliance margin. Rules proposed or promulgated since the IRP filing in September of 2017 include the replacement of the Clean Power Plan with the Affordable Clean Energy ("ACE") rule, final attainment designations for the national ambient air quality standards ("NAAQS") for ozone, revisions to the federal Coal Combustion Residual ("CCR") Rule, the proposal of Missouri regulations for the management of coal combustion residuals, and proposed revisions to the Steam Electric Effluent Limitations Guidelines ("ELG") rule, which requires dry ash handling systems and the construction of waste water treatment facilities.

Environmental regulations are an important factor to consider in resource planning. The future regulatory horizon is uncertain with respect to certain regulatory programs such as those addressing greenhouse gas emissions from coal-fired and natural gas-fired generating units. In this IRP, we have not included new coal-fired generation as a candidate resource option, but we will continue monitoring advancements, especially in carbon capture and sequestration ("CCS") technology. Ameren Missouri has incorporated assumptions regarding proposed and potential environmental regulations in its "most likely" case, and a corresponding compliance path characterized by environmental retrofits to its existing fleet. The cost and timing of those retrofits are reflected in the risk analysis presented in Chapter 9. Furthermore, the planning scenarios (described in Chapter 2) act as signposts for decision making and therefore are an important aspect of the strategy selection in Chapter 10.

5.1 Overview

Table 5.1 Current & Pending Environmental Regulations

| Regulatory Driver | Summary Requirements | Regulation Status | Compliance Timing |
|---|---|---|--|
| Cross-State Air Pollution Rule ("CSAPR") | Reduction in NOx and SO2 allowances vs. CAIR; New allowances for trading program (state level caps) | EPA implemented Phase 1 starting on 1/1/2015. On September 7, 2016 EPA finalized an update effective December 27, 2016 to lower the seasonal NOx (May-Sept) allocations beginning with the 2017 ozone season. | Phase 1: 1/1/2015 Phase 2: 1/1/2017 |
| Revisions to National Ambient Air Quality Standards ("NAAQS") | Lower PM, NOx and SO2 limits; Expansion of non-attainment areas | SO2 final rule June, 2010; EPA proposed redesignation from "unclassifiable" to attainment for area around Labadie based on 2017-2019 data; Redesignation of Jefferson County to attainment pending final action. | SO2: 2017 - 2020 |
| | | Fine particulate (PM2.5) lowered 1/15/2013; Attainment designations 03/2015; Missouri in attainment. | EPA proposed to retain standard in 2020 |
| | | Ozone standard lowered, final rule 12/2015; Attainment designations complete April 2018; St. Louis/Metro East area marginal nonattainment and size of area reduced. | EPA proposed to retain standard in 2020 |
| Mercury and Air Toxics Standards (MATS) | Reduction in emissions of Mercury, HCl (proxy for acid gases) and particulate emissions (proxy for non-mercury metals) | Final rule effective April 16, 2012. Compliance required by April 16, 2015. | Rush Island and Sioux Energy Centers compliant on April 16, 2015; Labadie and Meramec (units 3 & 4) Energy Centers received MDNR approved 1-yr extensions and compliant on April 16, 2016. |
| Clean Air Visibility Rule (CAVR)/Regional Haze Rule | Application of Best Available Retrofit Technology (BART); Targets reduction in transported SO2 and NOx; status of CSAPR may require state to change approach. | EPA issued revisions in Jan 2017 and guidance in 2018; States submit plans for second compliance period in 2021. | Missouri state plan required to be submitted to EPA by July 31, 2021. |
| Clean Water Act Section 316(a) Thermal Standards | Implementation through NPDES permit conditions | Evaluation covered by NPDES permits | Submittal for Labadie in 2020 |
| Clean Water Act Section 316(b) Protection of Aquatic Life | Case-by-case determination of controls required to meet entrainment standards; national standard for impingement | EPA revised rule effective October 2014; Study plans 2014; Studies 2015 - 2017; Compliance 2022 - 2024 | Field work complete; Labadie submittal in 2020; Rush Island and Sioux submittals with permit renewal applications. |
| Waters of The United States (WOTUS) | Protection of additional streams and tributaries | The EPA and Corps of Engineers finalized revisions and issued the Navigable Waters Protection Rule: Definition of "Waters of the United States" in April 2020. | Final rule effective June 21, 2020 |
| Revisions to Steam Electric Effluent Limitations Guidelines ("ELG") | Dry ash handling and installation of wastewater treatment facilities; Implemented through NPDES permit conditions | EPA linked ELG rule to CCR rule; EPA has stayed certain compliance deadlines during rulemaking to revise the final rule. | Implementing dry fly ash handling and wastewater treatment systems; coordinating with CCR compliance plan. |
| Coal Combustion Residuals ("CCR") | Conversion to dry bottom ash and fly ash; Closure of existing ash ponds; Dry disposal in landfill | Final determination that CCRs are nonhazardous by EPA in December 2014; final rule April 2015, effective October 19, 2015. Federal legislation (WINN Act) to revise rule signed December 16, 2016. USEPA rulemakings in progress to revise regulation in response to Court and to implement the WINN Act. | Pond closures and corrective measures in process. Completion in advance of regulatory deadline. |
| Clean Air Act Regulation of Greenhouse Gases ("GHG")/Affordable Clean Energy Rule ("ACE") | New Source Performance Standard ("NSPS") for new, modified, reconstructed units | New unit NSPS re-proposed Jan 2014; final rule effective 12/22/2015. EPA proposed revisions to rule in December, 2018; comments closed 3/18/2019. | New unit NSPS applies 1/8/2014; issuance of final rule pending. |
| | | EPA issued final rule for modified and reconstructed units effective 12/22/2015. EPA proposed revisions to rule in December 2018; comment period closed 3/18/2019. Challenges in DC Circuit Court held in abeyance. | Modified/reconstructed applies 6/18/2014; issuance of final rule pending. |
| | State emission limits for existing sources | Clean Power Plan final rule was stayed by Supreme Court 2/9/2016; EPA finalized repeal and replacement of CPP with ACE rule in 2019; DC Circuit Court dismissed CPP case in September 2019. | CPP was not implemented due to Supreme Court stay Final ACE rule effective September 2019 State plans due July 2022 |

Ameren Missouri is subject to various environmental laws and regulations enforced by federal, state (Missouri and Illinois) and local authorities. Table 5.1 summarizes the current environmental regulations for which Ameren Missouri must implement mitigation measures, along with expectations for compliance requirements for certain potential regulations. The following sections describe the status of the major current and future regulations that may govern the operations of Ameren Missouri facilities. Given the lack of certainty regarding future regulatory programs, Ameren Missouri has necessarily made good faith assumptions based upon available information regarding potential future compliance measures. Such assumptions are subject to revision.

5.2 Air Regulation and Compliance Assumptions

Clean Air Act Regulation of Greenhouse Gases/Affordable Clean Energy Rule

In 2015, the EPA issued the Clean Power Plan, which would have established CO₂ emissions standards applicable to existing power plants. The United States Supreme Court stayed the rule in February 2016, and the Clean Power Plan was not implemented. The EPA has proposed to repeal and replace the Clean Power Plan. The EPA proposed the ACE rule in August 2018 as a replacement for the Clean Power Plan. The public comment period for this rule concluded in October 2018. In July 2019, the EPA issued a final rule that repeals the Clean Power Plan and establishes the Affordable Clean Energy rule effective on September 6, 2019. States have three years, until July 8, 2022, to submit a plan to implement the ACE rule to the EPA, and the EPA has 18 months to review and approve the state plan. The state plan will generally take effect two years after submittal to the EPA, however a state can propose alternative compliance schedules. The ACE rule establishes emission guidelines for states to follow in developing plans to limit CO₂ emissions from coal-fired electric generating units. The EPA defines on-site, heat-rate efficiency improvements as the Best System of Emission Reduction ("BSER"). The emission guidelines provide states with a list of "candidate technologies" that can be used to establish standards of performance and can be incorporated into their state plans.

The Clean Air Act sets a framework in section 111(d) under which EPA issues guidelines that determine BSER for existing sources, and the states develop plans to establish standards of performance for their existing sources. The states then submit those plans to the EPA for approval. The ACE rule gives states the flexibility to design a plan that, in the state's judgment, will work best under its particular circumstances.

Attainment Designations for the National Ambient Air Quality Standard for Ozone

The air quality in the St. Louis area continues to improve. The EPA re-designated the St. Louis and Metro-East Illinois area to be in attainment with the 2008 eight-hour ozone standard. The EPA lowered the ambient standard for ozone from 75 parts per billion ("ppb") to 70 ppb in December 2015. The EPA made final designations for about 85

percent of the country in November, 2017, however those designations did not include the St. Louis/Metro-East Illinois area. The EPA released final designations for the St. Louis/Metro-East Illinois area as well as the other remaining areas of the country on April 30, 2018. The final designation for the St. Louis area reduces the size of the nonattainment area by removing Jefferson County in Missouri and Monroe County in Illinois, as well as all but a small portion (Boles Township) of Franklin County in Missouri. The St. Louis/Metro-East Illinois ozone nonattainment area includes St. Louis City, St. Louis County and St. Charles County in Missouri and Madison and St. Clair counties in Illinois. The St. Louis area is designated as marginal, which is the least severe category. Marginal areas have ozone design values from 71 ppb to 81 ppb. The St. Louis area has a design value of 71 ppb based on the last three years of monitoring data.

