DAVID J. POWERS
& ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS & PLANNERS

November 18, 2011

DOCKET
11-SPPE-01
DATE NOV 18 2011
RECD NOV 22 2011

Dockets Unit
California Energy Commission
1516 Ninth Street, MS 4
Sacramento, CA 95814

Re: Santa Clara SC-1 Data Center, Application for Small Power Plant Exemption - Response to Informal Data Requests

Dear Docket Unit Clerk:

Pursuant to requests from members of the staff of the California Energy Commission, Xeres Ventures LLC hereby submits the enclosed responses to informal data requests regarding the SPPE Application for the Santa Clara SC-1 Data Center project in Santa Clara, California. One hard copy and one CD are being provided for filing.

The attached responses address the technical information needed for a Visible Plume and Plume Velocity Analysis by the California Energy Commission and supplemental Air Quality information for the proposed 16 emergency backup generators and cooling towers used for building cooling at the Santa Clara SC-1 Data Center.

Please contact me if additional information or clarification of the data is needed.

Sincerely,

Nora H Monette

Nora Monette
Principal Project Manager

c.c. w/enclosures

Robert Worl, CEC Project Manager
Richard Waddell, DuPont Fabros/Xeres Ventures LLC
Monica Schwebs, Bingham McCutchen

Technical Area: Air Quality
Author: Joseph Hughes

Project Modeling
BACKGROUND

Operational emission air dispersion modeling needs to be evaluated to determine if it demonstrates project compliance with all ambient air quality standards, including the new Federal 1-hour NO2 standard. Staff is interested in modeling parameters that reflect permitted emissions and operation. Emission factors should reflect load percentages and emissions likely to occur during testing and maintenance scenarios as allowed in the Authority to Construct permits.

CLARIFICATION ISSUE

1. Please provide the operations modeling analysis, which includes all on-site operations emission sources that represent expected worst case operational impacts (not emergency situations). Alternatively, if you want us to get the information from the air district, please let us know.

Sierra Research conducted an air quality impacts analysis for compliance with both the federal 1-hour NO_2 National Ambient Air Quality Standard (NAAQS) and the California 1-hour NO_2 standard. Sierra's initial modeling results were presented in a report submitted to BAAQMD entitled "NO_2 Air Quality Impact Analysis & Diesel Particulate Health Risk Assessment for Xeres Ventures, LLC, Santa Clara Data Center, Santa Clara, California", October 2009 (Attachment A). This analysis considered both non-emergency operations at various load levels (operation of one engine for: 30-minute test runs at 75%, 50% and 25% loads; load-banked startup at 100%, 75% and 50% loads; uncontrolled startup at 25% load; and controlled operation at 100%, 75%, 50% and 25% loads), as well as emergency operations (operation of all 32 engines for: 30-minute emergencies at 75% and 50% load; emergency startup at 75% and 50% loads; and controlled emergency operation at 75% and 50% load). At BAAQMD's request, Sierra Research performed more refined modeling analysis for compliance with the 1-hour NO_2 NAAQS and California ambient air quality standard, as summarized in a memorandum dated March 12, 2010, "One-Hour NO_2 Air Quality Impact Analysis and Health Risk Assessment for Xeres Ventures Santa Clara Data Center" (Attachment B). BAAQMD reviewed these analyses and the underlying modeling filed and confirmed their results.

Specifically with respect to the 1-hour NO_2 NAAQS, BAAQMD's Engineering Evaluation Report provides as follows:

> b) Federal 1-hour NAAQS for NO2
>
> The Applicant's refined NO2 modeling, described above, also indicates that the project will not result in a violation of the new 1-hour national ambient air quality standard for NO2, which is expressed as the 8th highest 1-hour concentration in any year, not to exceed 188 µg/m3. Further discussion of this finding can also be found in the District's addendum to the Mitigated Negative Declaration (see Appendix E of Santa Clara SC-1 Data Center Application for Small Power Plant Exemption, November 2011).

