



# United States Environmental Protection Agency General Permit for New or Modified Minor Sources of Air Pollution in Indian Country

<http://www.epa.gov/air/tribal/tribalnsr.html>

## Background Document: True Minor Source Stone Quarrying, Crushing, and Screening Facilities General Permit

Version 1.0

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### 1. Stone Quarrying, Crushing and Screening Source Category Definition

A Stone Quarrying, Crushing, and Screening (SQCS) facility is any non-metallic mineral processing facility which uses rock crushers, grinding mills, screening operations, bucket elevators, belt conveyors, bagging operations, storage bins, storage piles, truck loading stations, or railcar loading stations to process stone, sand, gravel, or mineral aggregate. As diesel fuel is the most commonly used fuel at SQCS facilities, for the sake of simplicity, the permit is written to exclude the use of the general permit by sources that combust fuels other than diesel fuel/biodiesel. The proposed True Minor Source SQCS General Permit only covers SQCS operations that are located at true New Source Review (NSR) minor sources.

### 2. Source Category Characterization

The operations and equipment at a typical SQCS facility are described in [AP 42](#), Chapters 11.19.1, Sand and Gravel Processing and 11.19.2, Crushed Stone Processing and Pulverized Mineral Processing.<sup>1</sup> SQCS facilities are part of a larger industrial process where stone, sand, gravel, rock, and minerals are removed from the earth and prepared for industrial, commercial and residential use. Quarried stone normally is delivered to the processing plant by truck, and is dumped into a hoppers feeder, usually a vibrating grizzly type, or onto screens. The feeder or screens separate large boulders from finer rocks that do not require primary crushing, reducing the load to the primary crusher.<sup>2</sup>

In sand and gravel processing, deposits of sand and gravel are mined and processed with screens, washing, and clarifiers to segregate the material into different particle sizes. Sometimes, crushing equipment is utilized to reduce particle sizes. In rock crushing operations, rock is loosened by drilling and blasting and then loaded by front-end loader or power shovel into large haul trucks that transport the material to the processing operations. Processing operations may include: crushing, screening, size classification, material handling and storage operations. Rock is loaded into bins and sent through screens, sorted for size, and conveyed to one or more rock crushers until all of the raw material is reduced to the desired size. Each crusher machine has associated screening and conveying equipment. After crushing, the rock is sorted according to size in screeners and conveyed to storage piles by conveyors. Front end loaders and trucks are used to move finished materials offsite. Rock types processed by the crushed stone industry include: limestone, granite, dolomite, traprock, sandstone, quartz, quartzite, and lesser amounts of calcareous marl, marble, shell, and slate.

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<sup>1</sup> AP-42, Chapters 11.19.1, Sand and Gravel Processing and 11.19.2, Crushed Stone Processing and Pulverized Mineral Processing, <http://www.epa.gov/ttn/chief/ap42/ch11/index.html>.

<sup>2</sup> Emission Inventory Improvement Program, Point Source Committee (Joint EPA – STAPPA/ALAPCO Initiative), “Technical Assessment Paper: Available Information for Estimating Emissions from Stone Mining and Quarrying Operations,” May 1998.

<http://www.dep.wv.gov/dag/planning/inventory/Documents/EIIP%20V02%20Ch13%20Stone%20Mining%20and%20Quarrying%20Operations.pdf>

Electricity for the motors running the crushers, screens, and conveyors is provided either by grid electric power or by diesel generators. Criteria pollutant emissions of concern are primarily particulate matter (PM) from crushing and screening, and particulate matter and nitrogen oxides (NO<sub>x</sub>) from diesel generators. For sources with available water, water sprays may be used to control particulate emissions. In sand processing, water is typically used in clarifiers to sort the sand by size, and the sand is processed wet. Dry particulate control methods (baghouses) may also be used to control particulate emissions.<sup>3</sup> SQCS facilities are distributed almost uniformly around the country in proportion to population density, as the need for sand, gravel, and mineral aggregates is widespread, the technology is simple, and the barriers to starting a business are low. Information gathered from state permits indicates that this source category is not uniform in size or emissions.

### 3. State Minor Source Permit Programs

The U.S. Environmental Protection Agency (EPA) researched state air quality permitting websites for examples of general permits and permits by rule for sand and gravel facilities and rock crushing facilities. The EPA examined these documents for their applicability in developing a general permit for Indian Country. The EPA incorporated elements from these permits in developing the documents and regulations in the general permit for SQCS facilities. The EPA examined general permit documents for sand and gravel facilities for the States of [Florida](#) and [Indiana](#). The EPA also examined general permit documents for rock crushing and screening facilities for the States of [Alaska](#), [Arizona](#), [Florida](#), [Indiana](#), [Washington](#), and [Wisconsin](#) in developing this general permit. The EPA chose general permits from these states because of characteristics they possess:

- Readily available;
- Clear throughput limits; and
- Organization of the regulations followed the typical form for federal NSR permits:
  - Limitations and standards, and
  - Monitoring, testing, recordkeeping, and reporting requirements.

Very few states issue air general permits for sand and gravel facilities. Although Indiana issues both a sand and gravel permit and a rock crushing permit, their respective throughput limits are nearly identical. Many states issue air general permits for rock crushing facilities, and the EPA found that other states general permits for rock crushing and screening facilities are similar in content to the permits from the states listed above. The state general permits for SQCS facilities vary from the streamlined (Indiana, at four pages) to the extremely detailed and complex (Arizona, at 104 pages).

The state sand and gravel permits typically have throughput limits, but these vary by state. The assumptions and methodology for arriving at these throughput limitations are not discussed in the permit application documents, and, except for the Washington state rock crushing general permit, the technical support documents used in developing the throughput limits are not readily available. The EPA assumes that each state is calculating the throughput limits based on different equipment configurations and control scenarios.

