



March 29, 2022

Colorado Department of Public Health and Environment
Air Pollution Control Division
APCD-SS-B1
4300 Cherry Creek Drive South
Denver, CO 80246-1530

**Re: QTS DEN1
Construction Permit Application
Denver, Colorado**

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APCD
Stationary
Sources

Dear Air Pollution Control Division:

Quality Technology Services, LLC (QTS) is proposing to construct and operate a new data center (DC) located at 1160 N Gun Club Rd, Aurora, CO 80018 ("DEN1", the "facility"). With this Construction Permit Application (Application), QTS is proposing to install and operate 40 Kohler diesel-fired emergency generators (GEN01 – GEN40), each rated at 2,500 kilowatts (kWe). All proposed emergency generators are EPA Tier 2 certified and will each be equipped with a 9,458 gallon diesel fuel storage tank. All proposed diesel fuel storage tanks will be exempt from permitting in accordance with 5 CCR 1001-5 Part A Regulation No. 3 Section II.D.1.fff. No other emission units will be installed at the proposed facility.

This facility is located within the Denver ozone non-attainment area. As required by Colorado Department of Public Health and Environment (CDPHE), an air dispersion modeling demonstration was performed and the air dispersion modeling report will be submitted under a separate cover.

With this enclosed Application, the facility is proposing to use load tracking to limit facility-wide nitrogen oxides (NO_x) and volatile organic compound (VOC) potential to emit (PTE) to 25 tons per year (tpy), each. The 25 tpy limit is in anticipation of the re-designation of Arapahoe County from serious ozone nonattainment, to severe ozone nonattainment. The facility will be a synthetic minor source with respect to Title V and new source review.

In addition, QTS will limit the non-emergency operation of the generators as follows to demonstrate compliance with National Ambient Air Quality Standards:

1. Each generator will only operate between the hours of 7AM – 7PM; and
2. The facility will limit operation of emergency generators to a maximum of five generators at any given time.

QTS has included the following documentation as part of this application package:

- Appendix A: Required Air Pollutant Emissions Notice forms;
- Appendix B: Process flow diagram, plot plan and site map;
- Appendix C: Detailed emissions calculations; and
- Appendix D: Engine specifications and emissions data.

If you or your staff require any additional information regarding this request, please contact Jon Sizemore at (404) 640-7430 or Tiffany Cuni of Environmental Resources Management (ERM) at (513) 830-9062.

Thank you.

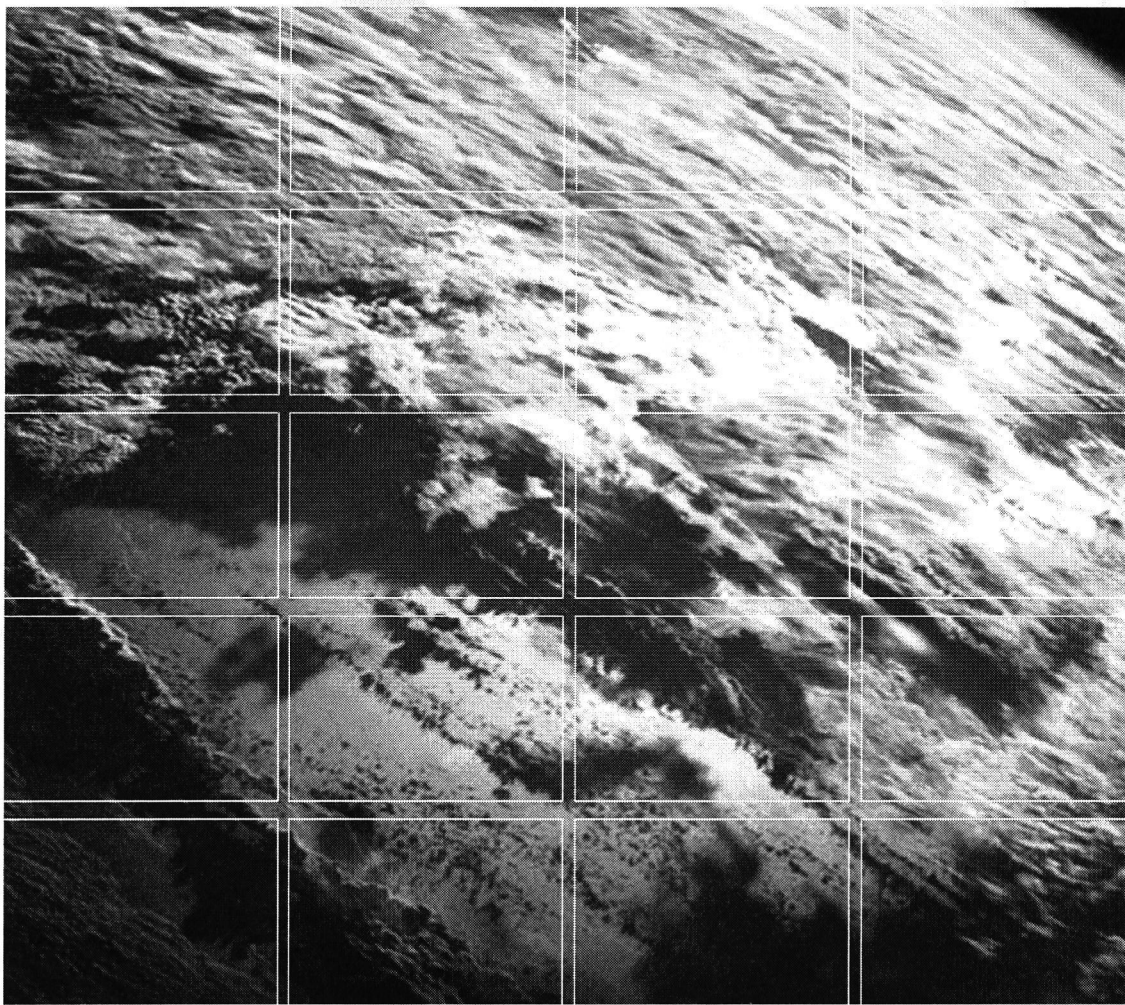
Sincerely,



EVP, Property Development

cc: Jon Sizemore, QTS
Tiffany Cuni, ERM

Attachments



Construction Permit Application

Quality Technology Services, LLC

Denver Facility, Colorado

30 March 2022

Project No.: 0606578

Signature Page

30 March 2022

Construction Permit Application

Quality Technology Services, LLC – DEN1



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CONTENTS

1.	INTRODUCTION	1
2.	PROJECT DESCRIPTION	1
3.	SUMMARY OF AIR DISPERSION MODELING REPORT RESULTS	2
4.	EMISSION SUMMARY	2
4.1	PROJECT EMISSIONS	3
5.	REGULATORY APPLICABILITY	5
5.1	FEDERAL REGULATIONS.....	5
5.1.1	New Source Performance Standards.....	5
5.1.2	National Emission Standards for Hazardous Air Pollutants	6
5.2	COLORADO STATE REGULATIONS	6
5.2.1	5 CCR 1001-5 Regulation No. 3, Part A – Concerning General Provisions Applicable to Reporting and Permitting	6
5.2.2	5 CCR 1001-5 Regulation No. 3, Part B – Concerning Construction Permits	7
5.2.3	5 CCR 1001-5 Regulation No. 3, Part C – Concerning Operating Permits	7
5.2.4	5 CCR 1001-8 Regulation No. 6 – Standards of Performance for New Stationary Sources.....	7
5.2.5	5 CCR 1001-9 Regulation No. 7, Part B – Storage, Transfer, and Disposal of Volatile Organic Compounds and Petroleum Liquids and Petroleum Processing and Refining.....	7
5.2.6	5 CCR 1001-10 Regulation No. 8 – Control of Hazardous Air Pollutants.....	8