Engineering Evaluation Report, Xeres Ventures LLC, P#18801, July 7, 2010, prepared by Tamiko Endow (BAAQMD Air Quality Engineer) at p. 12. The Engineering Evaluation Report is provided in Appendix I of the Santa Clara SC-1 Data Center Application for Small Power Plant Exemption (SPPE).

The referenced Addendum to the Mitigated Negative Declaration confirms this conclusion as follows:

> The modeling also shows that the project will not result in a violation of the new federal 1-hour NO_2 NAAQS (188 µg/m3, based on the 3-year average of the 98th percentile or 8th highest 1-hour NO_2 concentrations in any year).

Addendum to Mitigated Negative Declaration, Santa Clara SC-1 Data Center Project (Xeres Ventures, LLC), June 15, 2010, at 4 . The Addendum to the Mitigated Negative Declaration is included in Appendix E of the Santa Clara SC-1 Data Center Application for SPPE.

Project Engine Testing
BACKGROUND

Staff wants to know the minimum readiness testing requirements (minutes per week) to meet the engine availability requirements. This will help staff estimate realistic (rather than permitted) engine operation and expected impacts.

CLARIFICATION ISSUE

2. Please provide information on the minimum readiness testing requirements to meet the engine availability requirements. Please identify the source of the requirements (e.g., NFPA, reliability agreements or specification, insurance, local fire, etc,),

The minimum readiness testing requirements for the data center are what Xeres Ventures believes are necessary to meet its Service Level Agreement ("SLA") obligations to those who lease space from the data center. SLA obligations for data centers typically require power to be available all the time, with substantial reductions in lease payments applied for failure to meet the agreed availability standard. The SLA is the foundation of the business operation, and requires all support systems be available to attain the performance standards. These standards can only be met through periodic test regimens.

Xeres Ventures developed estimates of the amount of time that it would have to be able to test the back-up generators and electrical distribution equipment in Santa Clara SC-1 in order to meet its typical SLA obligations. These estimates were used to develop the limits in the BAAQMD Authority to Construct Permit issued in July 2010.

Attachment A

NO_2 Air Quality Impact Analysis
October 2009

NO_2 Air Quality Impact Analysis & Diesel Particulate Health Risk Assessment for Xeres Ventures, LLC Santa Clara Data Center Santa Clara, California

Submitted by

Xeres Ventures, LLC
Washington, D.C.

October 2009

prepared by:

Sierra Research, Inc.
1801 J Street
Sacramento, California 95811
(916) 444-6666

NO_2 AIR QUALITY IMPACT ANALYSIS & DIESEL PARTICULATE HEALTH RISK ASSESSMENT
for
XERES VENTURES, LLC
SANTA CLARA DATA CENTER
SANTA CLARA, CALIFORNIA

Submitted by:

Xeres Ventures, LLC
Washington, DC

October 2009

Prepared by:

Sierra Research, Inc.
1801 J Street
Sacramento, California 95811
(916) 444-6666

EXECUTIVE SUMMARY

In November 2007, Xeres Ventures LLC filed an application with the Bay Area Air Quality Management District (District) for Authority to Construct (ATC) permits for a new data center (SC1) to be constructed in Santa Clara, California. Xeres Ventures proposed to install thirty-two (32) diesel emergency generators and four permit-exempt space heaters.

The City of Santa Clara assumed the role of Lead Agency with respect to the California Environmental Quality Act (CEQA) review. The City prepared an Initial Study and issued a Mitigated Negative Declaration in March 2008. The November 2007 ATC application contained an air quality impact analysis, or AQIA, even though the District does not require an AQIA as part of its permitting process for a project of this type and size. While the AQIA demonstrated compliance with the national ambient air quality standards (AAQS) for nitrogen dioxide (NO_2), the AQIA showed an apparent exceedance of the California 1-hour NO_2 AAQS. Furthermore, the original permit application did not contain a health risk assessment (HRA) demonstrating that health risks associated with diesel particulate matter (DPM) emissions from the emergency generators would comply with the District's risk thresholds.

This report evaluates compliance of the proposed SC1 project with the California one-hour NO_2 AAQS and with the District's health risk thresholds. The AQIA indicates that emissions associated with non-emergency operation of the proposed SC1 data center would not cause an exceedance of the 1-hour NO_2 AAQS. The health risks for the proposed SC1 data center project are below the District's risk thresholds.