As required by the Clean Air Act, the EPA is in the process of evaluating the ambient standard for ozone. In September the EPA proposed to retain the current ambient standard and is expected to issue a final rule by the end of the year. Ameren Missouri evaluates compliance strategies to determine if additional reductions in NO_x emissions may be necessary in the future.

National Ambient Air Quality Standard for SO₂

The EPA lowered the SO₂ ambient standard to 75 ppb on June 2, 2010. Initial attainment designations were finalized on August 5, 2013, and included the designation of two areas in Missouri as nonattainment. The two nonattainment areas included an area in the vicinity of Kansas City (portions of Jackson County) and an area around Herculaneum (portions of Jefferson County). In 2015, the Missouri Department of Natural Resources ("MDNR") finalized attainment plans for both areas. The areas are required to demonstrate compliance with the new SO₂ standard no later than October 4, 2018. For the Herculaneum area, the MDNR has over three years of air quality monitoring data that indicates the area is in attainment with the standard. At MDNR's request, on June 23, 2017 the EPA proposed a determination that the area has attained the SO₂ ambient standard. On September 13, 2017, the EPA published a final determination that the Jefferson County area is in attainment with the SO₂ ambient standard. In December 2017, the MDNR submitted a formal request to the EPA to re-designate the Jefferson County SO₂ nonattainment area to attainment.

As a part of MDNR's state implementation plan for the Herculaneum area, Ameren Missouri entered into an agreement in 2015 to install an ambient SO₂ monitoring network in the vicinity of the Rush Island Energy Center. The agreement also includes lower SO₂ emissions limits for the Rush Island, Labadie and Meramec Energy Centers that took effect on January 1, 2017. The ambient SO₂ monitors near the Rush Island Energy Center began gathering data in December 2015 and, to date, measured values are significantly below the ambient air quality standard for SO₂. In each calendar year since commencement of the monitoring network through December 31, 2019, quality-assured

data has recorded fourth-highest hourly ambient SO₂ levels between 14 ppb and 30 ppb; 60 to 80 percent below the air quality level allowed (75 ppb) under the SO₂ NAAQS.

In addition to the initial attainment designations, the EPA is taking steps to complete the designation process for the SO₂ ambient standard. The EPA entered into a consent order with the Sierra Club and the Natural Resources Defense Council on March 2, 2015, and also finalized the “Data Requirements Rule” on August 21, 2015. The Data Requirements Rule requires states to evaluate emissions from “large sources” of SO₂ (generally greater than 2000 tons SO₂/year) by either the use of air dispersion modeling or ambient air quality monitoring. For areas where states choose to use modeling to determine attainment status states including Missouri, submitted their designations (and supporting information) to the EPA by January 13, 2017. Subsequently, the EPA designated those areas by December 31, 2017. For sources in Missouri for which the modeling option of the Data Requirements Rule was utilized, the MDNR completed the modeling analysis in the fall of 2016. In December 2016, the Missouri Air Conservation Commission approved the MDNR recommendation of attainment for eight sources in Missouri that included the Meramec Energy Center. The attainment recommendations were submitted to the EPA. On September 5, 2017, the EPA issued the preliminary designations for the modeling option, and the final designations were made on December 21, 2017.

For areas where states choose monitoring, states had to submit monitoring plans to the EPA by July 2016, and sources are required to have monitors installed by January 1, 2017. After 3 years of monitoring data is collected (2017-19), the states must certify the data collected by May 2020. The EPA will designate these areas either attainment or nonattainment by December 2020. Non-attaining areas must be in compliance by December 2025.

The Consent Order addresses areas that contain any stationary source not announced for retirement that according to the EPA’s Air Markets Database emitted in 2012 either (a) more than 16,000 tons of SO₂, or (b) more than 2,600 tons of SO₂ and had an average emission rate of at least 0.45 lbs. SO₂/MMBtu. The EPA finalized designations for these areas in July 2016. These areas have up to 5 years to achieve attainment. In September 2015, the MDNR recommended that the area around the Labadie Energy Center be designated as unclassifiable. In April 2015, Ameren Missouri began operating SO₂ ambient monitors to determine whether the area is in compliance with the SO₂ air quality standard. On June 30, 2016, the EPA issued a final determination of “unclassifiable” for the area around the Labadie Energy Center. Data collected from the ambient SO₂ monitors indicates that air quality in the vicinity of the Labadie Energy Center complies with the EPA standards. In accordance with the EPA’s Data Requirement Rule, the ambient SO₂ monitoring network for the Labadie Energy Center has been enhanced and

two additional monitors are in service as of January 2017. In each calendar year since commencement of the monitoring network in 2015, air quality data has recorded ambient SO₂ design concentration between 18 ppb and 38 ppb; approximately 50 to 76 percent below the SO₂ NAAQS. No exceedances of the SO₂ NAAQS have occurred between 2015 and present. There is now three full years of data from the expanded monitoring system available to EPA that demonstrates ambient conditions that are well-below the SO₂ NAAQS. Under the DRR, the EPA and the MDNR are reassessing the attainment classification using certified monitoring data from the 2017 through 2019 time period. In August, both the MDNR and the EPA proposed to re-designate the area around Labadie from unclassifiable to attainment. The EPA is expected to finalize the re-designation by the end of the year. Ameren Missouri continues to operate the monitoring systems and submit the data to both the MDNR and the EPA. Based on monitoring data gathered to date and the EPA proposal to designate the area as attainment, we have assumed the area around Labadie will ultimately be designated as "attainment." Ameren Missouri's assumptions for compliance regarding SO₂ emissions reflect this expectation as well as expected steps necessary to comply with The Cross State Air Pollution Rule ("CSAPR"). Apart from our base SO₂ compliance assumption, Ameren Missouri has documented assumptions for the cost for dry sorbent injection system ("DSI") for Labadie Energy Center and for wet flue gas desulfurization ("FGD") equipment for Rush Island and Labadie Energy Centers, as summarized in Table 5.2. Certain of these assumptions are reflected in our analysis of alternative resource plans as described in Chapter 9.

Table 5.2 Scrubber and DSI Cost Estimates¹

| \$Million (2019\$) | High Capex (Overnight) | Low Capex (Overnight) | Annual O&M |
|------------------------|---------------------------|--------------------------|------------|
| Rush Island FGD | \$833 | \$463 | \$7 |
| Labadie FGD* | \$880 | \$509 | \$8 |
| Labadie DSI | \$337 | \$178 | \$60 |

* For 2 units

Revisions to the National Ambient Air Quality Standard for Fine Particulate Matter

On December 14, 2012, the EPA revised the National Ambient Air Quality Standard for fine particulate matter ("PM_{2.5}"). The previous standards for PM_{2.5} were promulgated in 1997 and 2006 and included an annual standard and a 24-hour standard. The annual standard, which was set in 1997, was 15 micrograms per cubic meter (µg/m³), and the 24-hour standard, which was set in 2006, is 35 µg/m³. The revised NAAQS finalized in December 2012 retained the 24-hour standard, but lowered the annual standard from 15 µg/m³ to 12 µg/m³. In December 2013, the MDNR recommended that the entire state of

¹ EO-2020-0047 1.L

Missouri, including the St. Louis area that includes Franklin, Jefferson, St. Charles, and St. Louis Counties and St. Louis City, be designated as “attainment/unclassifiable.” Based on 2010 through 2012 ambient air monitoring data, all monitors in Missouri were in compliance with the standard. In January 2015, the EPA designated the St. Louis area and the metro-East area in Illinois as unclassifiable due to insufficient quality assured monitoring data for the state of Illinois to assess compliance with the 2012 annual fine particle standard. In December 2018, the MDNR submitted a request to the EPA to re-designate the Missouri portion of the unclassifiable area to attainment. Illinois has corrected the problems the EPA identified with their air quality monitoring data, and both Missouri and Illinois now have complete, quality assured, and certified ambient PM_{2.5} monitoring data for three years (2015-2017) demonstrating that the area is in attainment with the PM_{2.5} standard. Based on the current data, the area is in attainment. Ameren Missouri expects the area to remain in attainment and thus no further mitigation would be required at Ameren Missouri’s facilities.

The Clean Air Act requires the EPA to review all of the ambient standards on a periodic basis. In April 2020, the EPA proposed to retain the current standard for fine particulate matter. In the future, it is possible that the EPA will reevaluate the PM standards and determine whether a further reduction is required.