Most of the state sand and gravel permit applications mention that the permit cannot be issued to sources whose potential to emit (PTE) of particulate matter 10 microns or less (PM<sub>10</sub>), NO<sub>x</sub>, or carbon monoxide (CO) is greater than 100 tons per year (tpy). The applications do state that rock throughput, fuel throughput, and/or engine displacement shall be limited, but the methodology and emissions calculations underlying the

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<sup>3</sup> AP-42, Chapters 11.19.1, Sand and Gravel Processing and 11.19.2, Crushed Stone Processing and Pulverized Mineral Processing, <http://www.epa.gov/ttn/chief/ap42/ch11/index.html>.

relationship between the emission threshold(s) and the raw material throughput/fuel usage limit(s) are not clearly stated (except for the Washington state rock crushing permit). However, it is clear that these rock throughput limits, fuel usage limits, and engine displacement limits are intended to keep emissions below the major source thresholds. The Alaska rock crushing permit contains no rock throughput limits, but requires the applicant to calculate the PTE of their facility to verify that it is below 100 tpy prior to submitting the application. Similarly, the Florida sand and gravel permit does not contain any raw material throughput limits, but merely requires that the facility's PTE be less than 100 tpy for any criteria pollutant. However, these two permits are an exception. The state permits typically limit raw materials throughput and fuel usage as a surrogate for limiting emissions.

As previously mentioned, many of the state permits regulate emissions from engines, but the type of regulation varies. Some state permits that regulate combustion emissions (Alaska and Arizona) delineate between stationary engines and nonroad (portable) engines.<sup>4</sup> They do not regulate combustion emissions from the engines at rock crushing facilities which change location more frequently than once per year because, by definition, those engines are nonroad (portable) engines. They also do not regulate the amount of fuel used by mobile sources, such as trucks and front end loaders. The Florida and Wisconsin rock crushing permits do regulate combustion emissions, but assume that all combustion is from stationary engines. For all of the state permits mentioned here, combustion emissions from stationary engines at rock crushing facilities are regulated by limiting the amount of fuel that can be combusted per year, or the engine displacement. The fuel usage limits vary from state to state, and underlying calculations are not provided, so it is not clear what the intended emissions limit is for each state permit. The Indiana and Washington state permits do not regulate combustion emissions.

Most state permits (Arizona, Florida, Indiana, Washington, and Wisconsin) require control of particulate emissions, but the Alaska permit does not. In Alaska, the water sprays typically used to control particulate may freeze on the aggregate and the equipment, creating unsafe and unworkable conditions. All state sand and gravel permits require that the operator have a fugitive dust control plan and that fugitive emissions from roadways and storage piles be controlled. The Alaska permit qualifies this and requires fugitive emissions control if the facility is within 1,000 feet of a residence. The State of Washington conducted dispersion modeling for a rock crusher processing 5,300,000 tons of material per year, and determined that a 150 foot setback from the rock crusher to the property lines would ensure no violation of the 24-hour National Ambient Air Quality Standards for PM<sub>10</sub> (150 µg/m<sup>3</sup>).<sup>5</sup> The state permit for Alaska contains a 400 foot setback provision for the crusher and any diesel engine from the nearest residence. All of the state sand and gravel permits include opacity limitations, most require an operation and maintenance plan, and all include some variation of the monitoring and recordkeeping requirements found in typical minor source permits. The [South Coast Air Quality Management District](#) of California provides a comprehensive set of regulations<sup>6</sup> for control of fugitive dust in areas of serious or severe nonattainment for PM<sub>10</sub> and particulate matter 2.5 microns or less (PM<sub>2.5</sub>). A fugitive dust control plan is included in the permit.

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<sup>4</sup> Stationary engines include all internal-combustion engines that are used either in a fixed application, or in a portable (or transportable) application in which the engine will stay at a single site for at least a full year. "Emission Regulations for Stationary and Mobile Engines" US EPA, EPA420-F-02-034, September 2002.

<sup>5</sup> Washington State Dept. of Ecology, "Suitability of Rock Crushing Operations for Air Quality General Order of Approval: Evaluation of Control Technology, Ambient Impacts, and Potential Approval Criteria," June 2006.

<sup>6</sup> South Coast Air Quality Management District, Rule 1157 "PM10 Emission Reductions from Aggregate and Related Operations," <http://www.aqmd.gov/rules/reg/reg11/r1157.pdf>.

Several of the state general permits incorporate the requirements of New Source Performance Standards (NSPS) [Subpart 000](#) (Standards of Performance for Nonmetallic Mineral Processing Plants) into the text of the permit, while other states (Florida, Indiana) incorporate the Subpart 000 requirements by reference. Requirements for NSPS [Subpart IIII](#) (Standards of Performance for Stationary Compression Ignition Internal Combustion Engines) and National Emissions Standards for Hazardous Air Pollutants (NESHAP) [Subpart ZZZZ](#) (National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines) are not generally included in state permits for sand and gravel facilities.

## **4. Requirements for General Permits and Permits by Rule**

### **4.1 Documents for General Permits and Permits by Rule**

The EPA developed a standardized set of permit documents in support of a general permit for SQCS facilities located in Indian Country. These consist of the following documents:

- Questionnaire: Assists the facility owner or operator in determining whether they are eligible for a General Air Quality Permit;
- Request for Coverage under the General Air Quality Permit: States the criteria for qualification, gathers information on the source, facility location, and source contact, and requests technical information on facility equipment, throughput, and attainment status;
- Instructions: Guides the applicant in filling out the Request for Coverage under the General Air Quality Permit;
- General Air Quality Permit, Terms and Conditions: Contains the requirements and regulations with which the source must comply. The emission limitations, monitoring, recordkeeping and reporting requirements are in the permit, including requirements for sources located in nonattainment areas; and
- Potential to Emit Calculator spreadsheet: Allows applicants to calculate their PTE, based on owner inputs of the specific equipment present at their source, assuming continuous operation throughout the year. The PTE Calculator spreadsheet generates potential emissions, based on these inputs. The spreadsheet illustrates the correlation between equipment, raw material throughput, and emissions.

### **4.2 Exemption and Qualification for General Permits/Permits by Rule**

Facilities applying for the proposed general permit must meet the following criteria:

- Must be a true NSR minor source; and
- Be below the emission limitations established for the general permit.

New facilities with a PTE or modifications to existing facilities with an emissions increase lower than the minor NSR thresholds specified in Table 1 of Tribal NSR Rule ([40 CFR 49.153](#)) are exempt from the minor NSR program. The exemption thresholds for PM and criteria pollutants are listed in Table 1 below. Facilities applying for the proposed general permit may calculate their PTE using the PTE calculator provided to determine if they are exempt from the minor NSR program. The EPA is providing a PTE calculator to assist with this task.