NO_2 AIR QUALITY IMPACT ANALYSIS & DIESEL PARTICULATE HEALTH RISK ASSESSMENT for XERES VENTURES, LLC SANTA CLARA DATA CENTER SANTA CLARA, CALIFORNIA

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1. INTRODUCTION

A. Facility Information

Owner:	Xeres Ventures, LLC
Mailing Address:	1212 New York Avenue Washington, DC 20005
Facility Address:	535 Reed Street Santa Clara, CA 95054
General Business:	Data Center
Contact:	Dan Hopkins Director, Data Center Operations DuPont Fabros Technologies (202) 538-4638
Consultants:	Sierra Research, Inc. 1801 J Street Sacramento, California 95811 Contact: Dan Welch (916) 444-6666

B. Background

In November 2007, Xeres Ventures LLC, a subsidiary of DuPont Fabros Technology, Inc. (DFT), filed an application with the Bay Area Air Quality Management District (District) for Authority to Construct (ATC) permits for a new data center (SC1) to be constructed in Santa Clara, California. Xeres Ventures proposed to install thirty-two (32) diesel emergency generators and four permit-exempt space heaters. The City of Santa Clara assumed the role of Lead Agency with respect to the California Environmental Quality Act (CEQA) review. The City prepared an Initial Study and issued a Mitigated Negative Declaration in March 2008.

The original ATC application contained application forms, drawings, emission estimates, and an air quality impact analysis, or AQIA, even though the District does not require an AQIA as part of its permitting process for a project of this type and size. While the AQIA demonstrated compliance with the national ambient air quality standards (AAQS) for carbon monoxide (CO) and nitrogen dioxide (NO_2), the AQIA showed an apparent exceedance of the California one-hour NO_2 AAQS. Furthermore, the original permit application did not contain a health risk assessment (HRA) demonstrating that health risks associated with toxic air contaminant (TAC) emissions from the project would comply with the District's risk thresholds.

This report demonstrates compliance of the proposed SC1 project with the 1-hour NO_2 AAQS and with the District's health risk thresholds during non-emergency operation.