CSAPR and the CSAPR Update Rule

CSAPR was finalized on July 6, 2011 replacing the Clean Air Interstate Rule (“CAIR”). CSAPR established new allowances for the annual nitrogen oxides (“NO_x”) and sulfur dioxide (“SO₂”) trading programs and the seasonal NO_x trading program. CSAPR uses newly created allowances and thus there is no initial bank to rely on from the Acid Rain or CAIR programs to use for any potential shortfall. CSAPR was slated to become effective January 1, 2012, but the rule was stayed by a federal court decision on December 30, 2011 in response to several legal challenges. On June 26, 2014, the EPA filed a motion with the United States (“U.S.”) Court of Appeals for the District of Columbia (“D.C.”) Circuit to: (1) remove the stay of CSAPR and, (2) delay for three years all of the compliance deadlines that had not already passed when the stay was enacted. On October 23, 2014, the D.C. Circuit court lifted the stay. On December 3, 2014, the EPA implemented a three year toll that moved the starting date for Phase 1 of CSAPR to January 1, 2015, and January 1, 2017 for Phase 2. Ameren Missouri units are in compliance with the CSAPR limits for both SO₂ and NO_x.

In the future, the EPA could revise the rule with lower caps on SO₂ and NO_x emissions. If future revisions require additional reductions in the CSAPR SO₂ and/or NO_x allocations, Ameren Missouri would evaluate compliance strategies that could include modified operation of existing generation resources as well as the installation of additional pollution control equipment at one or more of its facilities depending on the level of required

reduction. Ameren Missouri expects future regulations would continue to allow for fleet averaging for demonstration of compliance. The following figures, 5.1, 5.2, and 5.3 show Ameren Missouri's coal fleet emissions relative to the various regulations promulgated by the EPA. As seen from these graphs, Ameren Missouri's fleet has margin to comply with both the CSAPR SO₂ and annual NO_x programs.

In December 2016, the EPA finalized a revision to the CSAPR ozone season NO_x program. The purpose of the CSAPR update rule is to help downwind areas achieve compliance with the 2008 ozone standard (75 ppb standard). The final update rule implements reductions in the ozone season NO_x allowance allocations for several states including Missouri and Illinois. The state of Missouri allocation was reduced to 15,780 allowances that are approximately 25% below previous CSAPR 2017 ozone season allowances. In addition, the Illinois combustion turbine ("CT") fleet received an allocation of approximately 30% fewer allowances in 2017 than they received in 2016 (85 allowances versus 122 allowances). However, there should still be sufficient allowances available to achieve compliance in Illinois based on projected levels of operation.

Ameren Missouri established a plan to comply with the revised Cross States Air Pollution Rule ozone season allowance allocation that was finalized by the EPA in May 2017 for the 2018 ozone season. Ameren Missouri's strategy for NO_x compliance was to continue operation of low NO_x burner ("LNB") and over-fire air ("OFA") systems at the coal-fired energy centers as well as neural net optimization systems to enhance NO_x emission reduction. In addition, the installed selective non-catalytic reduction ("SNCR") systems at the Sioux Energy Center were tuned and available for use if needed for additional NO_x reduction. The cost of operation of the SNCR systems was compared to the cost of purchasing additional NO_x allowances to determine the most cost effective compliance approach.

Figure 5.1 Ameren Missouri Coal Fleet SO₂ Emissions vs EPA Regulations

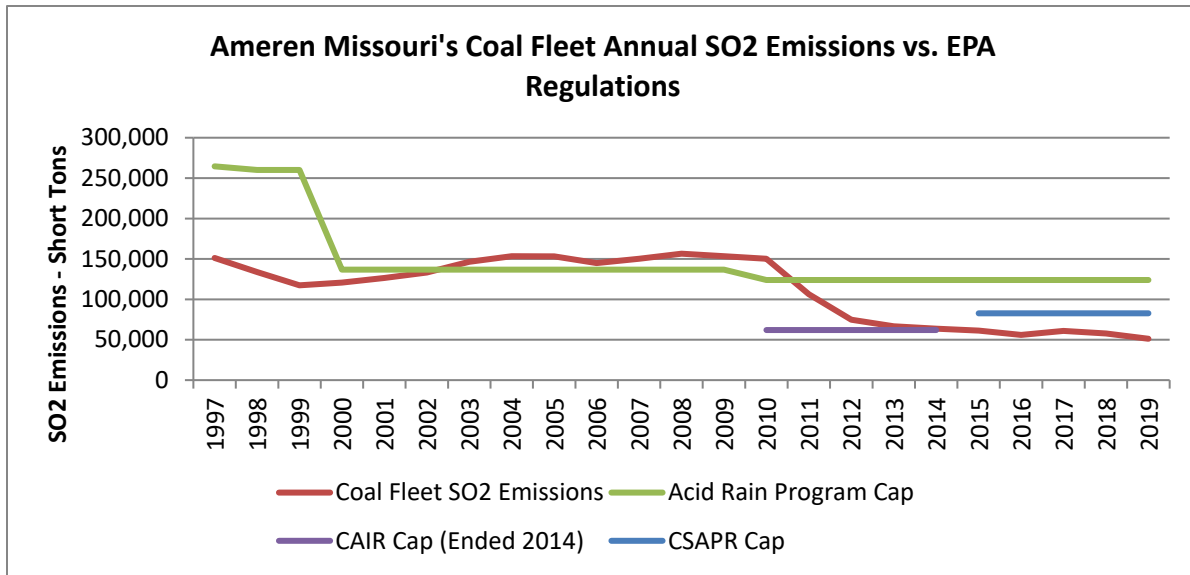


Figure 5.2 Ameren Missouri Coal Fleet Annual NO_x Emissions vs EPA Regulations

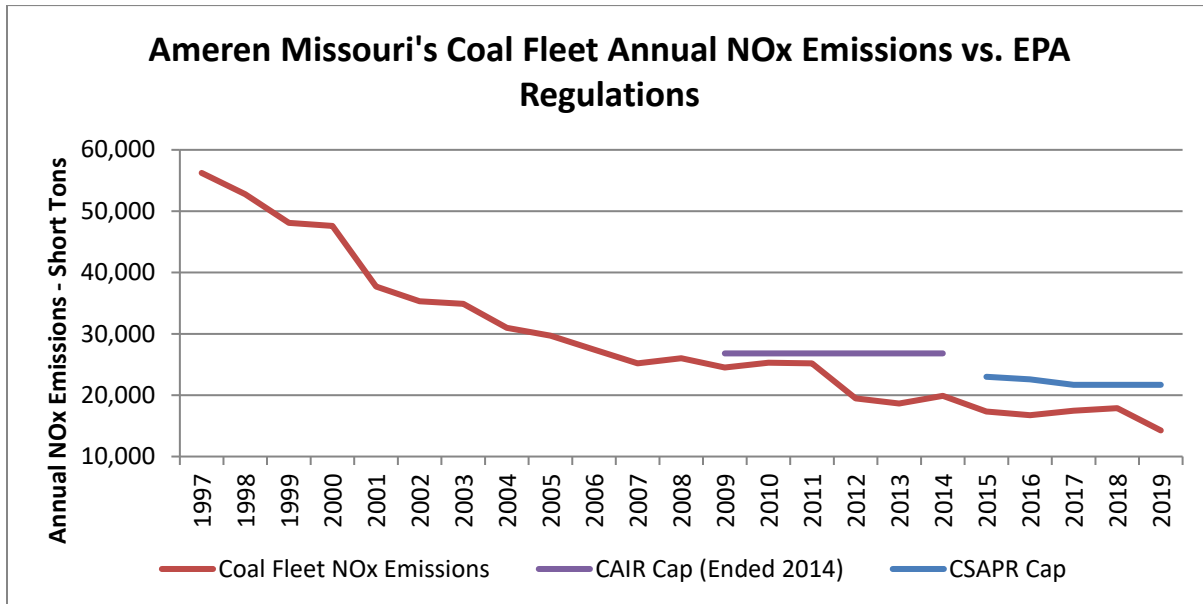
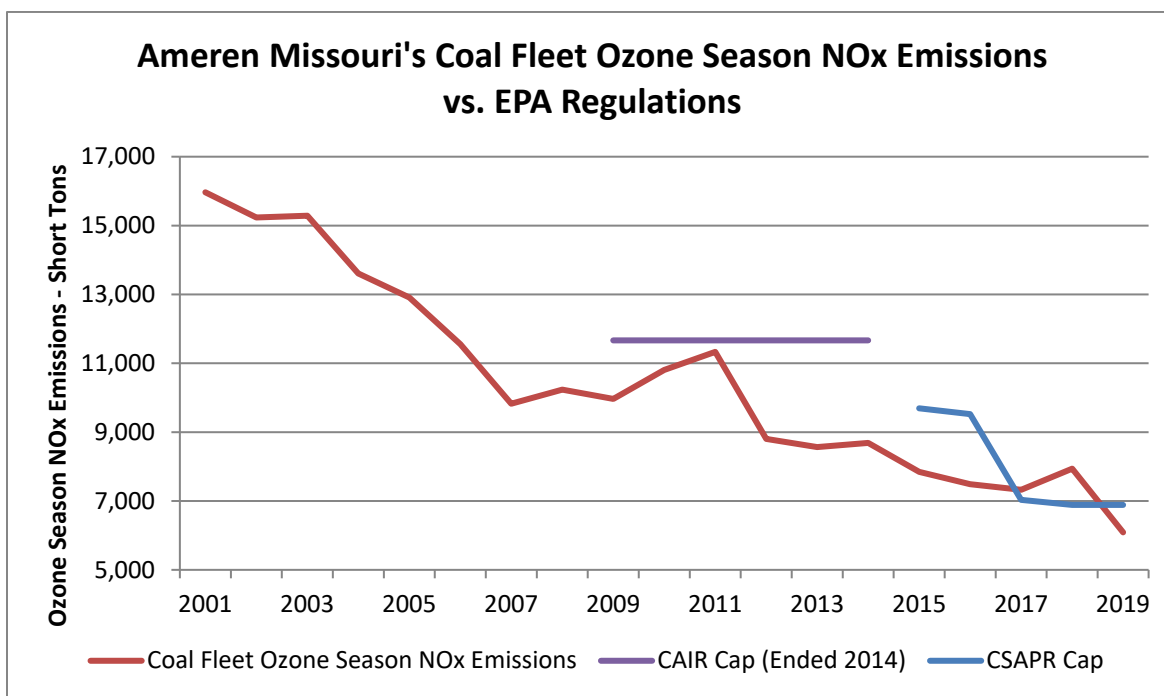