**Table 1: Minor NSR Thresholds in 40 CFR 49.153**

<b>Pollutant</b>	<b>Attainment Area</b>	<b>Nonattainment Area</b>
CO	10 tpy	5 tpy
PM	10 tpy	5 tpy
PM <sub>10</sub>	5 tpy	1 tpy
PM <sub>2.5</sub>	3 tpy	0.6 tpy
SO <sub>2</sub>	10 tpy	5 tpy
NO <sub>x</sub>	10 tpy	5 tpy
Volatile Organic Compounds (VOC)	5 tpy	2 tpy

Under current EPA policy, only true NSR minor sources qualify for the proposed general permit. Therefore, facilities will be required to compare their PTE to the NSR major source thresholds to determine if they qualify for the proposed general permit. For this source category – stone quarrying, crushing and screening facilities – the NSR major source threshold for attainment areas is 250 tpy of any criteria pollutant. The NSR major source thresholds for nonattainment areas are summarized in Table 2 below:

**Table 2: NSR Major Source Thresholds for Nonattainment Areas**

<b>Pollutant</b>	<b>Nonattainment Classification</b>	<b>NSR Major Source Threshold</b>
Ozone	Marginal	100 tpy of VOC or NO <sub>x</sub>
	Moderate	100 tpy of VOC or NO <sub>x</sub>
	Serious	50 tpy of VOC or NO <sub>x</sub>
	Severe	25 tpy of VOC or NO <sub>x</sub>
	Extreme	10 tpy of VOC or NO <sub>x</sub>
PM <sub>10</sub>	Moderate	100 tpy
	Serious	70 tpy
CO	Moderate	100 tpy
	Serious	50 tpy
SO <sub>2</sub> , NO <sub>x</sub> , PM <sub>2.5</sub>	No nonattainment classification	100 tpy

If the facility's PTE is above the NSR major source threshold of 250 tpy, or above the applicable nonattainment area thresholds listed in Table 2 (for any pollutant that is designated nonattainment in the area the source will locate), then the facility does not qualify for the proposed general permit. The following documents are available to assist sources in the screening and application process:

- Questionnaire; and
- Request for Coverage under the General Air Quality Permit.

For facilities not exempt from the minor NSR program and having a PTE below the NSR major source thresholds, the facilities will further evaluate if they could meet the throughput limits and operating requirements established in this general permit. The specific requirements for the proposed general permit are discussed in Sections 4.3, 4.4, 4.5, and 4.6. The emissions associated with the throughput limits are lower than the NSR major source thresholds and were derived as described below in Section 5.

### 4.3 Specific Permit Requirements for General Permits and Permits by Rule

The terms and conditions of the general permit were established according to the required permit content and analyses in the Tribal Minor NSR Rule. The required permit content is listed in 40 CFR 49.155(a) – *What information must my permit include?* Below we describe the basis for the permit conditions.

#### 40 CFR 49.155(a)(1) – General Requirements

The rule establishes general requirements that each permit must identify: the effective date of the permit; the date by which the owner/operator must commence construction in order for the permit to remain valid; the emission units subject to the permit and their associated emission limitations; and monitoring, recordkeeping, and reporting requirements to assure compliance with the emission limitations.

The proposed general permit contains all of this required information, except for the emission units subject to the permit. Because of the nature of general permits we believe it is more appropriate to identify the emission units covered by the general permit in the Approval of the Request for Coverage. The general permit incorporates the Approval of the Request for Coverage into the general permit. Each permit contains a separate section that specifically identifies the emission limitations and standards, monitoring and testing, recordkeeping, and reporting and notification requirements.

#### CFR 49.155(a)(2) – Emission Limitations

The permit must contain the emission limitations determined by the reviewing authority under 40 CFR 49.154(c) for each affected emissions unit. 40 CFR 49.154(c) – *How will the reviewing authority determine the emission limitations that will be required in my permit?* – identifies the case-by-case control technology review that must be used by the reviewing authority to determine the appropriate level of control. In carrying out the case-by-case control technology review, the reviewing authority must consider the following factors:

1. Local air quality conditions;
2. Typical control technology or other emission reduction measures used by similar sources in surrounding areas;
3. Anticipated economic growth in the area; and
4. Cost-effective emission reduction alternatives.

In addition, the reviewing authority must require a numerical limit on the quantity, rate or concentration of emissions for each regulated NSR pollutant emitted by each affected emissions unit, for which such a limit is technically feasible. The emission limitation required may also be included as pollution prevention techniques, design standards, equipment standards, work practices, operational standards or any combination thereof. However, the emission limitations must assure that each affected emission unit will comply with all requirements of 40 CFR parts 60, 61, and 63, as well as any federal or tribal implementation plans that apply to the unit. Finally, the emission limitations required may not rely on a stack height that exceeds good engineering practice or any other dispersion technique, except as allowed by 40 CFR 51.118(b). To address the requirements for establishing emission limitations the following consideration were used for setting the limits in the general permit for SRGCS facilities:

1. Local air quality conditions – To address this requirement, the general permit requires sources locating in ozone nonattainment areas to meet more stringent requirements on fuel use – the main source of NO<sub>x</sub> and VOC emissions at SRGCS facilities. This will also ensure these sources are not major sources in those areas. Also, PM emission may be a concern for SRGCS facilities, but the majority of those

emissions are fugitive. The permit contains a requirement to take corrective action if fugitive dust is visible beyond the property line. This will aid in reducing the local PM air quality impacts.

2. Typical control technology or other emission reduction measures used by similar sources in surrounding areas – For sources locating in attainment areas we looked at the control requirements required by 40 CFR parts 60, 61 and 63. These regulations establish minimum technology and emission limitations that must be met nationally and also meet the requirements of 40 CFR 49.154(c)(4) to ensure compliance with parts 60, 61, and 63. For this general permit we considered regulations that apply to the equipment at SRGCS facilities:
  - a. 40 CFR 60 Subpart OOO – Standards of Performance for Nonmetallic Mineral Processing Facilities;
  - b. 40 CFR 60 Subpart Kb – Standards of Performance for Volatile Organic Liquid Storage Vessels (Including Petroleum Liquid Storage Vessels) for Which Construction, Reconstruction, or Modification Commenced after July 23, 1984;
  - c. 40 CFR 60 Subpart IIII – Standards of Performance for Stationary Compression Ignition Internal Combustion Engines; and
  - d. 40 CFR 63 Subpart ZZZZ – National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines.

These regulations cover emissions from the following equipment at SRGCS facilities:

- Engines;
- Material handling equipment; and
- Fuel storage tanks.