APPENDIX A	CDPHE APEN FORMS
APPENDIX B	SITE MAP, PLOT PLAN AND PROCESS FLOW DIAGRAM
APPENDIX C	EMISSIONS CALCULATIONS
APPENDIX D	ENGINE MANUFACTURER SPECIFICATIONS

List of Tables

Table 3.1 Proposed Emission Factor per Generator	3
Table 3.2: Site Wide Projected Actual and Potential Emissions.....	4

1. INTRODUCTION

Quality Technology Services, LLC (QTS) is proposing to construct and operate a new data center ("DEN1", the "facility") located at 1160 N Gun Club Rd, Aurora, CO 80018. With this Construction Permit Application (application), QTS is proposing to install and operate 40 Kohler diesel-fired emergency generators (GEN01 – GEN40), each rated at 2,500 kilowatts (kWe). The facility maintains business-critical information and other computer-related services on servers and similar equipment. QTS is proposing to construct the new generators to ensure constant electrical supply for the new site.

2. PROJECT DESCRIPTION

With this Construction Permit Application (Application) QTS seeks to authorize the installation and operation of DEN1 consisting of 40 new Kohler KD2500 diesel-fired emergency generators, each rated at 2,500 kWe (GEN01 – GEN40). All proposed generators will be used to provide backup power for site operations in case of utility failure or other related on-site power failure. The proposed 40 new generators will each be equipped with a diesel fuel storage tank with a maximum capacity of 9,458 gallons that will be exempt from Air Pollutant Emissions Notice (APEN) requirements per the Code of Colorado Regulations (CCR) 1001-5 Part A Regulation No. 3, Section II.D.1.fff. No other sources of regulated air pollutant emission sources will be installed at the facility.

Following discussions with the Colorado Department of Public Health and Environment (CDPHE), QTS was informed that the non-attainment status for Arapahoe County, where DEN1 will be located, will be re-designated from serious non-attainment, to severe non-attainment in year 2022. This will lower the Title V major source threshold from 50 tons per year (tpy) of nitrogen oxides (NO_x) and volatile organic compounds (VOC), to 25 tpy, each. In anticipation of this change, QTS is proposing to limit the facility-wide potential to emit (PTE) of NO_x, the pollutant emitted at the greatest rate from diesel-fired engines, to 25 tpy with this application. In addition, QTS proposes the following operational limitations to be implemented.

1. Each generator will be limited to 500 total hours of operation per year;
2. Each generator will be limited to 100 hours per year for the purposes of non-emergency operation;
3. Each generator will only operate between the hours of 7AM – 7PM for the purposes of nonemergency operation; and
4. The facility will limit non-emergency operation of emergency generators to a maximum of five generators at any given time.

The facility will be a synthetic minor source with respect to Title V and new source review. Projected actual facility-wide emissions of NO_x are approximately 10.18 tpy, well below the anticipated 25 tpy Title V threshold. Detailed information regarding emissions for all pollutants can be found in Section 4 and included in Appendix C of this Application.

The proposed new emergency generators are subject to New Source Performance Standards (NSPS) Subpart IIII. As required by NSPS Subpart IIII, the emergency generators are Tier 2 certified and will be operated to comply with the corresponding testing and maintenance operating limit of 100 hours per year per unit. The generators will each be equipped with a non-resettable hour meter to track compliance with this limit. Additionally, QTS will only use ultra-low sulfur diesel (ULSD) fuel to maintain compliance with the fuel sulfur content usage restrictions per NSPS Subpart IIII. Logs will be used to track operating load and hours of operation for compliance with the 25 tpy NO_x PTE limit for the facility, further described in

Section 3.1. The generators will not be used for peak shaving or as part of an Emergency Demand Response Program as described in 40 CFR 60.4211 (f)(2)¹. Per 40 CFR 60.4211 (f)(3), the emergency generators will limit operation for non-emergency purposes unrelated to maintenance unrelated to maintenance and testing to 50 hours per calendar year, but will include these hours as part of the 100 hours per year limit for maintenance and testing. Detailed information regarding the emergency generators is included in Appendix D. Additional regulatory discussion for the facility is provided in Section 5 of this Application. The emission estimation for the diesel storage tanks is included in Appendix C.

3. SUMMARY OF AIR DISPERSION MODELING REPORT RESULTS

An air dispersion modeling report for this project is being submitted under a separate cover to the CDPHE. Modeling was performed for the proposed generators using the following assumptions:

- Air dispersion modeling is required for non-emergency operation only;
- Modeling is required to assess:
 - Short-term and annual impacts of NO_x emissions;
 - Short-term impacts of carbon monoxide (CO) emissions;
 - Short-term impacts of particulate matter (PM) with diameter of 10 micrometers (µm) or less (PM₁₀) emissions;
 - Short-term impacts of particulate matter with diameter of 2.5 µm or less (PM_{2.5}) emissions; and
 - Short-term impacts of sulfur dioxide (SO₂) emissions.
- Modeling included assessment of impact for 25%, 50%, 75%, and 100% load operations for each engine;
- Each proposed generator will only operate between the hours of 7AM – 7PM for non-emergency operation purposes; and
- A maximum of five proposed generators will be operated at any given time for non-emergency operation purposes.

As summarized in the modeling report, predicted air quality impacts from NO_x, CO, PM₁₀, PM_{2.5} and SO₂ emissions were above Significant Impact Level (SIL) thresholds. For any pollutant (and averaging time) where model predicted impacts are above SILs, the air dispersion modeling report demonstrates compliance for all proposed emergency generators with National Ambient Air Quality Standards (NAAQS).

4. EMISSION SUMMARY

The following section presents a discussion of the anticipated emissions from all proposed emergency generators (GEN01 – GEN40). The facility's PTE has been estimated for the following regulated air pollutants: NO_x, CO, VOC, SO₂, filterable PM, PM₁₀, PM_{2.5}, and hazardous air pollutants (HAPs), and are included in Appendix C.

¹ Per a D.C. Circuit Court Mandate made on May 4, 2016, subsections 60.4211(f)(2)(ii)-(iii) were vacated

4.1 PROJECT EMISSIONS

QTS proposes to use the manufacturer-supplied emission factors corresponding to each load percentage (i.e., 25%, 50%, 75%, 100%) as well as hours operated to determine monthly and 12-month rolling actual criteria pollutant emissions. All emergency generators at the facility are equipped with a non-resettable hour meter and a corresponding system for recording operating load. To be conservative and ensure permit compliance, QTS will round the average actual monthly load to the next higher load increment; for example, if the average monthly load for a specific generator is 33% of capacity, emissions would be determined using the 50% load emission rate. Accounting for the reduced operating loads that the emergency generators experience will result in a more accurate estimate of actual pollutant emissions and in turn help ensure ongoing compliance with the facility's 25 tpy NO_x PTE limit.

Table 3-1 below presents the emission factors per generator for use when accounting for actual operating load. The basis of the emissions calculations for GEN01 – GEN40 is derived from manufacturer specification sheets (Appendix D) for NO_x, CO, VOC and PM emissions. Emission factors for all other pollutants are derived from AP-42 Chapter 3, Section 3.4, *Large Stationary Diesel and All Stationary Dual-fuel Engines* dated 10/96. Detailed emission factors and emissions calculation can be found in Appendix C.