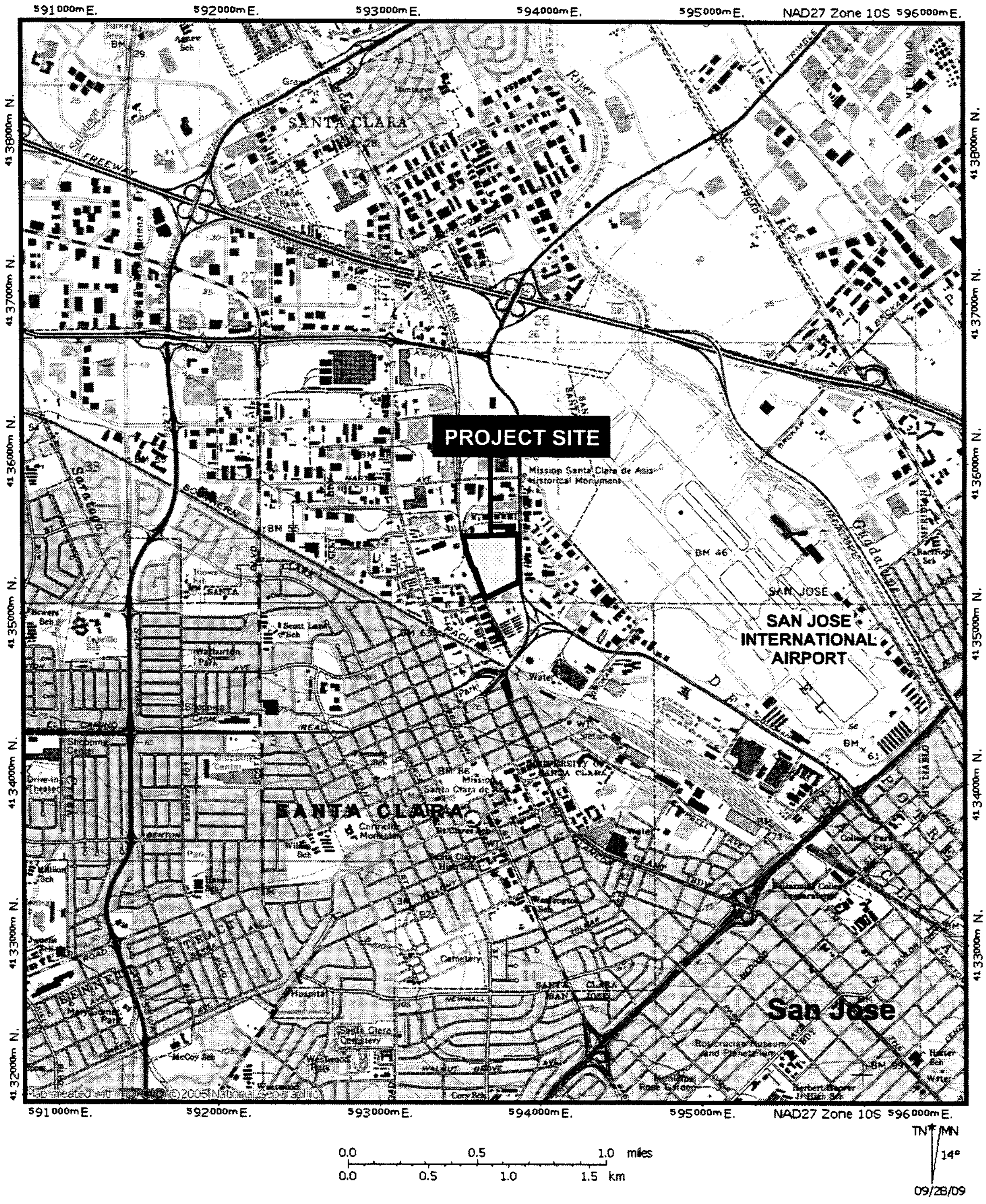
C. Project Description

The proposed SC1 will be located at the intersection of DeLa Cruz Boulevard and Reed Street, just west of the San Jose International Airport, in Santa Clara, California, as illustrated in Figure 1. The SC1 project will include a redundant uninterruptible power supply (UPS) to assure that the data center has a reliable power supply. Xeres Ventures will install the following equipment in conjunction with the SC1 project:

- Thirty-two diesel-fired 2,250 kW emergency electrical generators;
- Thirty-two (32) selective catalytic reduction (SCR) systems to control nitrogen oxides (NOx) emissions from the emergency generators; and
- Four 1.4 MMBtu/hr natural gas-fired space heaters.

The natural gas-fired space heaters will be permit-exempt devices pursuant to Section 114.1.2 of Rule 2-1 (General Requirements), which exempts from permitting natural gas-fired heaters rated less than 10 MMBtu/hr. Therefore, the proposed natural gas-fired space heaters were not addressed further in these analyses.