The derivation of applicability thresholds and the production and fuel usage limits in the applicability questionnaire, application, and conditions in the general permit are discussed fully in Section 5. The minor NSR thresholds are based on provisions of the *Review of New Sources and Modifications in Indian Country* rule at 40 CFR 49.153 and are also discussed fully in Section 5.

Review of the regulations and other existing general permits resulted in permit conditions requiring emissions from all crushers, screens, drop points, and other possible release points to be controlled by wet suppression, limiting fugitive emissions from crushers to 12% opacity, limiting fugitive emissions from all other processes to 7% opacity, requiring fugitive emissions to be controlled by a fugitive dust control plan, requiring new stationary engines to be certified to Tier standards, and requiring existing stationary engines to meet maintenance requirements, a 49 ppm CO at 15% O<sub>2</sub> limit, or a 23 ppm CO at 15% O<sub>2</sub> limit based on engine size.

In addition, the stationary engines are limited to using diesel and biodiesel as fuels. All liquid fuels are limited to no more than 0.0015 percent sulfur by weight. These conditions represent the standard fuels used for this equipment and the standard sulfur content these fuels must attain. Although we reviewed the NSPS requirements for tanks, we did not include any limits in the permit as the tanks used by SRGCS facilities will not need to meet the control requirements of the NSPS. The questionnaire limits eligibility for the general permit to tanks less than 151m<sup>3</sup> that store liquids with a true maximum vapor pressure less than 4.0 psi.

3. Anticipated economic growth in the area – The Reviewing Authority may consider anticipated economic growth when determining whether coverage under the proposed general permit is justifiable. Considering, however, that the proposed general permit sets emission standards that are consistent with what is required by SRGCS facilities across the country in both attainment and nonattainment areas, we expect that this will rarely be a factor.
4. Cost-effective emission reduction alternatives – The proposed general permit sets emission standards that are consistent with what is required by SRGCS facilities across the country, based on the particular attainment status where the source is locating. As such, the chosen technologies are considered widely available and consideration of more cost-effective alternatives is not necessary at this time. We intend to periodically review technology costs in the future to determine when more stringent, cost-effective technologies become widely available.

#### 40 CFR 49.155(a)(3) – Monitoring Requirements

The proposed general permit must include monitoring that is sufficient to assure compliance with the emission limitations that apply to the source. The proposed general permit requires monitoring that assures that the wet suppression system is operating properly, that a visible emissions survey is conducted on a weekly basis, that fugitive emissions surveys are conducted weekly, and that stationary engines with oxidation catalyst monitor the inlet temperature and pressure drop. The proposed general permit also requires initial and continuing testing of compliance with the opacity limits.

#### 40 CFR 49.155(a)(4) – Recordkeeping Requirements

The proposed general permit must include recordkeeping that is sufficient to assure compliance with the emission limitations and monitoring requirements, including certain statements listed in 40 CFR 49.155(a)(4)(i) and (ii). In addition to the recordkeeping requirements in 40 CFR 49.155(a)(4)(i), the proposed general permit also requires records of the amount of crushed rock, sand, and gravel produced each month, monthly fuel use, visible emission surveys, fugitive emission surveys, corrective actions taken, results of corrective actions taken, results of source tests, maintenance activities of stationary engines, and oxidation catalyst performance data, as applicable, for stationary engines.

#### 40 CFR 49.155(a)(5) – Reporting Requirements

The proposed general permit includes the reporting requirements listed in 40 CFR 49.1559(a)(5)(i) and (ii) related to annual reports and reporting of deviations.

#### 40 CFR 49.155(a)(6) – Severability Clause

The proposed general permit includes a severability clause to ensure the continued validity of the other portions of the permit in the event of a challenge to a portion of the permit.

#### 40 CFR 49.155(a)(7) – Additional Provisions

The proposed general permit contains the additional provision required for each permit. These conditions are found in the General Provisions of the proposed general permit.

### **4.4 Requirements for Sources Located in Nonattainment Areas**

We did not include any additional requirements for sources locating in ozone nonattainment areas, other than the limits on fuel use. We are not aware of any more stringent State/local control requirements for SRGCS facilities in nonattainment areas. The limits on fuel use will ensure that the general permit only applies to true minor sources locating in these nonattainment areas.

## **4.6 Additional Permit Requirements**

The EPA added a 150 foot setback requirement from the nearest property boundary and a 1,000 foot setback requirement between the rock crusher and the nearest residence to the general permit. These requirements are beyond EPA's NSPS and NESHAP, but are included in the Washington and Alaska permits, respectively. The setback requirement in the Washington permit is based on dispersion modeling for a rock crushing facility with a high rock throughput rate.

## **4.7 Requirements of the Endangered Species Act and National Historic Preservation Act**

Prior to seeking coverage under this general permit, sources must satisfactorily address the permitting requirements related to the Endangered Species Act and National Historic Preservation Act. Attached to the request for coverage document for the SQCS general permit, the EPA provides guidance to assist sources in complying with these two statutes.

## **5. Emission Limitations<sup>7</sup> and Surrogate Throughput Limits**

### **5.1 Developing the Surrogate Limits and Limitations**

The draft general permit includes a rock, sand, and gravel throughput limit that applies to sources in both attainment and nonattainment areas that serves as a surrogate emissions limitation. The general permit also includes surrogate fuel use limits that apply based on the particular ozone attainment or nonattainment classification in the area the source will locate. These surrogate limits correspond to a particular tpy emission rate, as discussed below.

The tpy emission rates used to determine eligibility for the general permit for sources located in attainment and nonattainment areas corresponds to the source-wide PTE at which a source would become a major source and subject to title V permitting (referred to hereafter as "the title V major source threshold"). In attainment areas, the title V major source threshold is 100 tpy for any criteria pollutant, 10 tpy for a single hazardous air pollutant (HAP), and 25 tpy for any combination of HAPs. The title V major source threshold in nonattainment areas varies by the pollutant and the nonattainment classification.