Table 3.1 Proposed Emission Factor per Generator

Source	Pollutant ^[1]	Emission Factor (EF) (lb/hr) ^[2, 3, 4]			
		25% Load	50% Load	75% Load	100% Load
GEN01 – GEN40	VOC	0.51	0.63	0.54	0.83
	NO _x	8.78	16.96	23.66	66.67
	CO	11.01	5.65	15.63	5.95
	PM	0.60	0.45	0.89	0.60
	PM ₁₀	0.49	0.37	0.73	0.49
	PM _{2.5}	0.47	0.36	0.71	0.47
	SO ₂	0.01	0.02	0.03	0.04

1. It is assumed that the PM₁₀ and PM_{2.5} are 83% and 80% of PM, respectively. Based on AP-42 Chapter 3.4 ratio between Total PM/PM₁₀ and Total PM/PM_{2.5}, that HC emissions approximate VOC, and that all engines use only ultra-low sulfur diesel fuel.
2. EFs of NO_x, CO, VOC and PM for GEN01 – GEN40 are based on Kohler KD2500 manufacturer specifications.
3. EFs were converted from manufacturer-supplied g/kWh to lb/hr by multiplying by the kilowatt-hour corresponding to each load and then converting from grams to pounds. See Appendix C for detailed emission calculations.
4. SO₂ emissions based on AP-42 Section 3.4 (10/96) emission rate of 8.09e-3 lb. /hp-hr. * Sulfur Content. Sulfur content of ultra-low sulfur diesel is 15 ppm.

$$\text{Equation A: Site Wide Monthly Emissions (tons)} = \frac{\sum_{i=1}^n (\text{Emission Factor @ Load } L \left(\frac{\text{lb}}{\text{hr}} \right) * \text{hrs}))}{2000 \frac{\text{lb}}{\text{ton}}}$$

Where:

- Emission Factor @ Load L = manufacturer-supplied, generator-specific emission rate corresponding to the average monthly generator load, where the average actual load is rounded up to the next higher level of 25%, 50%, 75%, or 100% load;
- hrs = total operating hours for each engine in the given month;
- i = generator number; and,
- n = number of emergency generators on site.

Projected actual site-wide emissions summarized in Table 3-2 below are based on projected actual usage of 30 hours per year per generator for non-emergency use at a typical 50% operating load. Detailed emissions calculations for all pollutants are included in Appendix C of this Application.

Table 3.2: Site Wide Projected Actual and Potential Emissions

Pollutant	GEN01 – GEN40 ^[1,2]	
	Projected Actual Emissions	Potential to Emit
	tpy	tpy
VOC	0.45	8.41
NO _x	10.18	<25
CO	3.39	59.52
PM	0.27	5.95
PM ₁₀	0.22	4.89
PM _{2.5}	0.21	4.75
SO ₂	0.01	0.44

Notes:

1. Projected actual emissions calculated based on non-emergency operation of 30 hours per generator per year at 50% load.
2. Site-wide emissions of VOC includes maximum VOC emissions from 40 diesel storage tanks, each with a capacity of 9,458 gal.

5. REGULATORY APPLICABILITY

The data center is located in Denver, Colorado, in Arapahoe County. Arapahoe County is currently a “serious” non-attainment area for 2008 8-hour ozone, and will soon be classified as a “severe” non-attainment area for ozone. The following regulatory analysis identifies potentially applicable state and federal air quality regulations and explains why each regulation is or is not considered applicable to the proposed project.

5.1 FEDERAL REGULATIONS

5.1.1 *New Source Performance Standards*

NSPS require new, modified, or reconstructed sources to control emissions to the level achievable by the best demonstrated technology as specified in the applicable provisions. The NSPS regulations may be found in 40 CFR 60. An analysis of potentially applicable NSPS subparts is presented below.

5.1.1.1 *Subpart A – General Provisions*

Facilities subject to source specific NSPS are also subject to the general provisions of NSPS Subpart A (40 CFR 60). Because the facility is subject to another 40 CFR 60 subpart, as discussed in Section 5.1.1.2, the provisions of Subpart A are applicable. NSPS Subpart A may require the following of facilities subject to a source specific NSPS:

- Initial construction/reconstruction notifications
- Initial startup notifications
- Performance tests
- Performance test date initial notifications
- General monitoring requirements
- General recordkeeping requirements
- Semiannual monitoring system and/or excess emissions reports.

The facility will comply with the provisions of NSPS Subpart A, as applicable.

5.1.1.2 *Subpart IIII – NSPS for Stationary Compression Ignition Internal Combustion Engines*

NSPS Subpart IIII establishes emission standards and compliance requirements for the control of emissions from stationary compression ignition (CI) internal combustion engines (ICE) which are constructed, reconstructed, or modified after July 11, 2005.

With this Application, QTS proposes to install 40 new CI ICE. Thus, QTS will operate a total of 40 CI ICE facility-wide that were constructed after July 2005. Therefore, the facility contains applicable units and is required to comply with the provisions of this subpart.

Because the applicable units are identified as emergency equipment, they will be equipped with a non-resettable hour meter and will not operate for greater than 100 hours per year for maintenance and testing purposes. The engines will comply with EPA Tier 2 emission standards, and the engines will comply with the fuel requirements of this subpart by using only 15 ppm or lower sulfur diesel fuel.

5.1.2 National Emission Standards for Hazardous Air Pollutants

National Emission Standards for Hazardous Air Pollutants (NESHAP) are emission standards for hazardous air pollutants (HAP) that are generally applicable to major sources of HAPs, but also apply to certain area sources of HAPs. A HAP major source is defined as having potential emissions in excess of 10 tons per year for any individual HAP and/or 25 tons per year for total HAPs. NESHAP apply to specific pollutant sources (40 CFR 61), or to sources in specifically regulated industrial source categories (CAA Section 112(d)), or on a case-by-case basis (Section 112(g) or 112(j)) for facilities not regulated as a specific industrial source type (40 CFR 63). The facility will be an area source for HAPs. An applicability analysis of potentially applicable NESHAP (Part 63) subparts is presented below.

5.1.2.1 Subpart A – General Provisions

All affected sources are subject to the general provisions of NESHAP Subpart A unless specifically excluded by the source specific NESHAP. NESHAP Subpart A requires initial notification, performance testing, recordkeeping, and monitoring, provides reference methods, and mandates general control device requirements for all other subparts as applicable.

5.1.2.2 Subpart ZZZZ – NESHAP for Stationary Reciprocating Internal Combustion Engines

NESHAP (40 CFR 63) Subpart ZZZZ provides HAP emission limitations and operating limitations for stationary reciprocating internal combustion engines (RICE), including emergency engines, located at facilities that are major or area sources of HAP emissions.

With this Application, QTS proposes to install 40 new CI ICE. Thus, QTS will operate a total of 40 CI ICE facility-wide. The facility has the potential to emit approximately 0.35 tons of total HAP per year, as shown in the emissions calculations included in Appendix C. Thus, proposed HAP emissions are below the Major Source threshold of 25 tpy combined HAP or 10 tpy for any single HAP, and the facility will remain an area source of HAP.

Per 40 CFR 63.6590(c)(1), QTS will comply with the New Source Performance Standard provisions in 40 CFR 60, Subpart IIII for the existing and planned generator engines. Consequently, no further provisions under NESHAP Subpart ZZZZ will apply to these engines.

5.2 COLORADO STATE REGULATIONS

The following regulatory review identifies potentially applicable state air quality regulations and explains why each regulation is or is not considered applicable to the facility.