Figure 1
Location Map – Santa Clara Data Center

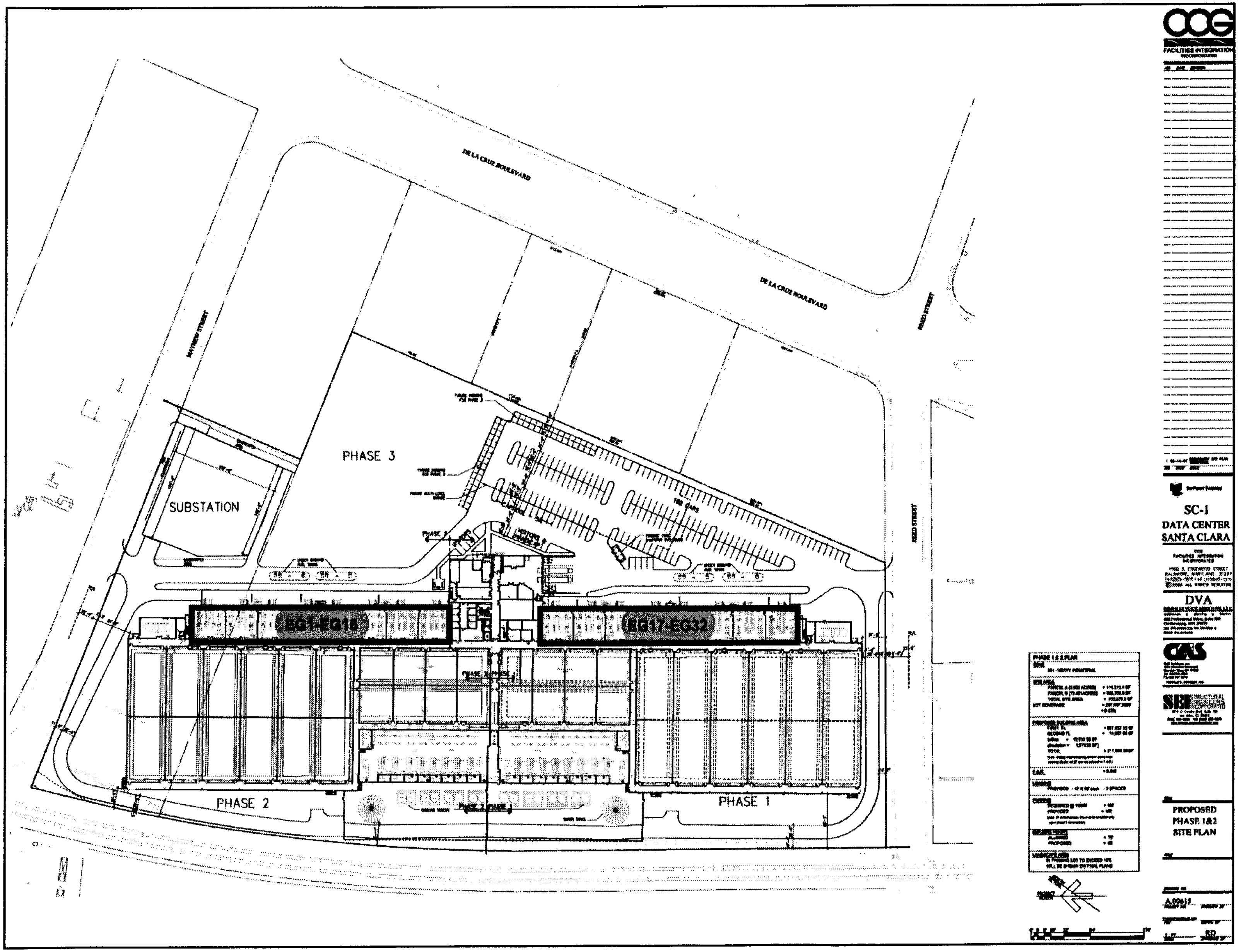


D. Equipment Description

The 32 emergency generators will provide redundant backup power for the primary UPS. The emergency generators will be fueled exclusively with Diesel. A 3,350 bhp MTU Detroit Diesel 16V4000G83 internal combustion engine will drive each 2,250 kW electrical generator. The engines are a four-stroke, compression ignition design with turbocharging and intercooling. Each emergency generator will be operated not more than 50 hours per year for maintenance and testing (excluding District-required emissions testing) pursuant to the California Air Resources Board's (CARB's) Airborne Toxic Control Measure for Stationary Compression Ignition Engines. Post-combustion air pollution controls on each engine will consist of an SCR system, designed to obtain 90% control of NOx emissions, installed on the engine exhaust piping. Engine exhaust will pass through the SCR reactor, into which urea will be injected, and the catalyzed oxidation-reduction reaction will convert ammonia and NOx to nitrogen gas and water. The SC1 project will also include a load bank, which will allow full load non-emergency operation of a single engine in order to shorten the startup period for the SCR system when the emergency generator is scheduled for longer non-emergency operation at reduced load. The proposed locations of the emergency generators are shown in Figure 2. Equipment specifications for the emergency generators are summarized in Table 1. Engineering specifications are contained in Appendix A.