The rock, sand and/or gravel throughput limit was established based on the title V major source thresholds and assumptions about the equipment configuration at a "typical" rock, sand and/or gravel crushing facility. The assumptions about equipment configuration have a significant impact on the level of pollutants emitted. The rock, sand and/or gravel crushing permit materials from only two states (Indiana and Washington) contained information on the equipment configurations used in determining the PTE and rock throughput limits. The Indiana permit had figures for the number of crushing and screening machines for three different permit levels, but there was no information on other equipment (conveyors, storage piles, loading and unloading, etc) or how the emissions are calculated. The technical support document for the Washington Department of Ecology rock crushing permit contains more information on equipment and emissions calculations. The Washington Department of Ecology surveyed rock crushing operations and found that a typical rock crusher had three

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<sup>7</sup> The definition of emission limitation used in this Background Document is the one provided in the Indian Country NSR rule (described in Section 4.3) and includes requirements established by the reviewing authority that relate to the operation of a source, which allows for the use of production throughput limits.

crushers, three screens, and six conveying operations. Their calculations include emissions from this equipment, as well as transfer operations and haul roads. The “typical facility” calculations supporting this general permit use this same equipment configuration, and also include emissions from storage piles and truck unloading and loading operations. The EPA developed a Limit Calculator spreadsheet of PTE calculations showing pollutant emissions for the emission units at the “typical” rock, sand and/or gravel crushing and screening facility described above using AP 42 emission factors. Since AP 42 emission factors are not available for all types of operations at a rock, sand and/or gravel crushing facility, the EPA estimated some emission factors for primary and secondary crushing and screening, based on existing emission factors for tertiary crushing and screening and the relative surface area of the rock produced in each process. The calculations for these estimated emission factors are included in the PTE Calculator and Limit Calculator spreadsheets. The EPA then used the Limit Calculator spreadsheet to calculate the materials throughput limits for the SQCS general permit, based on the emission limitations.

Chapter 11.19.1 (Sand and Gravel Processing) of AP 42 does not contain emission factors for the materials handling operations that occur at sand and gravel plants. The discussion in AP 42 on sand processing plants indicates that this material is excavated in a wet condition, and is processed with water. Under these conditions, particulate emissions would be minimal. In contrast, rock, sand and/or gravel crushing operations process a raw material that is dry and releases additional fine particulate matter when it is crushed, screened and handled. Emission factors for rock crushing operations have been developed, and emission estimates can be quantified, based on the amount of material and the steps in the process. The materials throughput limits in this general permit are based on emissions from rock crushing, not sand and gravel processing. As there are no particulate emission factors for wet sand and gravel processing, no upper throughput limit for sand processing can be calculated. The raw materials limits in the general permit, which are based on the particulate emissions from a specific configuration of rock crushing equipment, have been used for sand and gravel plants.

Although fuel usage limits are included in the permit, it is unknown whether an SQCS facility issued a general permit would be restricted by the fuel limit. Stationary rock crushers typically use utility electric power, while portable rock crushers use generators, which are nonroad engines. Nonroad engines are not subject to Prevention of Significant Deterioration (PSD), Title V, or NSPS Subpart IIII, unless the engines remain in one place for more than one year, in which case they become stationary engines. For purposes of developing the general permit, no limits have been included precluding the rock crushers from remaining in place for more than one year, so emissions from any stationary engines are counted when considering the pollutant thresholds.

The draft permit includes the throughput limits listed in Table 8 for SQCS plants located in attainment and nonattainment areas. The two production limits are set at the same levels because the EPA has selected the same emissions limitations for attainment and nonattainment areas. They are set at levels intended to keep the sources emissions below the Title V major source thresholds in Table 3 (PM is the controlling pollutants the throughput calculations are contained in Attachment A).

**Table 3: Emission Rates used to Determine Emission Limitations for Stone Quarrying, Crushing and Screening Facilities**

Pollutant of Concern	Attainment Areas	Nonattainment Areas
PM	100 tpy	100 tpy
PM <sub>10</sub> *	100 tpy	100 tpy (moderate areas)
		70 tpy (serious areas)

Pollutant of Concern	Attainment Areas	Nonattainment Areas
PM <sub>2.5</sub> *	100 tpy	100 tpy
NO <sub>x</sub>	100 tpy	100 tpy (marginal and moderate ozone areas)
		50 tpy (serious ozone areas)
		25 tpy (severe ozone areas)
		10 tpy (extreme ozone areas)

\*Note: The emission thresholds for these pollutants include fugitive emissions.

## 5.2 Emission Limitations

Three considerations form the basis for the upper eligibility emission limitations for general permits and permits by rule:

1. Are there any EPA regulation-based emission limitations?
2. What do actual emissions data from the 2008 National Emissions Inventory (NEI)<sup>8</sup> indicate about the size profile of the source category?
3. Where do state programs establish eligibility limits?

### 5.2.1 EPA Regulation-Based Emissions Limitations

The only EPA regulation-based emissions limitations for rock crushing and screening facilities are the emission limitations from the exhaust of affected facilities equipped with capture systems of 0.014 grains per dry standard cubic foot of exhaust. Affected facilities are each crusher, grinding mill, screening operation, bucket elevator, belt conveyor, bagging operation, storage bin, enclosed truck or railcar loading station. In general, facilities in attainment areas with PTE of any criteria pollutant equal or greater than 250 tpy are NSR major sources. Facilities with PTE of any criteria pollutant equal to or greater than 100 tpy or HAP emissions greater than 10 tpy for a single HAP and 25 tpy for total HAPs are subject to Title V operating permit program.

### 5.2.2 Analysis of NEI Data

The EPA analyzed 2008 NEI data for existing sand and gravel processing and rock crushing plants across the U.S. to evaluate the emission limitations established in the general permit. Although the NEI does not include actual emissions information for sources in Indian Country, it reflects the actual emissions from general sand, gravel, and rock crushing operations in 50 states. In order to analyze facilities whose emissions are similar to those for sources potentially subject to the Indian Country NSR Rule, the EPA selected facilities for analysis with the North American Industry Classification System (NAICS) codes listed in Table 4. For sources in these four NAICS codes, the EPA selected actual emissions<sup>9</sup> within the ranges listed in Table 5.

<sup>8</sup> For more information, go to: <http://www.epa.gov/ttn/chief/net/2008inventory.html>.

<sup>9</sup> Only point source NEI data were used for this analysis. The point source inventory does not include emissions from nonroad engines.