5.2.1 5 CCR 1001-5 Regulation No. 3, Part A – Concerning General Provisions Applicable to Reporting and Permitting

Under CCR 1001-5 Part A of Regulation No. 3, a stationary source is required to submit an APEN for each individual emission point in a nonattainment area with uncontrolled actual emissions of one tpy or more of any individual criteria pollutant. For non-criteria reportable pollutants, an APEN is required for each individual emission point with uncontrolled actual emissions equal to or greater than 250 lbs. per year or more of any individual non-criteria reportable pollutant.

The data center will consist of 40 diesel-fired emergency generators rated at 2,500 kW each. Each generator will have uncontrolled emissions of greater than one tpy of NO_x and will not emit more than 250 lbs. of any non-criteria reportable pollutants. Therefore, the facility is submitting this APEN specific to compression ignition engines.

Each engine will also have an associated belly tank for diesel fuel storage with a maximum annual throughput of 86,000 gallons per year, based on maximum operation of 500 hours per year per generator at 100% load for both emergency and non-emergency purposes. Pursuant Section II.D.1.fff of this regulation, storage tanks whose annual throughput is less than 400,000 gallons of certain liquids including diesel fuel are exempt from APEN requirements. Thus, these tanks will be exempt.

5.2.2 5 CCR 1001-5 Regulation No. 3, Part B – Concerning Construction Permits

Under CCR 1001-5 Part B of Regulation No. 3, no person shall commence construction of any stationary source or modification of a stationary source without first obtaining or having a valid construction permit from the Division. Additionally, the CDPHE defines the emission threshold quantities that establish reasonably available control technology (RACT) applicability under this regulation.

QTS is submitting this application to obtain a construction permit for 40 diesel-fired emergency generators rated at 2,500 kW each. All 40 generators combined are located within the Denver Metropolitan PM₁₀ attainment/maintenance area and will not have a PTE of more than 40 tpy of NO_x. Therefore, QTS is not required to complete a RACT analysis for this project.

5.2.3 5 CCR 1001-5 Regulation No. 3, Part C – Concerning Operating Permits

The provisions of this Regulation Number 3, Part C shall apply statewide to all sources of air pollutants that are required to obtain an operating permit as specified in Section II of this part.

The facility-wide PTE will not exceed 25 tpy for any criteria pollutants. Thus, QTS Denver will be considered a synthetic minor source as described in CCR 1001-5 Part G Regulation No. 3, Section II.5. Additionally, the associated diesel storage tanks are exempt pursuant to Part C Section II.E.3.fff. The facility will maintain monthly records of operating hours and emissions on site for annual reporting requirements.

5.2.4 5 CCR 1001-8 Regulation No. 6 – Standards of Performance for New Stationary Sources

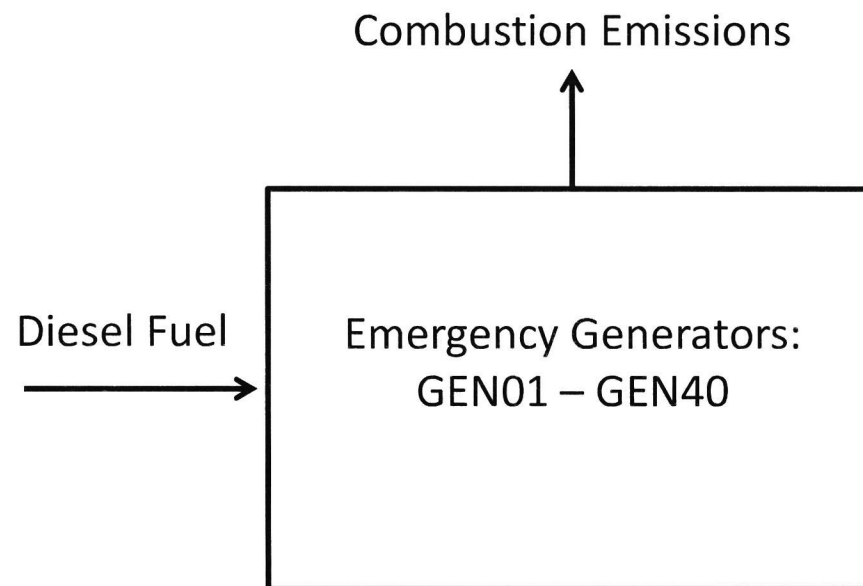
Certain regulations promulgated by the United States Environmental Protection Agency (EPA) found in 40 CFR 60 are adopted by the Colorado Air Quality Control Commission and are hereby incorporated by reference.

Applicability to adopted regulations in CCR 1001-8 Regulation No. 6 are included as part of the Federal Regulatory Applicability in Section 5.1 above.

5.2.5 5 CCR 1001-9 Regulation No. 7, Part B – Storage, Transfer, and Disposal of Volatile Organic Compounds and Petroleum Liquids and Petroleum Processing and Refining

The provisions of this regulation apply to any ozone nonattainment area, which includes areas designated nonattainment for either the 1-hour or 8-hour ozone standard. The provisions set operational and control requirements for applicable sources.

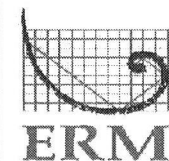
Pursuant Section IV.B.1(a), the proposed diesel storage tanks are exempt from regulation as they only store Fuel Oil #2. Additionally, the 40 diesel-fired emergency engines are not considered affected sources. Therefore, QTS Denver is not subject to regulation under this rule.