Table 1 **Emergency Generator Design Specifications**	
Manufacturer (Generator/Engine)	MTU Detroit Diesel
Model (Generator/Engine)	16V4000G83
Fuel	Diesel
Generator Power Output	2,250 kW
Engine Work Output	3,350 bhp
Fuel Consumption Rate	163.6 gal/hr
Heat Input Rate @ HHV	22.9 MMBtu/hr
Exhaust Flow Rate	17,832 wacfm
Exhaust Temperature	940 °F
Exhaust Pipe Diameter	18 inches
Exhaust Pipe Exit Height Above Grade	54.5 feet

Figure 2
Site Plan – Santa Clara Data Center



E. Operations

The following non-emergency operating scenarios, during which only a single generator will be operated, are envisioned for the emergency generators:

- Bi-weekly testing of the engines, unloaded, for no more than 30 minutes;
- Monthly testing of the generators at 50% load for no more than 30 minutes;
- Quarterly engine preventative maintenance runs, at 50% to 75% load, for no more than 30 minutes;
- Quarterly (or more frequently) testing of the UPS system at 75% load for no more than 30 minutes;
- Triennial infrared scans (for inspection of electrical connections to find signs of overheating) at 100% load for up to one hour (load banked operation); and
- Triennial medium voltage transformer preventative maintenance at 50% to 75% load for up to 8 hours.

Xeres Ventures estimates the following startup periods for the SCR system (unassisted by the load bank):

- 15 minutes at 100% load;
- 30 minutes at 75% load; and
- 60 minutes at 50% load or less.

Use of the load bank will allow initial non-emergency operation of an emergency generator at 100% load, thus shortening the SCR startup period for reduced load non-emergency operations (e.g., triennial medium voltage preventive maintenance runs) to 15 minutes. The load bank will be used for planned non-emergency operation longer than 30 minutes because the additional emissions generated via the load bank startup will not be offset by the subsequent controlled operation of less than 30 minutes (e.g., during weekly testing). The load bank will not be used for planned non-emergency operation longer than 30 minutes at loads much less than 50% because the additional emissions generated via the load bank startup will not be offset by the subsequent controlled operation at much less than 50% load (e.g., triennial maintenance).

2. EMISSION ASSESSMENT

The SC1 project will emit affected pollutants, including (but not limited to) NOx and diesel particulate matter (DPM). This report addresses only the following:

- Hourly NOx emissions from the emergency generators to characterize the maximum hourly NO_2 impacts associated with the SC1 project; and
- Annual DPM emissions from the emergency generators to characterize the health risks associated with the SC1 project.

A. Maximum Hourly NOx Emissions

Hourly emissions were characterized for uncontrolled operation, controlled operation, startup, and 30-minute operation.

1. Uncontrolled Operation

Though the generators will never be operated for more than 30 minutes without the use of the SCR system, except well below 50% load, uncontrolled emissions are presented to show the basis for subsequent calculation of non-emergency operation emissions. Uncontrolled hourly NOx emissions were calculated at 100%/75%/50%/25% load from emission factors (in g/bhp-hr) and the engine work output (in bhp). NOx emission factors at 100%/75%/50%/25% loads were obtained from MTU Detroit Diesel, the generator manufacturer. Maximum emissions were calculated based upon a full load engine work output rate of 3,350 bhp. Uncontrolled hourly NOx emissions from an emergency generator are summarized in Table 2. Spreadsheets containing detailed emission calculations are presented in Appendix B.

Table 2
Uncontrolled NOx Emissions from an Emergency Generator

Engine Load [a]		NOx Emissions		
		g/kW-hr [a]	g/bhp-hr	lb/hr
100%	3,350	7.174	5.35	39.5
75%	2,513	5.631	4.20	23.3
50%	1,675	5.175	3.86	14.2
25%	838	4.747	3.54	6.53

Notes:
[a] Obtained from MTU Detroit Diesel, the engine manufacturer.

2. Controlled Operation

Controlled hourly NOx emissions were calculated assuming a 90% NOx control efficiency for the SCR system. Controlled emissions do not reflect startup conditions, but rather operation once the SCR system is operating. Controlled hourly NOx emissions from an emergency generator are summarized in Table 3. Spreadsheets containing detailed emission calculations are presented in Appendix B.