Figure 5.3 Ameren Missouri Coal Fleet Ozone Season NO_x Emissions vs EPA Regulations



Maximum Achievable Control Technology ("MACT") Standards to Control Mercury and Other Hazardous Air Pollutants for Electric Generating Units ("EGU")

The MACT rule for EGU's was effective on April 16, 2012. This final rule is known as the Mercury and Air Toxics Standards ("MATS"). The MATS includes standards for mercury, particulate matter as a surrogate for non-mercury metals hydrogen chloride ("HCl") as a surrogate for acid gases, work practices for organic emissions and monitoring requirements. The MATS standard also includes more stringent emission limits for new sources.

Ameren Missouri's Rush Island and Sioux Energy Centers were compliant with the MATS on April 16, 2015. The Labadie and Meramec (units 3 & 4) Energy Centers received a one-year extension and achieved compliance with the MATS on April 16, 2016. Units 1 & 2 at the Meramec Energy Center began burning natural gas only on April 16, 2016, and thus were not subject to MATS. Ameren Missouri installed Activated Carbon Injection technologies at all four of its coal-fueled energy centers and made modifications to the existing PM controls at its Labadie Energy Center. In addition, Ameren Missouri will utilize work practices and fuel choices to meet the other MATS regulated hazardous air pollutants. The figures below show Ameren Missouri's coal fleet compliance with the MATS requirements. Ameren Missouri is achieving compliance with some margin. In the unlikely event some of these limits would be lowered, Ameren Missouri believes its facilities would be able to comply without the installation of additional control technology.

The data is based on a 30-day rolling average comprised of hourly data when the emission unit is operating. If the unit is not operating there will be gaps in the 30-day rolling average.