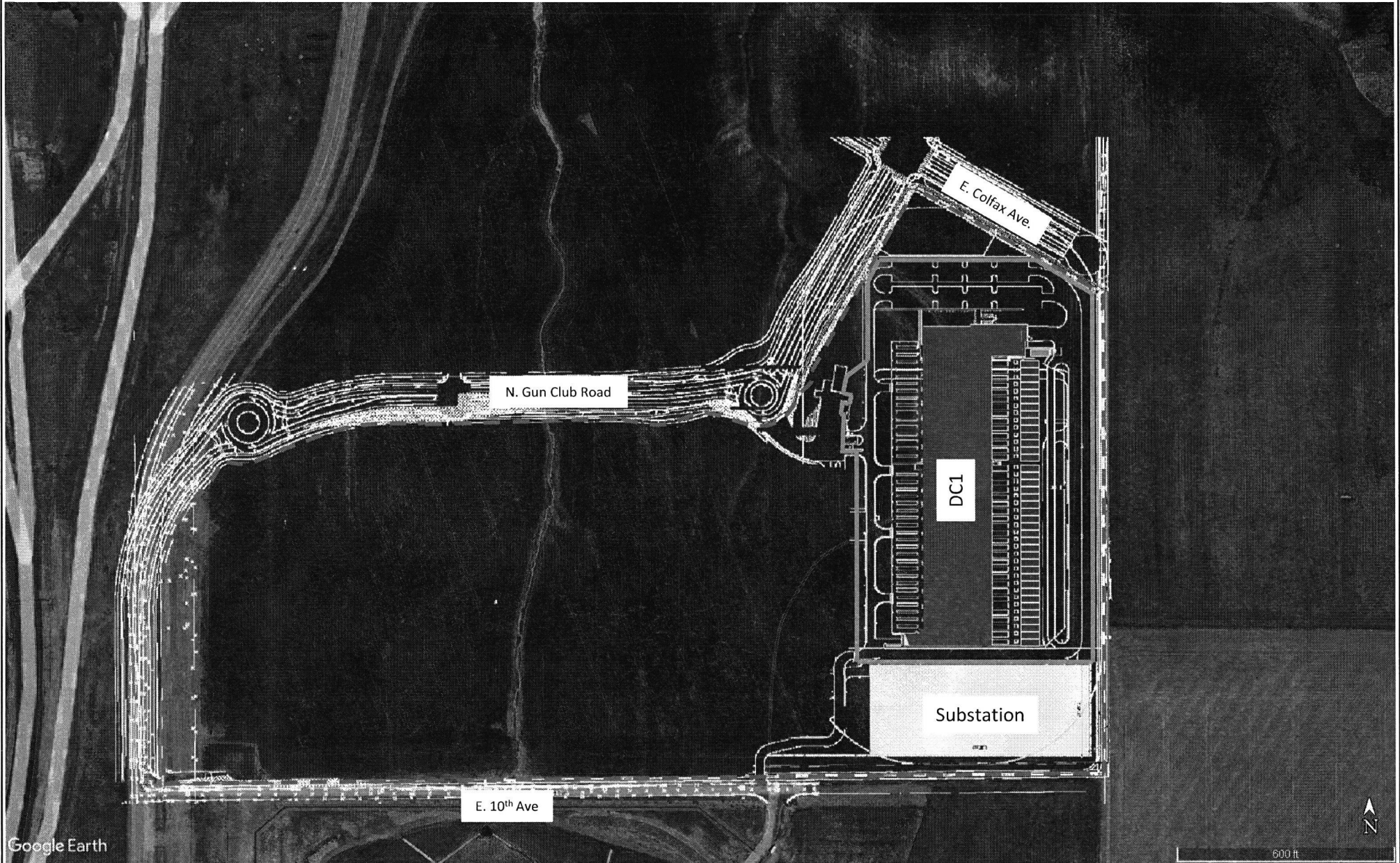


**Environmental Resources
Management**

DESIGN: B. WILDEY	DRAWN: M. TOPP	CHKD.: Y. SHI
DATE: 02/16/2022	SCALE: n/a	REVISION: 0.0

Attachment B - Process Flow Diagram
QTS DEN1
Arapahoe County, Colorado





--- Approximate Property Boundary
 --- Approximate Fence Line

■ Primary Generators
 ■ House Generator

DESIGN: B. WILDEY	DRAWN: B. WILDEY	CHKD.: Y. SHI
DATE: 02/16/2022	SCALE: n/a	REVISION: 0.0

Attachment B - Site Map
 QTS DEN1
 Arapahoe County, Colorado

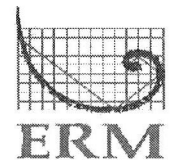


Table 1 Emergency Standby Generator Specifications

Manufacturer	Kohler
Model	KD2500
Rating ⁽¹⁾	2,500 kW
Company Equipment ID	GEN01 - GEN40
Power generation per unit @ 50% load ⁽¹⁾	1,350 kW
	1,810 bhp
Power generation per unit @ 100% load ⁽¹⁾	2,700 kW
	3,621 bhp
Number of units	40
Maximum operating hours per year (emergency + non-emergency) ⁽²⁾	500
Projected actual operating hours per year (non-emergency) ⁽²⁾	30
Fuel type	Diesel
Fuel high heat value	0.138 MMBtu/gal
Fuel consumption per unit @ 50% load ⁽¹⁾	102.8 gal/hr
	14.2 MMBtu/hr
Fuel consumption per unit @ 100% load ⁽¹⁾	172.0 gal/hr
	23.7 MMBtu/hr

1. Based on manufacturer specifications for Kohler KD2500 diesel generator set.
 2. Per 40 CFR 60 Subpart IIII, maintenance and testing of emergency standby generators must not exceed 100 hours per year.

Table 2 Emergency Standby Generator Ratings and Fuel Consumption Rates ^(1,2)

Operating Load	Rating		Fuel Consumption
	(kW)	(bhp)	(gal/hr)
25%	675	905	58.7
50%	1,350	1,810	102.8
75%	2,025	2,716	151.0
100%	2,700	3,621	172.0

1. Based on manufacturer specifications for Kohler KD2500 diesel generator set.

Table 3 GEN01 - GEN40 Emission Factors for Each Generator

Pollutant ^(1,2,3,4)	25% Load		50% Load		75% Load		100% Load	
	(g/kWh)	(lb/hr)	(g/kWh)	(lb/hr)	(g/kWh)	(lb/hr)	(g/kWh)	(lb/hr)
VOC	0.34	0.51	0.21	0.63	0.12	0.54	0.14	0.83
NO _x	5.90	8.78	5.70	16.96	5.30	23.66	11.20	66.67
CO	7.40	11.01	1.90	5.65	3.50	15.63	1.00	5.95
SO ₂	-	0.01	-	0.02	-	0.03	-	0.04
PM	0.40	0.60	0.15	0.45	0.20	0.89	0.10	0.60
PM ₁₀	0.33	0.49	0.12	0.37	0.16	0.73	0.08	0.49
PM _{2.5}	0.32	0.47	0.12	0.36	0.16	0.71	0.08	0.47
CO ₂	887.6	1,321	777.2	2,313	761.1	3,398	650.2	3,870
CH ₄	0.04	0.05	0.03	0.09	0.03	0.1	0.03	0.2
N ₂ O	0.007	0.01	0.006	0.02	0.006	0.03	0.005	0.03
CO ₂ e	890.6	1,325	779.9	2,321	763.7	3,409	652.4	3,884

1. Based on manufacturer specifications for engine model Kohler KD2500 for standby operation. Emission factors were converted from (g/kWh) to (lb/hr) by multiplying by the corresponding kilowatt-hour (kWh) and converting from grams to pounds.
 2. SO₂ emissions based on AP-42 Section 3.4 (10/96) emission rate of 8.09E-3 lb/hr * Sulfur Content. Sulfur content of ultra-low sulfur diesel is 15 ppm.
 3. It is assumed that the PM₁₀ and PM_{2.5} are 82% and 80% of PM, respectively. Based on AP-42 Chapter 3.4 ratio between Total PM PM₁₀ and Total PM PM_{2.5}.
 4. CO₂e emissions based on 40 CFR 98 Global Warming Potentials for CH₄ and N₂O from Table A-1 and emission factors for N₂O, CH₄ and CO₂ from Tables C-1 and C-2. Converted from kg/MMBtu to lb/hr by multiplying by the corresponding engine fuel input
 5. Sample Calculation:

$$25\% \text{ Load NO}_x (\text{lb/hr}) = 5.9 \left(\frac{\text{g}}{\text{kWh}} \right) \cdot 675 \text{ kW} \cdot \left(\frac{1 \text{ lb}}{453.592 \text{ g}} \right) \cdot \left(\frac{1 \text{ ton}}{2000 \text{ lb}} \right) = 8.8 \text{ lb/hr}$$

Table 4 Criteria Pollutant Site-Wide Projected Actual Emissions and PTE

Pollutant	Projected Actual Emissions ⁽¹⁾			Potential to Emit ^(2,3)		
	Emission Factor per Generator ^(3,4,5,6)	Projected Actual Emissions per Generator	Site-Wide Projected Actual	Emission Factor per Generator ^(3,4,5,6)	PTE per Generator	Site-Wide PTE
	lb/hr	tpy	tpy	lb/hr	tpy	tpy
VOC	0.63	0.01	0.45	0.83	0.21	8.41
NO _x	16.96	0.25	10.18	66.67	16.67	<25
CO	5.65	0.08	3.39	5.95	1.49	59.52
SO ₂	0.02	0.0003	0.01	0.04	0.01	0.44
PM	0.45	0.01	0.27	0.60	0.15	5.95
PM ₁₀	0.37	0.01	0.22	0.49	0.12	4.89
PM _{2.5}	0.36	0.01	0.21	0.47	0.12	4.75
CO ₂ e	2,321	35	1,393	3,884	971	38,835