**Table 4: NAICS Codes Selected for Stone Quarrying, Crushing and Screening Facilities**

NAICS Code	Description
212311	Dimension Stone Mining and Quarrying
212312	Crushed and Broken Limestone Mining and Quarrying
212313	Crushed and Broken Granite Mining and Quarrying
212319	Other Crushed and Broken Stone Mining and Quarrying
212321	Construction Sand and Gravel Mining

**Table 5: Emission Ranges Selected for Stone Quarrying, Crushing and Screening Facilities**

Criteria Pollutants	PM <sub>10</sub>	PM <sub>2.5</sub>	NO <sub>x</sub>
<b>Attainment Area</b>			
Min. Emissions (tpy)	5	3	10
Max. Emissions (tpy)	250	250	250
<b>Nonattainment Area</b>			
Min. Emissions (tpy)	1	0.6	5
Max. Emissions (tpy)	250	250	250

The 2008 NEI data does not include emissions information for total PM. The EPA analyzed the emissions rates listed in Table 3 that were used to establish the surrogate throughput emissions limitations and selected the facilities with emission levels similar to the facilities potentially subject to the NSR minor program, i.e., the facilities with emissions greater than the minor NSR applicability thresholds in Table 1 of 40 CFR 49.153 ([Tribal minor NSR Rule](#)) and less than the PSD major source threshold of 250 tpy. For purposes of this analysis, facilities located in nonattainment areas are defined as facilities located in counties that are designated nonattainment for the pollutant being analyzed.

With the NAICS codes listed in Table 4 and the emission ranges defined in Table 5, the EPA identified the SQCS facilities located in attainment and nonattainment areas for NO<sub>x</sub>, PM<sub>10</sub>, and PM<sub>2.5</sub>. The EPA is providing the number of facilities (and average emissions) under the proposed emissions limitations and above the minor source thresholds.

**Table 6: Number of Facilities and Average Emissions for Hot Mix Asphalt Facilities Selected.**

Criteria Pollutants	Number of Facilities
<b>Attainment Areas</b>	
<b>NO<sub>x</sub></b>	
Facilities >10 tpy and < 100 tpy	172 (25% of facilities covered)
Average Emissions (tpy)	22
Facilities > 100 tpy and < 250 tpy	2
Average Emissions (tpy)	106
<b>PM<sub>2.5</sub></b>	
Facilities >3 tpy and < 100 tpy	353 (15% of facilities covered)
Average Emissions (tpy)	11
Facilities > 100 tpy and < 250 tpy	1
Average Emissions (tpy)	126
<b>PM<sub>10</sub></b>	
Facilities >5 tpy and < 100 tpy	541 (22% of facilities covered)
Average Emissions (tpy)	18

<b>Criteria Pollutants</b>	<b>Number of Facilities</b>
Facilities > 100 tpy and < 250 tpy	11
Average Emissions (tpy)	154
<b>Nonattainment Areas</b>	
<b>NO<sub>x</sub> (marginal and moderate)</b>	
Facilities >5 tpy and < 100 tpy	25 (36% of facilities covered)
Average Emissions (tpy)	12
Facilities > 100 tpy and < 250 tpy	1
Average Emissions (tpy)	161
<b>NO<sub>x</sub> (serious)</b>	
Facilities >5 tpy and < 50 tpy	1(25% of facilities covered)
Average Emissions (tpy)	6
Facilities > 50 tpy and < 250 tpy	0
Average Emissions (tpy)	N/A
<b>NO<sub>x</sub> (severe)</b>	
Facilities >5 tpy and < 25tpy	6 (30% of facilities covered)
Average Emissions (tpy)	11
Facilities > 25 tpy and < 250 tpy	1
Average Emissions (tpy)	60
<b>NO<sub>x</sub> (extreme)</b>	
Facilities >5 tpy and < 10 tpy	2 (9% of facilities covered)
Average Emissions (tpy)	8
Facilities > 10 tpy and < 250 tpy	0
Average Emissions (tpy)	N/A
<b>PM<sub>2.5</sub></b>	
Facilities >5 tpy and < 100 tpy	82 (55% of facilities covered)
Average Emissions (tpy)	3
Facilities > 100 tpy and < 250 tpy	0
Average Emissions (tpy)	N/A
<b>PM<sub>10</sub> (moderate)</b>	
Facilities >5 tpy and < 100 tpy	19 (68% of facilities covered)
Average Emissions (tpy)	12
Facilities > 100 tpy and < 250 tpy	2
Average Emissions (tpy)	165
<b>PM<sub>10</sub> (serious)</b>	
Facilities >5 tpy and < 70 tpy	35 (90% of facilities covered)
Average Emissions (tpy)	10
Facilities > 70 tpy and < 250 tpy	0
Average Emissions (tpy)	N/A

### 5.2.3 State Program Limits

The upper limits in state permits vary in that they either limit pollutant emissions or raw material and fuel throughput. Only the Indiana permit limits both emissions and raw material throughput. Indiana limits emissions of PM<sub>10</sub> from smaller SQCS facilities to less than 25 tpy, and limits emissions of PM<sub>10</sub> from large facilities to less than 100 tpy. Alaska and Florida limit PM<sub>10</sub> emissions to less than 100 tpy. As mentioned previously, the rock

throughput limits corresponding to the 100 tpy limit on PM<sub>10</sub> emissions vary from state to state, and the underlying assumptions and calculations are not explicitly stated. Since nearly all states require control of emissions from rock crushing equipment, and fugitive emissions as well, this may account for some of the variation seen in throughput limits from state to state. The Alaska permit<sup>10</sup> does not contain throughput limits, but instead requires that applicants calculate their PTE of PM<sub>10</sub>. This is a source-specific approach, and requires skilled permitting staff to verify that the calculations are accurate. The Indiana rock crushing permit<sup>11</sup>, with its 100 tpy limit on PM<sub>10</sub> emissions, and similar emission control requirements, sets the throughput threshold at 3,000,000 tpy. The Wisconsin general permit<sup>12</sup> is similar to the Indiana general permit in that it has a 100 tpy limit on PM<sub>10</sub> emissions, emission control requirements, and sets the throughput limit at 250,000 tons per month (equivalent to 3,000,000 tpy). A comparison of requirements for attainment and nonattainment areas is not possible due to lack of a distinction made in most state programs. The Arizona general permit<sup>13</sup> limits emissions of PM<sub>10</sub> to 13.64 tpy, but this may be due to the fact that nearly half of the counties in Arizona have been designated nonattainment for PM<sub>10</sub>. The Arizona permit is one example of a SQCS permit designed for an area designated as nonattainment for PM<sub>10</sub>. Table 7 shows the limits imposed by rock crushing and screening permits for the states reviewed.