Figure 5.4 Labadie MATS Compliance – Mercury

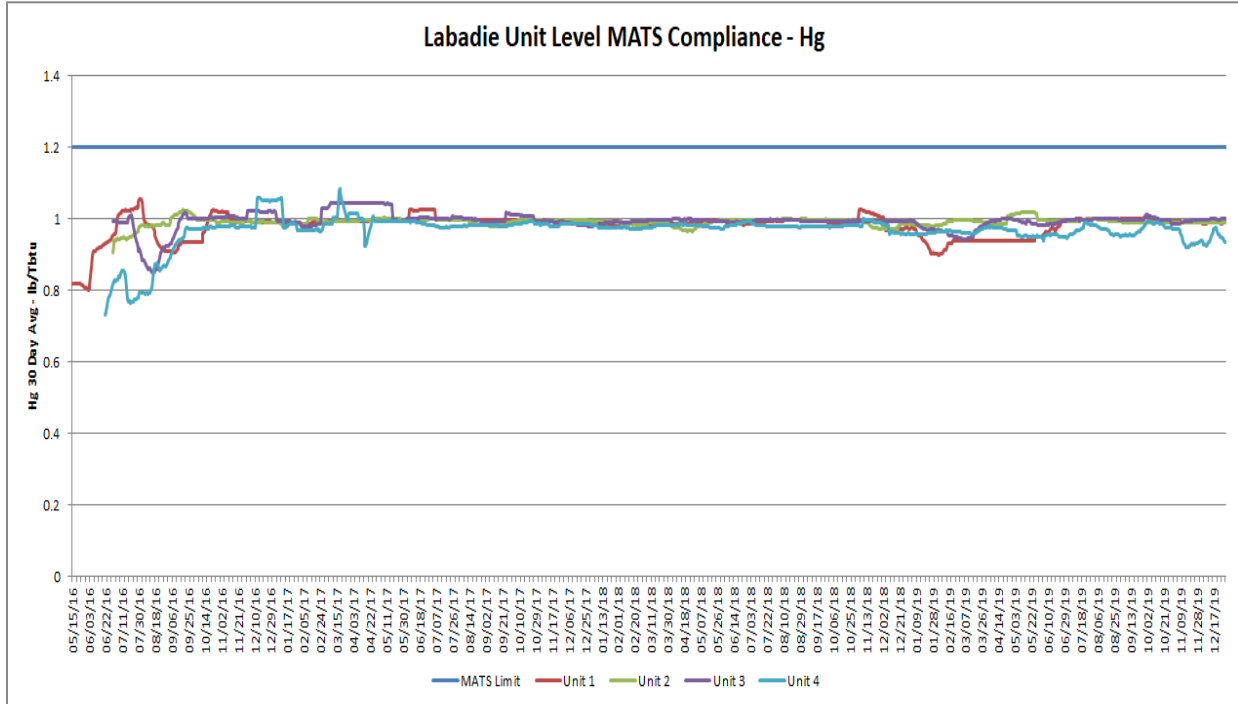


Figure 5.5 Meramec MATS Compliance – Mercury

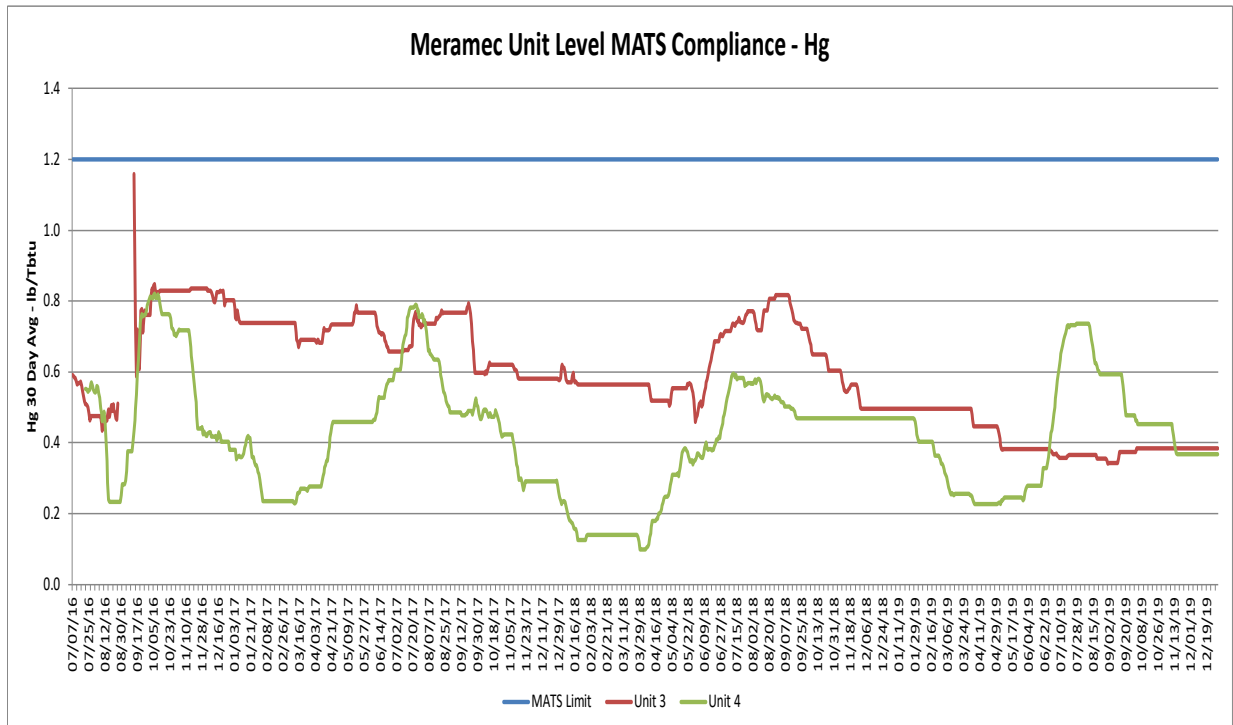


Figure 5.6 Rush Island MATS Compliance – Mercury

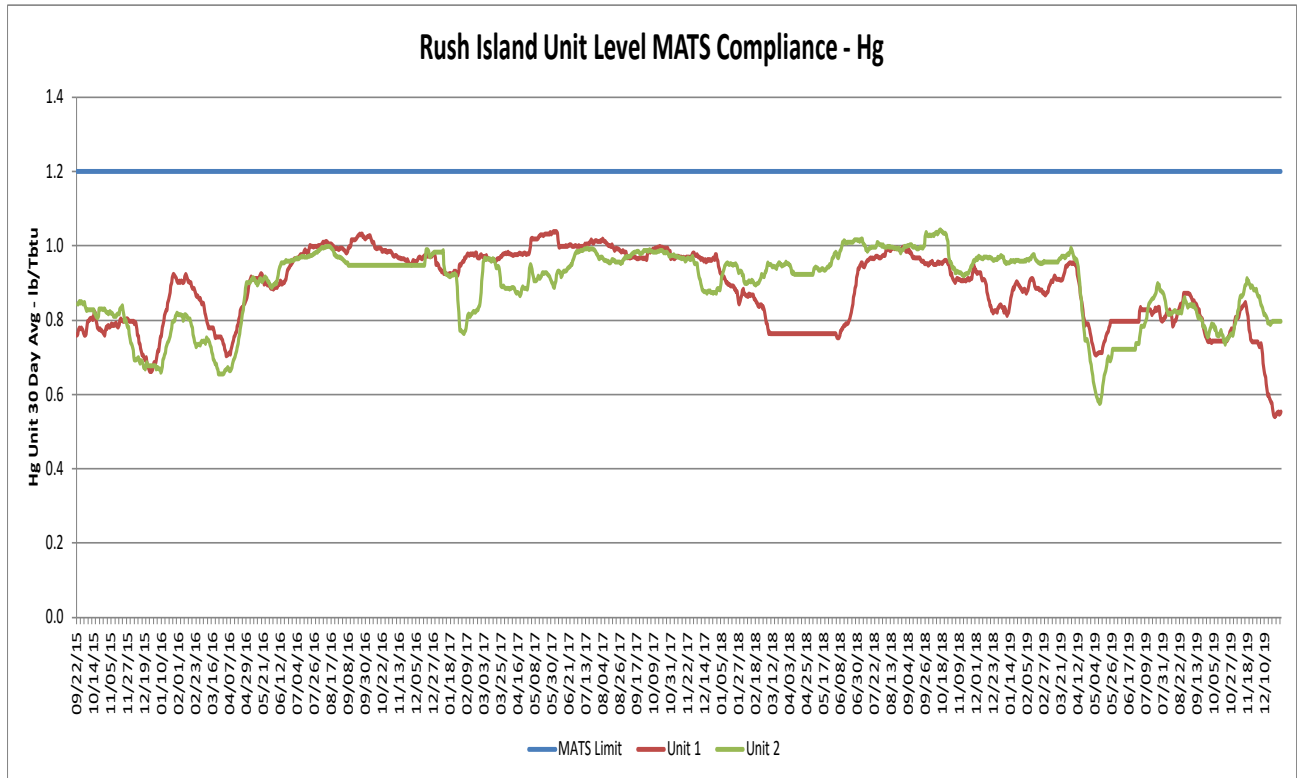


Figure 5.7 Sioux MATS Compliance – Mercury

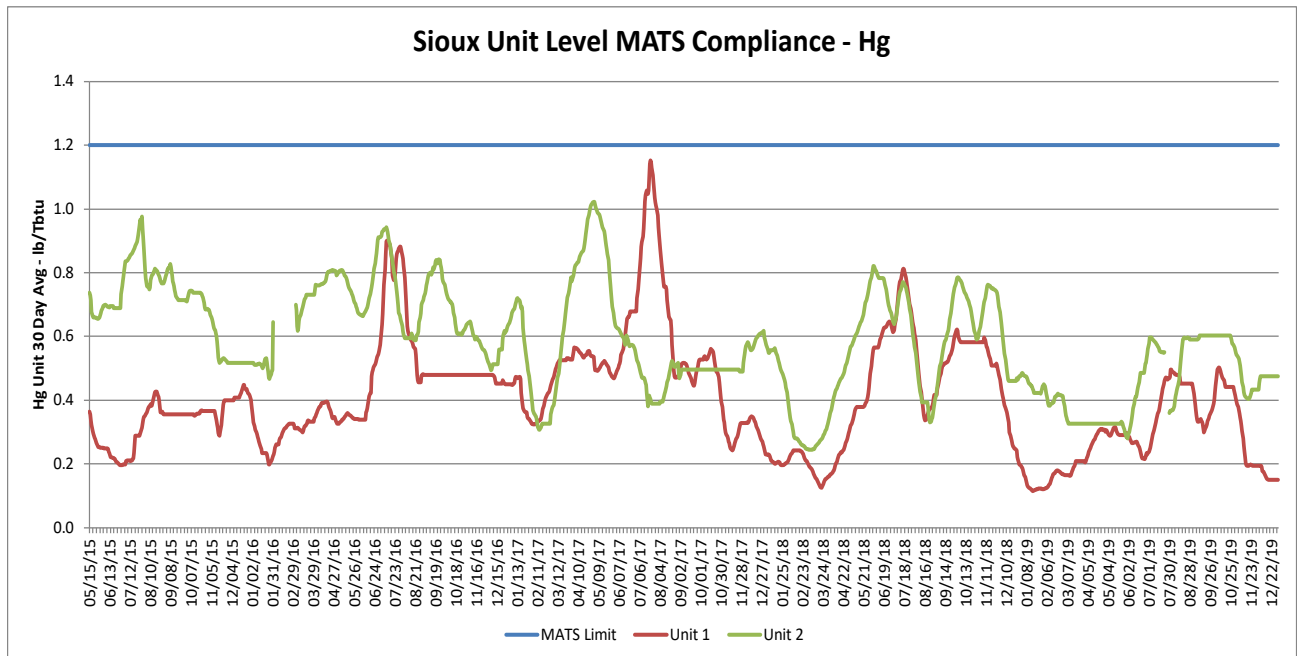


Figure 5.8 Labadie MATS Compliance – PM

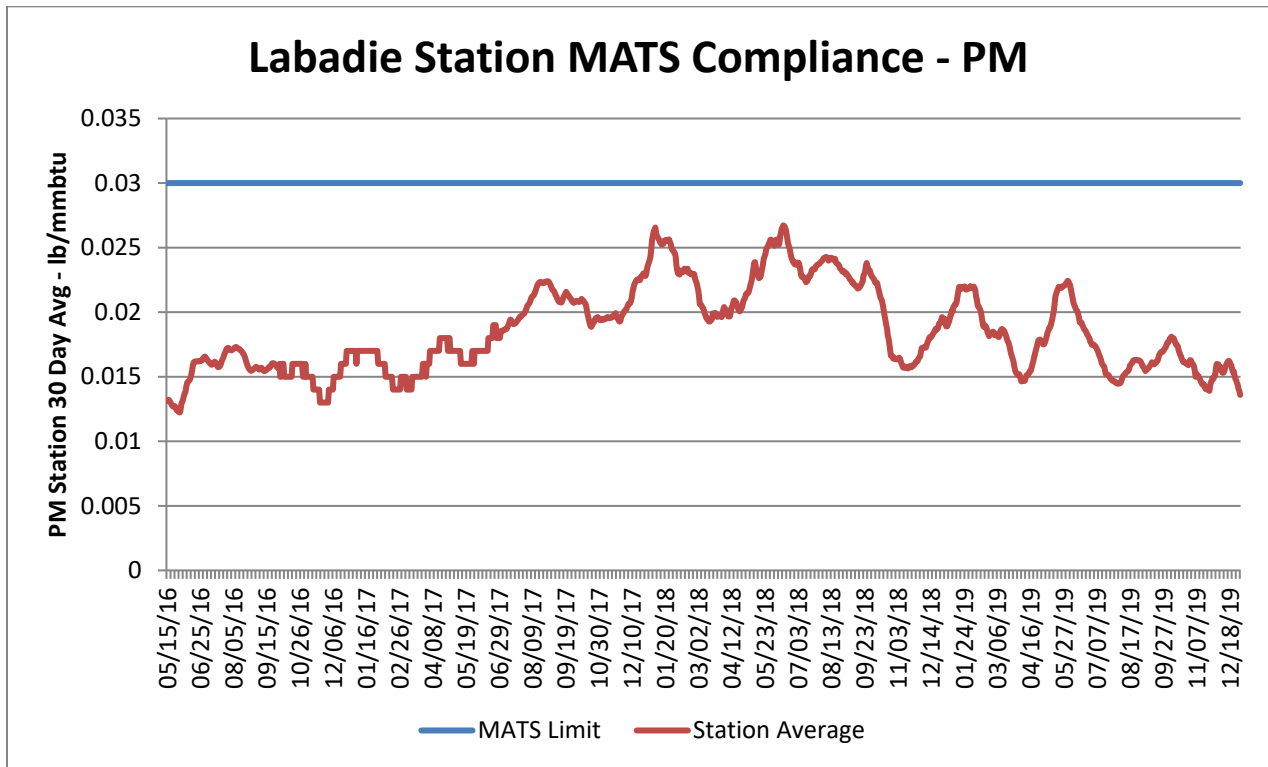


Figure 5.9 Meramec MATS Compliance – PM

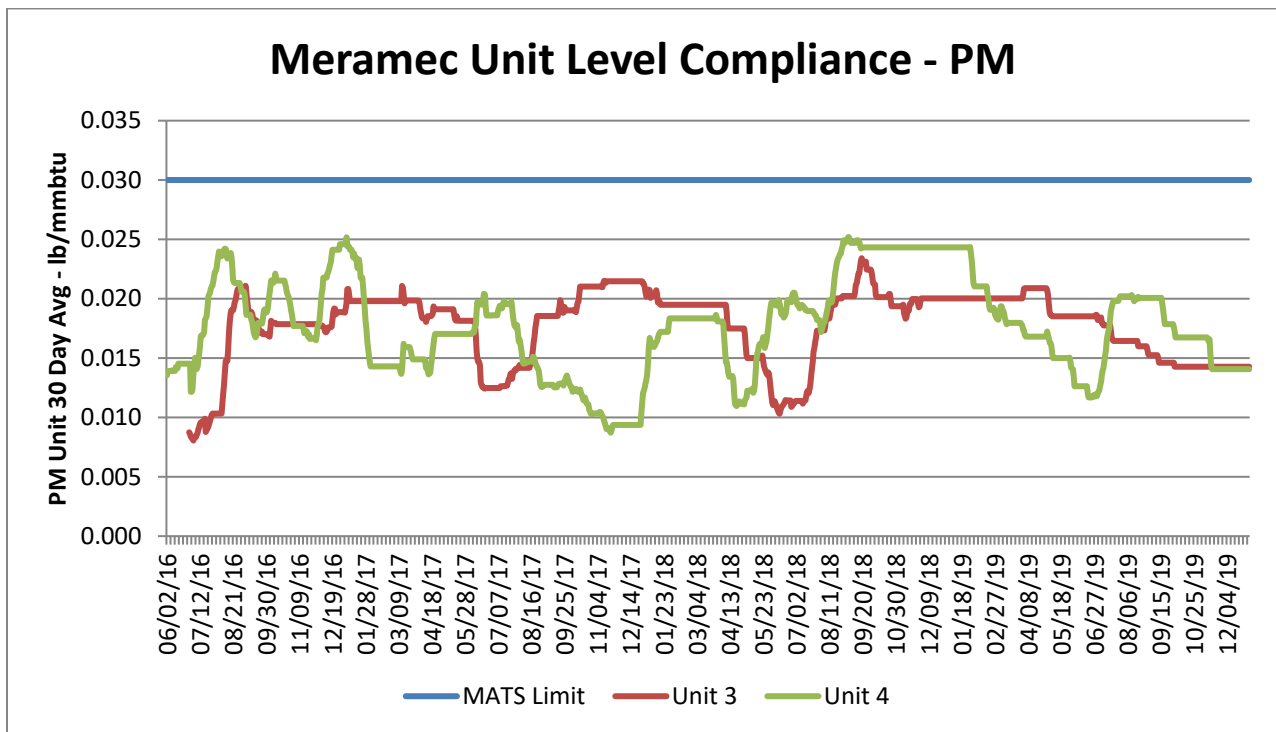


Figure 5.10 Rush Island MATS Compliance – PM

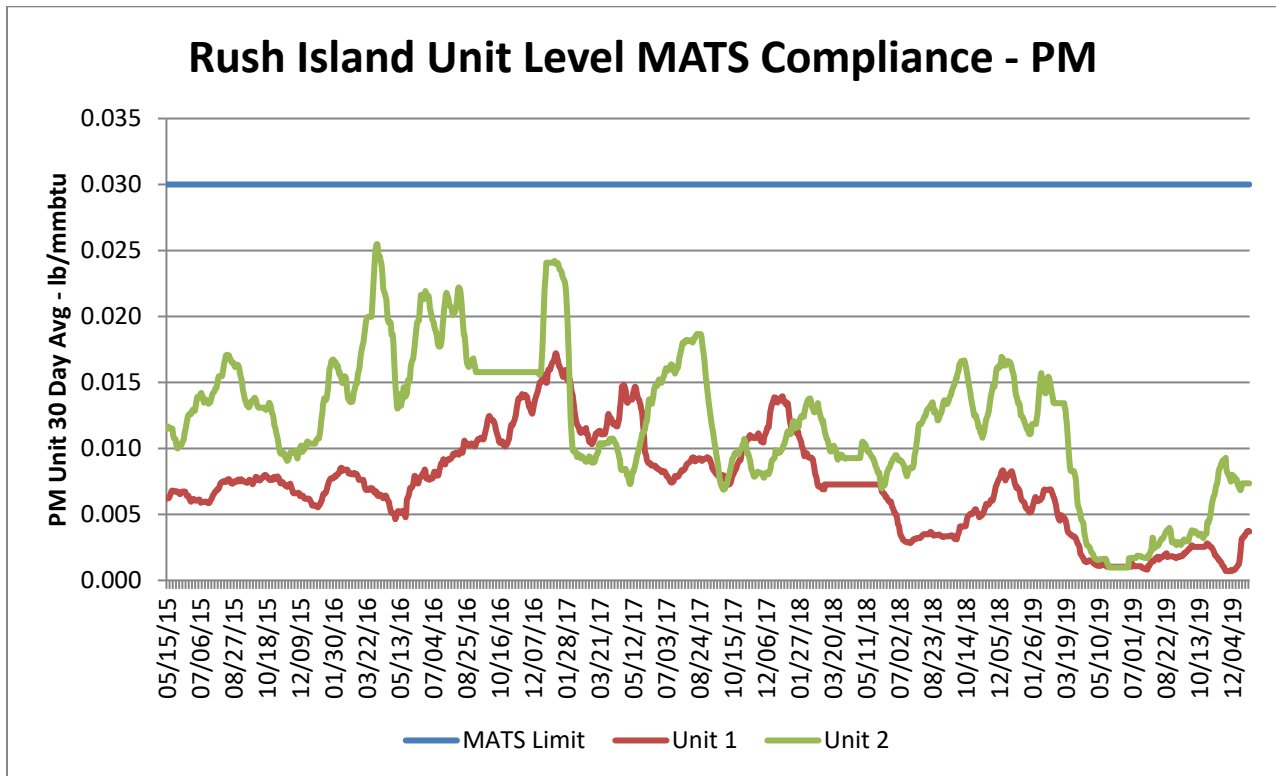


Figure 5.11 Sioux MATS Compliance – PM

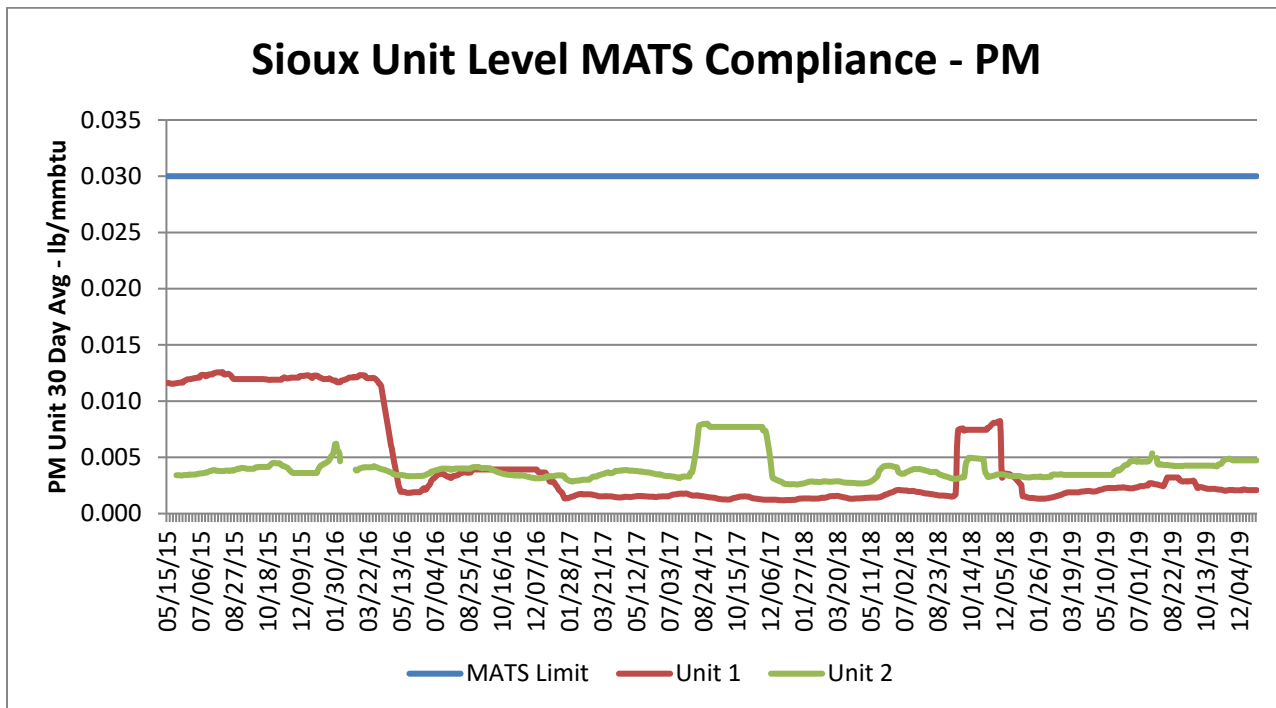
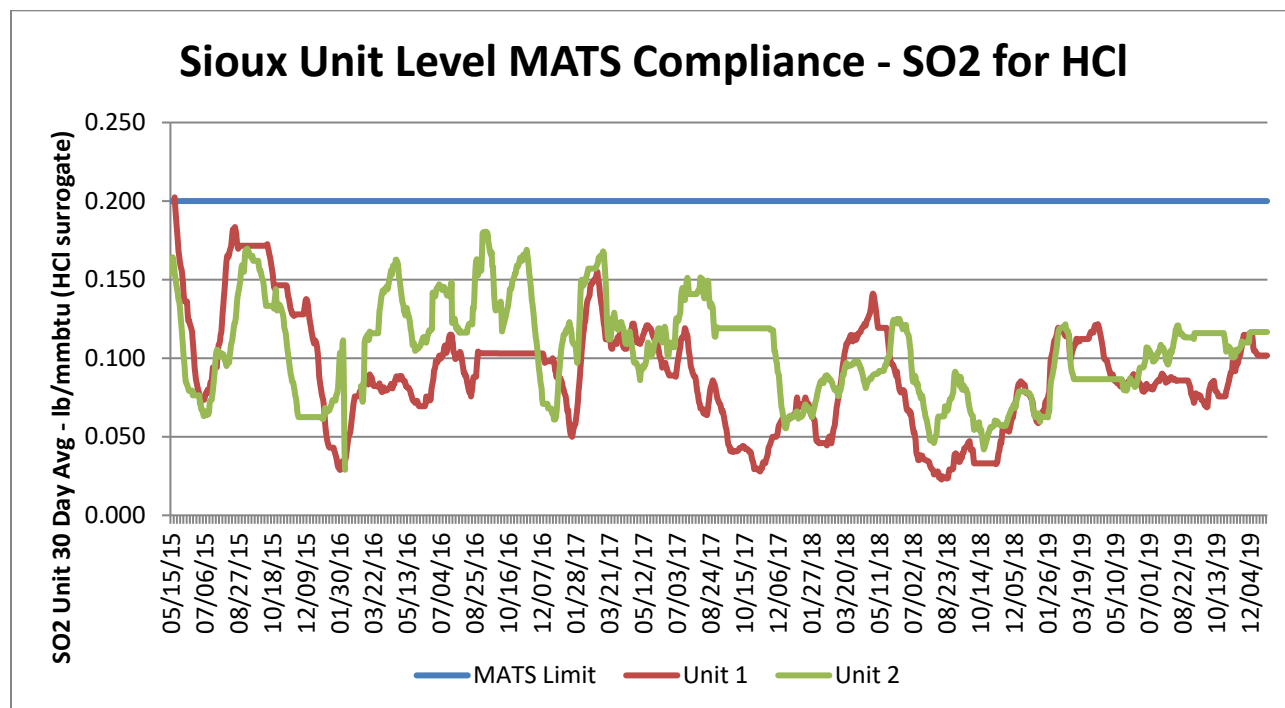


Figure 5.12 Sioux MATS Compliance – HCl (Sioux uses SO₂ as a surrogate)

Clean Air Act Regional Haze Requirements

The goal of the Regional Haze Rule is to set visibility equivalent to natural background levels by 2064 in Class I areas. Class I areas are defined as national parks exceeding 6,000 acres, wilderness and national memorial parks exceeding 5,000 acres and all international parks in existence on August 7, 1977. There are currently 156 Class I areas, two of which are in the State of Missouri (Hercules Glade and Mingo). As part of the first planning period (2008-2018), states have developed implementation plans necessary to meet the glide path for the first 10 year planning period. In addition, the Regional Haze Rule requires compliance with Best Available Retrofit Technology ("BART") for SO₂ & NO_x for the first planning period. The EPA has determined that compliance with CSAPR meets the BART requirements. Ameren Missouri is fully compliant with CSAPR, and thus, is compliant with the BART requirements. In January 2017, the EPA extended the deadline for states to submit plans for the second planning period. Those plans must be submitted to the EPA by July 2021. The MDNR is beginning to develop the state plan that will go through a public notice and comment period prior to submittal to the EPA. Ameren Missouri has assumed in this IRP that its compliance with CSAPR will allow it to be in compliance with the BART requirements of the Regional Haze Rule.

Clean Air Act – New Source Review ("NSR")

Ameren Missouri is required to review projects that it intends to perform under 40 CFR 52.21(r)(6) to determine if NSR permitting is applicable for existing major sources. For