1. Projected actual emissions are based on 30 hours per year per generator for non-emergency use at 50% standby load.
 2. PTE are based on 500 hours per year per generator for both emergency and non-emergency use at 100% standby load. Emissions of NO_x will be limited to the Title V threshold of 25 tpy through the implementation of load tracking.
 3. Based on manufacturer data for Kohler KD2500, emission factors were converted from (g/kWh) to (lb/hr) by multiplying by the corresponding kilowatt-hour (kWh) and converting from grams to pounds.
 4. Each unit will fire 15 ppm (0.0015%) sulfur diesel fuel. Emission Factor calculated based on AP-42 Chapter 3, Section 4. 8.09E-3 * S = 8.09E-3 * 0.0015 = 1.2E-5 lb/hr.
 5. It is assumed that the PM₁₀ and PM_{2.5} are 82% and 80% of PM, respectively. Based on AP-42 Chapter 3.4 ratio between Total PM PM₁₀ and Total PM PM_{2.5}.
 6. CO₂e emissions based on 40 CFR 98 Global Warming Potentials for CH₄ and N₂O from Table A-1 and emission factors for N₂O, CH₄ and CO₂ from Tables C-1 and C-2. Converted from kg/MMBtu to lb/hr by multiplying by the corresponding engine fuel input capacity and converting from kilograms to pounds.
 7. Site-wide emissions of VOC includes maximum VOC emissions from 40 diesel storage tanks, each with a capacity of 9,458 gal.

Table 5 Hazardous Air Pollutant Projected Site-Wide Projected Actual Emissions ⁽¹⁾

Pollutant	Emission Factor per Generator ⁽²⁾	Site-Wide Projected Actual ⁽¹⁾	Site-Wide PTE ⁽²⁾
	lb/MMBtu	tpy	tpy
Benzene	7.76E-04	6.61E-03	1.84E-01
Toluene	2.81E-04	2.39E-03	6.67E-02
Xylenes	1.93E-04	1.64E-03	4.58E-02
Formaldehyde	7.89E-05	6.72E-04	1.87E-02
Acetaldehyde	2.52E-05	2.14E-04	5.98E-03
Acrolein	7.88E-06	6.71E-05	1.87E-03
Naphthalene	1.30E-04	1.11E-03	3.09E-02
Total HAP		0.01	0.35

1. Projected actual emissions are based on 30 hours per year per generator for non-emergency use at 50% standby load.
 2. PTE are based on 500 hours per year per generator for both emergency and non-emergency use at 100% standby load.
 3. Emission factors based on AP-42 Table 3.4-3, speciated organic compound emission factors for large uncontrolled stationary diesel engines and Table 3.4-4, PAH emission factors for large uncontrolled stationary diesel engines.

Table 6 Tank Calculations

Tank Capacity (per Tank)	9,458	gal
Tank Throughput (per Tank) ⁽¹⁾	86,000	gal/yr
Total Losses (per Tank) ⁽²⁾	3.66	lb/yr
Number of Tanks on Site	40	-
Annual Site-wide VOC Emissions ⁽²⁾	146.41	lb/yr
	0.07	tpy

1. Tank throughput based on maximum operating hours of 500 hrs/yr/gen at 100% load.
 2. Losses includes breathing losses and working losses.

Title Page

Product:

Process:

Process Cycle Time: 365 days

Final Product Amount: 86000 gal

Evaluation Date: 3/2/2022

File Name: C:\Users\Yvonne.Shi\Documents\ERM\Quality Technology Services - Air Permitting
Management - Documents\2. QTS\Denver\Gen Application\Reference\Tank Calc 3-2-2022.emm

Connected Database: Emaster = \\usbdcl01\EMTanks\Emaster

Calculation type: MACT98

Condenser Calc. type: Single Stage

Charge Calc. type: Initial Composition

Material Balance: No Emissions Subtracted

Last Saved User: Yvonne.Shi

Last Saved Time: 11:32:22 AM, 3/2/2022

Comment:

Defined Activities

- 1) [Storage] Denver 9458 Gal

1: Storage Tank Activity

Title: Denver 9458 Gal

Start Date: 1/1/2022

End Date: 12/31/2022

Elapsed Time: 365.0 days

Vent ID:

Noncondensable: Air @ 0 Nm³/h

Saturation: 100%

Pressure: -2.578 psig

Using Monthly Avg. Temp.

Location: Colorado, Denver Volume Throughput: 86000 gal

Crude Oil Factor-Kc: 0.75

Vessel Name: Denver 9458 Gal

Void Vol.: 9,776.31 gal Work Vol.: 9,458 gal

No Control Devices

Final Contents	9458.0 gal	67170.1057 lb	-0.1 °C				
	Weight	Pure-Vp	W[i]	X[i]	A[i]	X*Vp*A	
[Liquid Phase]	(lb)	(kPa)				(kPa)	
Distillate Fuel Oil No. 2	67170.1057	0.0153	1.0	1.0	1	0.0153	

Emissions From Vessel: Denver 9458 Gal

	Effective Vp	Working	Breathing	Total	Rate
[Non Condensables]	(mm Hg)	(lb)	(lb)	(lb)	(lb/hr)
Air	83.5166	551.4684	667.3203	1218.7887	0.1391
[Condensables]	(mm Hg)	(lb)	(lb)	(lb)	(lb/hr)
Distillate Fuel Oil No. 2	0.0386	1.622	2.0382	3.6602	4.0e-4

Summary Page

Emissions for (Unspecified Vent):

	CAS	Avg. Rate	Max. Rate	Total Weight
Air	132259-10-0	0.1391 lb/hr	0.1391 lb/hr	1218.7887 lb
Distillate Fuel Oil No. 2	64742-47-8	4.0e-4 lb/hr	4.0e-4 lb/hr	3.6602 lb

Total emissions for all vents:

	CAS	Avg. Rate	Max. Rate	Total Weight
Air	132259-10-0	0.1391 lb/hr	0.1391 lb/hr	1218.7887 lb
Distillate Fuel Oil No. 2	64742-47-8	4.0e-4 lb/hr	4.0e-4 lb/hr	3.6602 lb

Model: KD2500, continued

Exhaust

Exhaust System

Exhaust flow at rated kW, m ³ /min. (cfm)	579 (20447)
Exhaust temperature at rated kW, dry exhaust, °C (°F)	500 (932)
Maximum allowable back pressure, kPa (in. Hg)	8.5 (2.5)
Exh. outlet size at eng. hookup, mm (in.)	See ADV Drawing

Engine Electrical

Engine Electrical System

Starter motor qty. at starter motor power rating, rated voltage (DC)	Standard: 2 @ 9 kW, 24
Battery charging alternator: Ground (negative/positive)	Negative
Battery charging alternator: Volts (DC)	24
Battery charging alternator: Ampere rating	140
Quantity, CCA rating each, type (with standard starters)	4, 1110, AGM
Battery voltage (DC)	12

Fuel

Fuel System

Fuel type	Diesel
Fuel supply line, min. ID, mm (in.)	25 (1.0)
Fuel return line, min. ID, mm (in.)	19 (0.75)
Max. fuel flow, Lph (gph)	881 (232.7)
Min./max. fuel pressure at engine supply connection, kPa (in. Hg)	-30/30 (-8.8/8.8)
Max. return line restriction, kPa (in. Hg)	30 (8.9)