**Table 7: State Rock Crushing and Screening Permit Throughput Limits and Emission Limitations**

State	Rock Throughput Limits	Criteria Pollutant Emission Limitations	Engine Fuel or Size Limit	Setback Required?	Fugitive Dust Controls Required?	Particulate Emissions Controls Required?
Alaska	Min: 5 tons per hour Max: None	All: 100 tpy	Less than 1,100 bhp	1,000 ft	No	No
Arizona	Min: 25 tons per hour Max: None	PM <sub>10</sub> : 13.64 tpy NO <sub>x</sub> , CO: 90 tpy	None	None	Yes	Yes
Florida	Min: None Max: None	All: 100 tpy	275,000 gal diesel/year	None	Yes	Yes
Indiana (small)	Min: None Max: 1,000,000 tpy	PM <sub>10</sub> : 25 tpy	None	None	Yes	Yes
Indiana (large)	Min: None Max: 3,000,000 tpy	PM <sub>10</sub> : 100 tpy	None	None	Yes	Yes
Washington	Min: None Max: 14,500 tons per day, 1,500,000 tpy	None	None	150 ft	Yes	Yes

<sup>10</sup> For more information, go to: <http://dec.alaska.gov/air/ap/docs/MG9%20Final%20Permit%204-8-09.pdf>.

<sup>11</sup> For more information, go to: [http://www.in.gov/idem/5157.htm#oag\\_permits\\_ssoa](http://www.in.gov/idem/5157.htm#oag_permits_ssoa).

<sup>12</sup> For more information, go to: <http://dnr.wi.gov/files/PDF/pubs/am/AM381.pdf>.

<sup>13</sup> For more information, go to: <http://www.azdeg.gov/envirom/air/permits/download/gncspermit.pdf>.

State	Rock Throughput Limits	Criteria Pollutant Emission Limitations	Engine Fuel or Size Limit	Setback Required?	Fugitive Dust Controls Required?	Particulate Emissions Controls Required?
Wisconsin	Min: None Max: 250,000 tons per month	None	20,000 gal/month (6,870 gal/month in ozone non-attainment area)	None	Yes	Yes

### 5.3 Calculating the Surrogate Throughput Limits

For new or modified SQCS facilities, the Title V major source thresholds are used as the emission rates for calculating throughput limits. The EPA evaluated the emission rates at which a new or modified source would become a major source under Title V. This is 100 tpy for PM<sub>10</sub>, PM<sub>2.5</sub>, NO<sub>x</sub>, and CO in attainment areas. The EPA used 100 tpy to establish the limits for PM<sub>10</sub>, PM<sub>2.5</sub>, NO<sub>x</sub>, and CO. The EPA back-calculated the throughput of materials and usage of fuels that yielded emissions at these limits by using the equipment profile from the Washington Department of Ecology permit support document and emission factors from AP 42, Chapter 11.9.2. These results are shown in Table 8. The calculations indicate that PM<sub>10</sub> and NO<sub>x</sub> are the limiting pollutants. The equivalent materials throughput and fuel usage limits are incorporated into the permit documents as the upper limits for materials throughput and fuel usage for attainment and nonattainment areas. Using these limits will also ensure that major source NSR will not be triggered for any new source.

**Table 8: Surrogate Rock Throughput and Fuel Usage Upper Limits**

Attainment Status	Upper Rock Throughput Limit (tpy)	Upper Fuel Usage Limit (gallons per year)
Attainment Area	10,500,000	310,000
Nonattainment Area	10,500,000	30,000/ 80,00/ 153,000 <sup>a</sup>

<sup>a</sup> These upper fuel usage limits are for a facility located in extreme, severe, and serious ozone nonattainment areas, respectively.

## References

40 CFR 49.1 – 40 CFR 49.173, Indian Country Air Quality Planning and Management.

<http://www.gpo.gov/fdsys/pkg/CFR-2011-title40-vol1/pdf/CFR-2011-title40-vol1-part49.pdf>

40 CFR 52.21, Prevention of Significant Deterioration of Air Quality.

<http://www.gpo.gov/fdsys/pkg/CFR-2007-title40-vol3/xml/CFR-2007-title40-vol3-sec52-21.xml>

40 CFR Part 60, Subpart IIII, Standards of Performance for Stationary Compression Ignition Internal Combustion Engines.

[http://ecfr.gpoaccess.gov/cgi/t/text/text-](http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=f2c4f71bd50d2a8883adafec36732010&rgn=div6&view=text&node=40:6.0.1.1.1.98&idno=40)

[idx?c=ecfr&sid=f2c4f71bd50d2a8883adafec36732010&rgn=div6&view=text&node=40:6.0.1.1.1.98&idno=40](http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=f2c4f71bd50d2a8883adafec36732010&rgn=div6&view=text&node=40:6.0.1.1.1.98&idno=40)

40 CFR Part 60, Subpart OOO, Standards of Performance for Nonmetallic Mineral Processing Plants.

<http://www.gpo.gov/fdsys/granule/CFR-2012-title40-vol7/CFR-2012-title40-vol7-part60-subpartOOO/content-detail.html>

40 CFR Part 63, Subpart ZZZZ, National Emission Standards for Hazardous Air Pollutant for Reciprocating Internal Combustion Engines (RICE).

<http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&rgn=div6&view=text&node=40:13.0.1.1.1.1&idno=40>

Alaska Department of Environmental Conservation, “Minor General Permit 9 for Rock Crushers.”

<http://www.dec.state.ak.us/air/ap/docs/MG9%20Final%20Permit%204-8-09.pdf>

AP 42, Fifth Edition, Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, U.S. Environmental Protection Agency. <http://www.epa.gov/ttn/chief/ap42/>

Arizona Department of Environmental Quality, “Crushing and Screening General Permit.”

<http://www.azdeq.gov/environ/air/permits/class.html#general>

Emission Inventory Improvement Program, Point Source Committee (Joint EPA – STAPPA/ALAPCO Initiative), “Technical Assessment Paper: Available Information for Estimating Emissions from Stone Mining and Quarrying Operations,” May 1998.

<http://www.dep.wv.gov/daq/planning/inventory/Documents/EIIP%20V02%20Ch13%20Stone%20Mining%20and%20Quarrying%20Operations.pdf>

Federal Register Vol. 76, No. 127, July 1, 2011, Pages 38748-38808, “Review of New Sources and Modifications in Indian Country; Final Rule” (Indian Country NSR Rule).