new facilities not located at Ameren Missouri's existing facilities, evaluations are performed based on the level of expected emissions and whether these projects fall under regulations defined under the New Source Performance Standards ("NSPS") (Clean Air Act Section 111), National Emission Standards for Hazardous Air Pollutants ("NESHAP") (Clean Air Act Section 112) or other state construction permitting requirements.

- Ameren Missouri continues to review major projects at its existing facilities related to maintenance activities and compliance initiatives (e.g. electrostatic precipitator ("ESP") upgrades, ACI systems for MATS compliance...) for the EPA's and the state's regulations.
- Ameren Missouri currently is not involved in construction of new major air pollutant emitting facilities requiring compliance with NSPS, NESHAP or other state air regulations.

5.3 Water Regulation and Compliance Assumptions

Clean Water Act (Amended 1972)

The Clean Water Act ("CWA"), in conjunction with State regulations, establishes pollutant-specific water quality standards for discharges to surface waterbodies. The National Pollutant Discharge Elimination System ("NPDES") permit process provides for protection of water resources for industrial facilities. Technology and water quality based effluent limitations are in place to ensure water quality meets the applicable standards. In order to comply with effluent standards, it may be necessary to modify operations and/or install additional water pollution control equipment to meet a water quality standard.

CWA, Section 316(a) Thermal Discharges.

Section 316(a) of the CWA requires limitations on thermal discharges from industrial sources, including power plants.

The EPA and MDNR regulate cooling water systems at the Ameren Missouri energy centers through the NPDES permit program. The Missouri Department of Natural Resources administers the NPDES permit program for sources in Missouri including the Ameren Missouri energy centers.

The Labadie Energy Center cooling water discharge and the associated thermal plume has been studied extensively since the facility's initial NPDES permit application. Energy center operations have not changed significantly since the original studies were performed. Further biological studies were voluntarily and periodically performed over the years. In 2017, the MDNR approved a biological study plan in accordance with the current NPDES permit for the Labadie energy center. In 2016, Ameren Missouri requested a modification to the Labadie Energy Center NPDES permit to allow use of a site-specific