Lubrication

Lubrication System

Type	Full Pressure
Oil pan capacity with filter, L (qt.)	335 (354)
Oil filter: quantity, type	6, Cartridge
Oil cooler	Water-Cooled

Cooling

Radiator System

Ambient temperature, °C (°F)	50 (122)
Engine jacket water flow, Lpm (gpm)	2082 (550)
Engine jacket water capacity, L (gal.)	356 (94)
Radiator system capacity, including engine, L (gal.)	643 (170)
Charge cooler water flow, Lpm (gpm)	662 (174)
Heat rejected to cooling water at rated kW, dry exhaust, kW (Btu/min.)	870 (49476)
Heat rejected to charge air cooling water at rated kW, dry exhaust, Kw Btu/min.	760 (43220)
Fan diameter, including blades, mm (in.)	2434 (96)
Fan, kWm (HP)	90 (120.7)
Max. restriction of cooling air, intake and discharge side of radiator, kPa (in. H ₂ O)	0.125 (0.5)

* Enclosure with enclosed silencer reduces ambient temperature capability by 5 °C (9 °F)

Model: KD2500, continued

Air Requirements

Radiator-cooled cooling air, m3/min. (scfm) *	2549 (90000)
Cooling air required for generator set when equipped with city water cooling or remote radiator, based on 14°C (25°F) rise, m3/min. rise and ambient temp. of 29°C (85°F) m3/min. (cfm)	1116 (39398)
Combustion air, m3/min. (cfm)	208 (7345)
Heat rejected to ambient air: Engine, kW (Btu/min.)	150 (8530)
Heat rejected to ambient air: Alternator, kW (Btu/min.)	160 (9099)

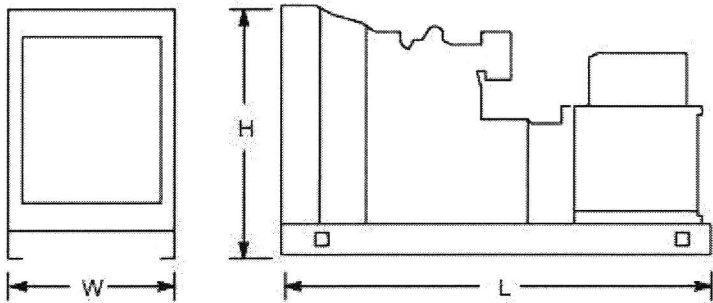
*Air density = 1.20 kg/m3 (0.075 lbm/ft3)

Fuel Consumption

Diesel, Lph (gph), at % load	Rating
Standby Fuel Consumption at 100% load	651 Lph (172.0 gph)
Standby Fuel Consumption at 75% load	572 Lph (151.0 gph)
Standby Fuel Consumption at 50% load	389 Lph (102.8 gph)
Standby Fuel Consumption at 25% load	222 Lph (58.7 gph)

Dimensions and Weights

Dim Weight Spec	Dim Weight Value
Fuel	Diesel
Engine Manufacturer	Kohler
Overall Size, L x W x H, mm (in.):	6957 x 2852 x 3307 (273.9 x 112.3 x 130.2)
Weight (radiator model), wet, kg (lb.):	27033 (59598)



NOTE: This drawing is provided for reference only and should not be used for planning installation. Contact your local distributor for more detailed information.



KD2500

60 Hz. Diesel Generator Set

Tier 2 EPA Certified for Stationary Emergency Applications

EMISSION OPTIMIZED DATA SHEET

ENGINE INFORMATION

Model:	KD62V12	Bore:	175 mm (6.89 in.)
Nameplate kW @ 1800 RPM:	2700	Stroke:	215 mm (8.46 in.)
Type:	4-Cycle, 12-V Cylinder	Displacement:	62 L (3783 cu. in.)
Aspiration:	Turbocharged, Intercooled	EPA Family:	MLHAL103.ESP
Compression ratio:	16:0:1	EPA Certificate:	MLHAL103.ESP-001
Emission Control Device:	Direct Diesel Injection, Engine Control Module, Turbocharger, Charge Air Cooler		

EXHAUST EMISSION DATA:

EPA D2 Cycle 5-mode weighted

HC	0.17 g/kWh
NO _x (Oxides of Nitrogen as NO ₂)	5.28 g/kWh
CO (Carbon Monoxide)	1.22 g/kWh
PM (Particulate Matter)	0.14 g/kWh

TEST METHODS AND CONDITIONS

Test Methods:

Steady-State emissions recorded per EPA CFR 40 Part 89, and ISO8178-1 during operation at rated engine speed (+/-2%) and stated constant load (+/-2%) with engine temperatures, pressures and emission rates stabilized.

Fuel Specification:

40-48 Cetane Number, 0.05 Wt. % max. Sulfur; Reference ISO8178-5, 40CFR86.1313-98 Type 2-D and ASTM D975 No. 2-D.

Reference Conditions:

25 °C (77 °F) Air Inlet Temperature, 40 °C (104 °F) Fuel Inlet Temperature, 100 kPa (29.53 in Hg) Barometric Pressure; 10.7 g/kg (75 grains H₂O/lb.) of dry air Humidity (required for NO_x correction); Intake Restriction set to maximum allowable limit for clean filter; Exhaust Back pressure set to maximum allowable limit.

Data was taken from a single engine test according to the test methods, fuel specification and reference conditions stated above and is subjected to instrumentation and engine-to-engine variability. Tests conducted with alternate test methods, instrumentation, fuel or reference conditions can yield different results.

Data and specifications subject to change without notice.



KD2500

60 Hz. Diesel Generator Set Tier 2 EPA Certified for Stationary Emergency Applications EMISSION OPTIMIZED DATA SHEET

ENGINE INFORMATION

Model:	KD62V12	Bore:	175 mm (6.89 in.)
Type:	4-Cycle, 12-V Cylinder	Stroke:	215 mm (8.46 in.)
Aspiration:	Turbocharged, Intercooled	Displacement:	62 L (3783 cu. in.)
Compression ratio:	16:0:1		
Emission Control Device:	Direct Diesel Injection, Engine Control Module, Turbocharger, Charge Air Cooler		

NOMINAL EMISSION DATA

Cycle point	100% ESP	75% ESP	50% ESP	25% ESP
Power [kW]	2700	2025	1350	675
Speed [rpm]	1800	1800	1800	1800
Exhaust Gas Flow [kg/h]	15085	15390	10714	6183
Exhaust Gas Temperature [C]	456	464	447	464
NO _x [g/kWh]	9.5	4.5	4.9	5.0
CO [g/kWh]	0.3	1.2	0.7	2.6
HC [g/kWh]	0.12	0.10	0.18	0.29
PM [g/kWh]	0.06	0.16	0.12	0.34

NOT TO EXCEED EMISSION DATA

Cycle point	100% ESP	75% ESP	50% ESP	25% ESP
NO _x [g/kWh]	11.2	5.3	5.7	5.9
CO [g/kWh]	1.0	3.5	1.9	7.4
HC [g/kWh]	0.14	0.12	0.21	0.34
PM [g/kWh]	0.10	0.20	0.15	0.40

TEST METHODS AND CONDITIONS

Test Methods:

Steady-State emissions recorded per EPA CFR 40 Part 89, and ISO8178-1 during operation at rated engine speed (+/-2%) and stated constant load (+/-2%) with engine temperatures, pressures and emission rated stabilized.

Fuel Specification:

40-48 Cetane Number, 0.05 Wt. % max. Sulfur; Reference ISO8178-5, 40CFR86.1313-98 Type 2-D and ASTM D975 No. 2-D.