<http://www.gpo.gov/fdsys/pkg/FR-2011-07-01/pdf/2011-14981.pdf>

Florida Department of Environmental Protection, “Nonmetallic Mineral Processing Plant (Crusher) Air General Permit Registration Form.” <http://www.dep.state.fl.us/air/emission/mineral.htm>

Indiana Department of Environmental Management, “OA-08 Crushed Stone Processing Plants.”

[http://www.in.gov/idem/5157.htm#oaq\\_permits\\_gsd](http://www.in.gov/idem/5157.htm#oaq_permits_gsd)

South Coast Air Quality Management District, Rule 1157 “PM<sub>10</sub> Emission Reductions from Aggregate and Related Operations.” <http://www.aqmd.gov/rules/reg/reg11/r1157.pdf>

Washington Department of Ecology, "Suitability of Rock Crushing Operations for Air Quality General Order of Approval." [http://www.ecy.wa.gov/programs/air/AOP\\_Permits/Boiler/TTODd/PDFS/ROCKCRUSHER.PDF](http://www.ecy.wa.gov/programs/air/AOP_Permits/Boiler/TTODd/PDFS/ROCKCRUSHER.PDF)

Wisconsin Dept. of Natural Resources, "Air Program Fact Sheet - General Permits for Crushers." <http://dnr.wi.gov/files/PDF/pubs/am/AM381.pdf>

**Attachment A:  
Emissions Calculations for Rock Throughput and Fuel Usage Limits for Attainment Areas**

**Emissions from Crushing, Screening, and Conveying:**

Type of Operation	Emission Factors (lbs/ton)		Emissions (tpy)	
	PM	PM10	PM	PM10
Primary Crushing	ND	ND	ND	ND
Secondary Crushing	ND	ND	ND	ND
Tertiary Crushing	1.20E-03	5.40E-04	6.30	2.84
Fines Crushing	3.00E-03	1.20E-03	15.75	6.30
Screening of Primary Crusher Output	2.20E-03	7.40E-04	11.55	3.89
Screening of Secondary Crusher Output	2.20E-03	7.40E-04	11.55	3.89
Screening (Tertiary Crushing)	2.20E-03	7.40E-04	11.55	3.89
Screening (Fines)	3.6E-03	2.2E-03	18.90	11.55
Conveyor Transfer Point (x12)	1.40E-04	4.60E-05	8.82	2.90
Truck Unloading - Fragmented Stone	1.60E-05	1.60E-05	0.08	0.08
Truck Loading - Conveyor, crushed stone	1.00E-04	1.00E-04	0.53	0.53
<b>Total</b>			<b>85.03</b>	<b>35.85</b>

Controlled emission factors from AP 42 Table 11.19.2-2

Sample calculation, Fines Crushing:

$$\begin{aligned} \text{PM} &= 10,500,000 \text{ (tons/year)} \times 3.00\text{E-}3 \text{ (lb/ton)} \times 1/2,000 \text{ (ton/lb)} \\ &= 93.67 \text{ tpy} \end{aligned}$$

Emissions from Engines:

Ozone Attainment Areas and Marginal or Moderate Ozone Nonattainment Areas:

$$\begin{aligned} \text{NOx} &= 310,000 \text{ (gallons/year)} \times 7.1 \text{ (lb/gallon)} \times 0.0193 \text{ (MMBtu/lb)} \times 4.41 \text{ (lb/MMBtu)} \times 1/2,000 \text{ (ton/lb)} \\ &= 48.9 \text{ tpy} \end{aligned}$$

$$\begin{aligned} \text{PM}_{10} &= 310,000 \text{ (gallons/year)} \times 7.1 \text{ (lb/gallon)} \times 0.0193 \text{ (MMBtu/lb)} \times 0.31 \text{ (lb/MMBtu)} \times 1/2,000 \text{ (ton/lb)} \\ &= 6.58 \text{ tpy} \end{aligned}$$

Serious Ozone Nonattainment Areas:

$$\begin{aligned} \text{NOx} &= 153,000 \text{ (gallons/year)} \times 7.1 \text{ (lb/gallon)} \times 0.0193 \text{ (MMBtu/lb)} \times 4.41 \text{ (lb/MMBtu)} \times 1/2,000 \text{ (ton/lb)} \\ &= 46.2 \text{ tpy} \end{aligned}$$

$$\begin{aligned} \text{PM}_{10} &= 153,000 \text{ (gallons/year)} \times 7.1 \text{ (lb/gallon)} \times 0.0193 \text{ (MMBtu/lb)} \times 0.31 \text{ (lb/MMBtu)} \times 1/2,000 \text{ (ton/lb)} \\ &= 3.25 \text{ tpy} \end{aligned}$$

Severe Ozone Nonattainment Areas:

$$\begin{aligned} \text{NOx} &= 80,000 \text{ (gallons/year)} \times 7.1 \text{ (lb/gallon)} \times 0.0193 \text{ (MMBtu/lb)} \times 4.41 \text{ (lb/MMBtu)} \times 1/2,000 \text{ (ton/lb)} \\ &= 24.2 \text{ tpy} \end{aligned}$$

$$\begin{aligned} \text{PM}_{10} &= 80,000 \text{ (gallons/year)} \times 7.1 \text{ (lb/gallon)} \times 0.0193 \text{ (MMBtu/lb)} \times 0.31 \text{ (lb/MMBtu)} \times 1/2,000 \text{ (ton/lb)} \\ &= 1.70 \text{ tpy} \end{aligned}$$

Extreme Ozone Nonattainment Areas:

$$\begin{aligned} \text{NO}_x &= 30,000 \text{ (gallons/year)} \times 7.1 \text{ (lb/gallon)} \times 0.0193 \text{ (MMBtu/lb)} \times 4.41 \text{ (lb/MMBtu)} \times 1/2,000 \text{ (ton/lb)} \\ &= 9.06 \text{ tpy} \end{aligned}$$

$$\begin{aligned} \text{PM}_{10} &= 30,000 \text{ (gallons/year)} \times 7.1 \text{ (lb/gallon)} \times 0.0193 \text{ (MMBtu/lb)} \times 0.31 \text{ (lb/MMBtu)} \times 1/2,000 \text{ (ton/lb)} \\ &= 0.64 \text{ tpy} \end{aligned}$$