model to determine compliance with Missouri Water Quality Standards ("MWQS"). The model established that an effluent limitation expressed as a Thermal Discharge Parameter ("TDP") would ensure compliance with the water quality standard. In May 2017, the MDNR issued a revised NPDES permit establishing a thermal effluent limitation of 0.95 TDP for both the interim and final thermal effluent limitations. In 2018, Ameren Missouri submitted a request to implement the final thermal effluent limitations effective on August 1, 2018, well in advance of the NPDES permit timeline.

The TDP limit incorporates a 5 percent margin of safety to ensure compliance with the MWQS. Nevertheless, there is the potential for occasional, infrequent exceedances (less than one percent of the time on average based on existing data) of the MWQS. This could occur during conditions of extraordinarily high ambient river temperature and/or extraordinarily low river flow leading Ameren Missouri to seek alternative thermal effluent limitations. In April 2020, Ameren Missouri submitted CWA 316(a) Final Demonstration proposing an alternative temperature effluent limit to ensure continued operation of the Labadie Energy Center, at the same time, assuring the protection and propagation of a balanced indigenous aquatic community in the lower Missouri River.

Ameren Missouri has identified operating procedures it would implement to address any thermal issues. This will allow it to avoid requirements to install cooling towers at the Labadie Energy Center. In addition, Ameren Missouri does not believe there are any thermal issues at its other fossil energy centers that would require cooling towers.

CWA, Section 316(b) Entrainment and Impingement of Aquatic Organisms

Section 316(b) of the CWA was established to protect fish and aquatic habitat from detrimental impacts associated with water intake structures. At energy centers, aquatic organisms can be impinged (e.g. trapped or pinned against the intake screens) and entrained (e.g. pass through the screens, enter the heat exchanger and then be discharged) within cooling water intake structures/piping and condenser systems. The EPA and MDNR establish regulations to limit adverse impacts associated with cooling water intake structure operation through the NPDES permit process. Compliance with CWA §316(b) standards may incorporate performance and/or design criteria, or the utilization of specific control technologies. The presence of threatened or endangered species at a cooling water intake structure could potentially result in the need for additional operational and physical changes.