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Data and specifications subject to change without notice.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
2021 MODEL YEAR
CERTIFICATE OF CONFORMITY
WITH THE CLEAN AIR ACT

OFFICE OF TRANSPORTATION
AND AIR QUALITY
ANN ARBOR, MICHIGAN 48105

Certificate Issued To: **Liebherr Machines Bulle SA**
(U.S. Manufacturer or Importer)

Certificate Number: **MLHAL103.ESP-001**

Effective Date:

09/30/2020

Expiration Date:

12/31/2021

Byron J. Bunker, Division Director
Compliance Division

Issue Date:

09/30/2020

Revision Date:

N/A

Model Year: 2021

Manufacturer Type: Original Engine Manufacturer

Engine Family: MLHAL103.ESP

Mobile/Stationary Indicator: Stationary

Emissions Power Category: kW>560

Fuel Type: Diesel

After Treatment Devices: No After Treatment Devices Installed

Non-after Treatment Devices: Electronic Control

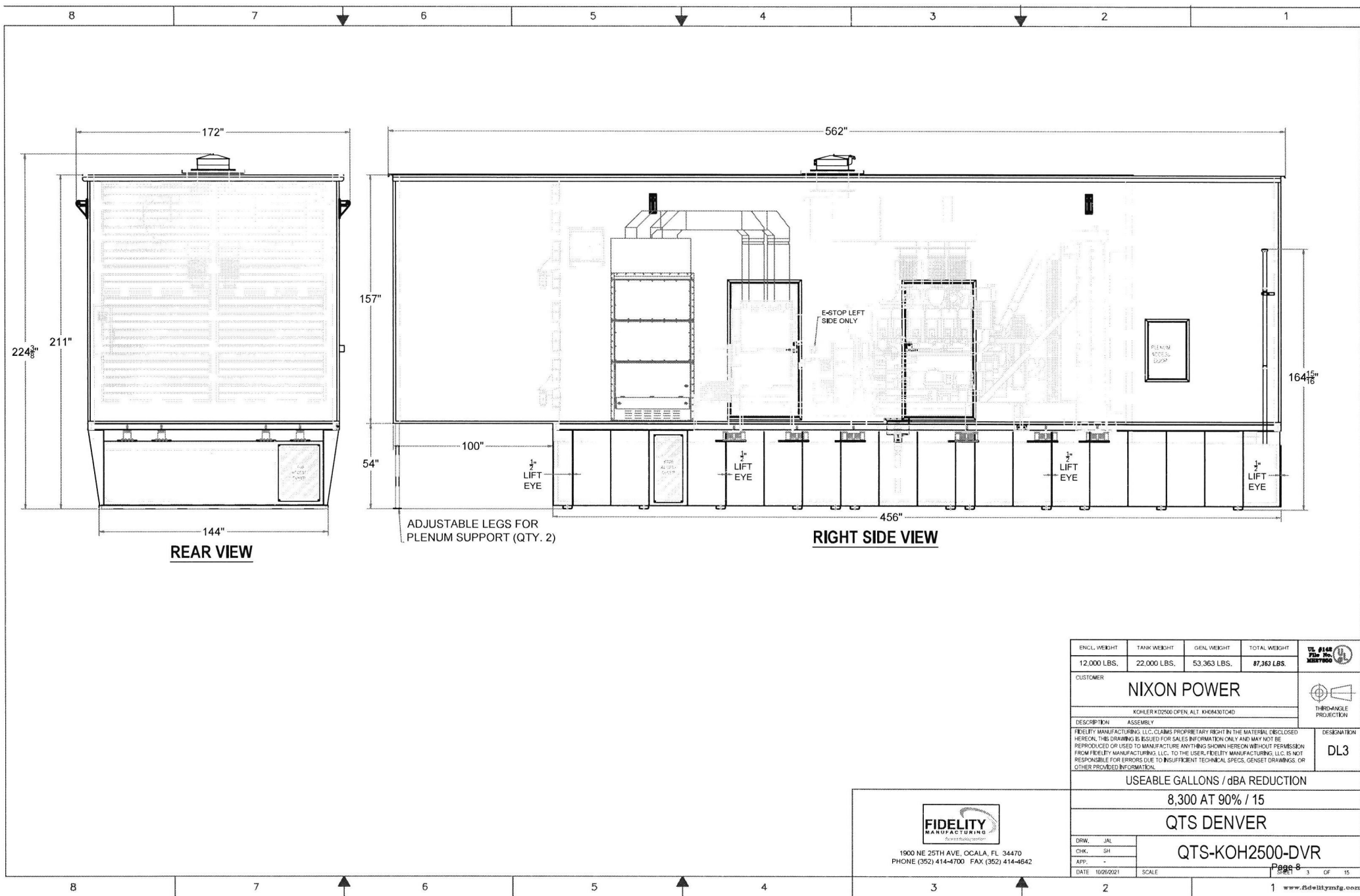
Pursuant to Section 111 and Section 213 of the Clean Air Act (42 U.S.C. sections 7411 and 7547) and 40 CFR Part 60, and subject to the terms and conditions prescribed in those provisions, this certificate of conformity is hereby issued with respect to the test engines which have been found to conform to applicable requirements and which represent the following engines, by engine family, more fully described in the documentation required by 40 CFR Part 60 and produced in the stated model year.

This certificate of conformity covers only those new compression-ignition engines which conform in all material respects to the design specifications that applied to those engines described in the documentation required by 40 CFR Part 60 and which are produced during the model year stated on this certificate of the said manufacturer, as defined in 40 CFR Part 60.

It is a term of this certificate that the manufacturer shall consent to all inspections described in 40 CFR 1068 and authorized in a warrant or court order. Failure to comply with the requirements of such a warrant or court order may lead to revocation or suspension of this certificate for reasons specified in 40 CFR Part 60. It is also a term of this certificate that this certificate may be revoked or suspended or rendered void *ab initio* for other reasons specified in 40 CFR Part 60.

This certificate does not cover engines sold, offered for sale, or introduced, or delivered for introduction, into commerce in the U.S. prior to the effective date of the certificate.

The actual engine power may lie outside the limits of the Emissions Power Category shown above. See the certificate application for details.



ENCL. WEIGHT	TANK WEIGHT	GENL. WEIGHT	TOTAL WEIGHT	UL #148 File No. MB7900 
12,000 LBS.	22,000 LBS.	53,363 LBS.	87,363 LBS.	
CUSTOMER				 THIRD-ANGLE PROJECTION
NIXON POWER				
KOHLEK02500 OPEN ALT. KH0430T04D				
DESCRIPTION ASSEMBLY				DL3
FIDELITY MANUFACTURING LLC CLAIMS PROPRIETARY RIGHT IN THE MATERIAL DISCLOSED HEREON. THIS DRAWING IS ISSUED FOR SALES INFORMATION ONLY AND MAY NOT BE REPRODUCED OR USED TO MANUFACTURE ANYTHING SHOWN HEREON WITHOUT PERMISSION FROM FIDELITY MANUFACTURING LLC. TO THE USER, FIDELITY MANUFACTURING LLC IS NOT RESPONSIBLE FOR ERRORS DUE TO INSUFFICIENT TECHNICAL SPECS, GENSET DRAWINGS, OR OTHER PROVIDED INFORMATION.				
USEABLE GALLONS / dBA REDUCTION				
8,300 AT 90% / 15				
QTS DENVER				
QTS-KOH2500-DVR				
DRW.	JAL	Page 8 SHEET 3 OF 15		
CHK.	SH			
APP.	-			
DATE	10/26/2021			
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