The EPA issued revised CWA §316(b) regulations on August 15, 2014. While the rules do not expressly require the installation of cooling towers at all facilities, they are expected to result in capital expenditures for modifications to existing cooling water intake structures to achieve compliance. All facilities with a cooling water intake structure are required to perform studies for review by the MDNR and other agencies. Facilities withdrawing in excess of 125 million gallons of water per day are required to perform

additional studies to determine what control technologies are required. Intake structure owners are provided the option of selecting one of seven different impingement compliance options. These options include: (1) closed cycle cooling; (2) 0.5 foot per second (ft./sec) through-screen velocity (by design); (3) 0.5 ft./sec through-screen velocity (as measured); (4) existing off-shore velocity cap; (5) modified traveling water screens; (6) a “suite of technologies” determined by the permit writer to represent the best available technology; or (7) any technology that results in an annual impingement mortality rate of less than 24%. For those facilities that withdraw over 125 million gallons of water per day, or at the discretion of the permitting authority, the regulation also requires the reduction of entrainment similar to closed cycle cooling or a site-specific standard. New generating units are required to install closed cycle cooling.

The compliance options that have been considered to meet the CWA §316(b) include the following.

To meet the impingement and entrainment standards:

- Modified traveling water screens
- Installation of Fine Mesh Screens
- Installation of closed cycle cooling using Cooling Towers

In 2015, Ameren Missouri began two-year entrainment characterization studies as the next step in complying with Section 316(b). Ameren Missouri is finalizing biological studies at the Labadie, Rush Island and Sioux coal-fired energy centers. Due to the retirement of the Meramec Energy Center at the end of 2022, no additional mitigation is necessary. Fish studies performed at the Callaway Energy Center have resulted in the initial determination that no additional modifications of its intake structure are required to achieve compliance with CWA §316(b) requirements.

Pursuant to the current NPDES operating permits for the energy centers, Ameren Missouri is required to submit a Section 316(b) report as part of the next permit renewal application. In January 2020, Ameren Missouri submitted the NPDES permit renewal application for the Labadie Energy Center. The application included the Section 316(b) report. This report details the results of the biomonitoring studies and the selected path forward for implementing impingement and entrainment modifications at the intake structure

Coarse-mesh modified traveling water screens have been found to be the more appropriate impingement mortality reduction technology at the Labadie Energy Center. The final determination will be made by the MDNR and implemented via the NPDES permit.

While cooling towers and various fine-mesh screen technologies could potentially reduce entrainment, such technologies pose significant challenges to the operation of the energy centers. Additionally, none of the entrainment reduction technology costs are justified by their benefits.

For the IRP, the installation of modified traveling water screens are assumed at the Labadie, Rush Island and Sioux Energy Centers.

CWA, Steam Electric Effluent Limitation Guidelines Revisions

Sector specific effluent limitation guidelines are periodically updated by the EPA to ensure best available technology is utilized in the treatment of wastewater discharges, including those from steam electric power plants. The existing steam electric effluent limitations guidelines were last revised in 1982. On November 3, 2015, the EPA issued a revised rulemaking for steam electric power plant discharges. Although most of the impact of this rule is associated with discharges from flue gas desulfurization ("FGD") wastewater, the rule prohibits discharges of ash transport water. As a consequence, Ameren Missouri has initiated projects at the Labadie, Rush Island and Sioux energy centers to construct new or augmented fly ash handling systems and new bottom ash handling systems. Ameren Missouri has also initiated projects to construct and operate new wastewater treatment systems to manage discharges from various power plant systems such as demineralizer regenerations, storm water, and other process wastewater.

The revised rule establishes federal limits on the levels of toxic metals in wastewater that can be discharged from power plants including mercury, arsenic, and selenium. These guidelines will require the use of new physical, chemical and/or biological treatment systems. Ameren Missouri has assumed that existing and any new installations would require dry systems with the use of landfills for disposal. Compliance obligations are implemented through the NPDES permit process with compliance required no later than November 2023. However, the EPA has taken action to stay certain compliance dates in the rule as litigation of the rule proceeds.

The compliance options that have been initiated to meet the Steam Electric Effluent Limitation Guidelines include the following:

- Installation of Wastewater Treatment Systems
- Installation of Dry Fly Ash Systems
- Installation of Dry Discharge Bottom Ash Systems

Ameren Missouri has initiated and is in the process of completing projects to comply with the Steam Electric Effluent Limitation Guidelines at each of our coal-fired energy centers except for Meramec. With its retirement at the end of 2022, installation of a wastewater treatment system at Meramec will not be necessary.

5.4 Solid Waste Regulation and Compliance Assumptions

Coal Combustion Residuals

The CCR rule was published April 17, 2015, and became effective October 19, 2015. It establishes national standards for the management of CCRs. The CCR rule is self-implementing, however in December 2016, Congress amended federal solid waste statutes to classify coal combustion residual units as “sanitary landfills” and authorized the states under the WIIN Act to develop programs that, following EPA approval, would act in lieu of the federal rule. Under the WIIN Act, each state may submit to the EPA a permitting program or other system of approval to achieve compliance with the CCR rule or "other State criteria that [the EPA] determines to be "at least as protective as" that rule.² The amendments afford states flexibility in establishing a CCR management program, and state agencies are not required to adopt verbatim the federal CCR Rule. The EPA has initiated a series of rulemakings to revise the federal CCR rule in accordance with the WIIN Act as well as recent court decisions.

These rulemakings are in progress, however Ameren Missouri is executing its compliance strategy in advance of the regulatory deadlines. The Company continues to monitor the potential for further changes in regulation that may impact resource planning decisions. Table 5.3 below shows the capex and O&M assumptions for environmental mitigation.

Ash Pond Closure Initiatives

This year, Ameren Missouri will complete the closure of certain impoundments at Labadie, Meramec and Rush Island and we expect to have closed approximately 92% on a CCR volumes basis by 2021, several years in advance of regulatory requirements. After retirement of the Meramec Energy Center the remaining CCR ponds will be closed in 2023. The closure of these ash ponds will reduce our consumption of approximately 11 billion gallons of water per year. With regard to groundwater and drinking water concerns, extensive analyses and tests have been undertaken by an independent third party expert (many of which are beyond regulatory requirements).

Those tests have concluded:

- There is no significant adverse impact on human health or the environment from our CCR management practices
- There is no evidence of CCR impacts in rivers or streams close to our facilities or in groundwater used for drinking water

² Solid Waste Disposal Act ("SWDA") §4005 (d)(1)(B), 42 U.S.C. §6945(d)(1)(B)

In response to the CCR rules and the Effluent Limitation Guidelines, Ameren Missouri is planning the following projects for its energy centers:

Labadie Energy Center

- Operate the on-site landfill
- Dry ash conversion projects substantively completed
- Close the bottom and fly ash ponds by the end of 2020
- New wastewater treatment facility installed

Meramec Energy Center

- The closure of some of the ponds except for those necessary for operation until retirement when the remaining ponds are being closed
- Closure of remaining ponds after retirement by end of 2023

Rush Island Energy Center

- Dry ash conversion projects are implemented
- Closure of the bottom and fly ash ponds by end of 2020
- New wastewater treatment facility installed
- Off-site reuse or disposal options will be established

Sioux Energy Center

- Continue the operation of the on-site landfill
- Dry ash conversion projects will be implemented by the end of 2020
- Close the bottom and fly ash ponds by the end of 2021
- New wastewater treatment facility under construction, completion in 2020

While mitigation has been included in our analysis for current and certain potential future regulations, further changes in regulations are possible. The Company continues to monitor the potential for further changes in regulation that may impact resource planning decisions. Table 5.2 below shows the capex and O&M assumptions for environmental mitigation.³

³ 20 CSR 4240-22.040(1); EO-2020-0047 1.M

Table 5.3 Environmental Mitigation Costs

| Facility | Environmental Mitigation | Regulation | In-Service Year | Cost (incl. AFUDC) \$ Million | Annual O&M \$ Million |
|--------------------|----------------------------|-------------|-----------------|-----------------------------------|--------------------------|
| Meramec | Ash Pond Closure | CCR | 2023 | 48 | 0.1 |
| | Groundwater Monitoring | CWA | 2022 | 1 | - |
| Meramec | Total Environmental | | | 48 | 0.1 |
| Labadie | Landfill Cells | CCR | 2026* | 68 | - |
| | Aquatic Life | CWA 316 | 2025 | 41 | - |
| | Groundwater Monitoring | CWA | 2022 | 1 | 0.1 |
| Labadie | Total Environmental | | | 111 | 0.1 |
| Rush Island | Traveling Screens | CWA 316 (b) | 2026 | 25 | - |
| | Groundwater Monitoring | CWA | 2025 | 1 | - |
| Rush Island | Total Environmental | | | 26 | 0.0 |
| Sioux | Ash Pond Closure | CCR | 2022 | 26 | - |
| | Landfill Cells | CCR | 2022** | 26 | - |
| | Traveling Screens | CWA 316 (b) | 2025 | 16 | - |
| | Groundwater Monitoring | CWA | 2023 | 1 | 0.1 |
| Sioux | Total Environmental | | | 43 | 0.1 |
| TOTAL | Total Environmental | | | 227 | 0.2 |

* Multiple cells in service by 2026, 2030, 2037

** Multiple cells in service by 2022, 2025

5.5 Compliance References

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|-----------------------------|----|
| 20 CSR 4240-22.040(1) | 21 |
| EO-2020-0047 1.L..... | 6 |
| EO-2020-0047 1.M..... | 21 |