Table 3
Controlled NOx Emissions from an Emergency Generator

Engine Load	NOx Emissions (lb/hr)		
	Uncontrolled [a]	Control Eff	Controlled [b]
100%	39.5	90%	3.95
75%	23.3	90%	2.33
50%	14.2	90%	1.42
25%	6.53	90%	0.65

Notes:
[a] Presented previously in Table 2.
[b] Routine emissions, SCR system fully operational (i.e., excludes startup).

3. Startup

During startup, NOx emissions initially will be uncontrolled while the SCR catalyst is heated to its design operating temperature. Startup emissions were calculated from uncontrolled and controlled emission rates, apportioned appropriately over the first hour of operation. SCR startup times were estimated by DFT for 100%/75%/50%/25% load. Uncontrolled and controlled NOx emissions were presented previously in Tables 2 and 3, respectively. Xeres Ventures is proposing to install a load bank to allow a generator to operate at full load upon non-emergency startup, which will enable the SCR system to start up more quickly (i.e., 15 minutes) and will better control NOx emissions during startup. Load-banked startup emissions were similarly calculated from uncontrolled emission rates (at full load) and controlled emission rates at the subsequent operating load, apportioned appropriately over the first hour of operation. Startup NOx emissions from an emergency generator are summarized in Table 4. Spreadsheets containing detailed emission calculations are presented in Appendix B. Load-banking will reduce startup emissions at 75% and 50% loads but would yield higher emissions at 25% load due to the required operation at full-load to quickly heat the SCR system prior to reducing load back to 25%.

Table 4 **Startup NOx Emissions from an Emergency Generator**				
	Startup Duration (min) [a]		Startup NOx Emissions (lb/hr)	
Engine Load	W/o Load Bank	w/ Load Bank	w/o Load Bank [b]	w/ Load Bank [c]
100%	15	15	12.8	12.8
75%	30	15	12.8	11.6
50%	60	15	14.2	10.9
25%	60+	15	6.53	10.4

Notes:
[a] Startup duration is the time from ignition until the SCR system is operational
[b] Calculated from uncontrolled and controlled emission rates, presented previously in Tables 2 and 3, apportioned appropriately over the first hour of operation.
[c] Calculated from uncontrolled emission rates (at full load) and controlled emission rates at the subsequent operating load, presented previously in Tables 2 and 3, apportioned appropriately over the first hour of operation.

4. Thirty-Minute Operation NOx Emissions

Xeres Ventures will frequently test the generators for up to 30 minutes of non-emergency operation at not more than 75% load. At these lower loads, load-banked startups (plus 30 minutes of controlled non-emergency operation) would yield comparable, or greater, NOx emissions than would uncontrolled non-emergency operation for 30 minutes. Therefore, 30-minute emissions were calculated from uncontrolled emission rates, apportioned appropriately over 30 minutes of operation. Uncontrolled NOx emissions were presented previously in Table 2. Thirty-minute NOx emissions from an emergency generator, with and without load-banking, are summarized in Table 5. Spreadsheets containing detailed emission calculations are presented in Appendix B.

Table 5 **30-Minute NOx Emissions from an Emergency Generator**		
	NOx Emissions (lb/hr)	
Engine Load	Load-Banked [a]	Uncontrolled [b]
100%	N/A	N/A
75%	11.0	11.6
50%	10.6	7.12
25%	10.2	3.27

Notes:
[a] Calculated from uncontrolled emission rate, as presented previously in Table 2, at full load for 15 minutes and controlled emission rates, as presented previously in Table 3, at the subsequent operating load for 30 minutes.
[b] Calculated from uncontrolled emission rates, presented previously in Table 2, for 30 minutes.

B. Maximum Annual Diesel Particulate Matter Emissions

Particulate matter less than 10 microns in diameter (PM_{10}) was assumed to comprise 100% DPM. Hourly DPM emissions were calculated at 100%/75%/50%/25% load from PM_{10} emission factors (in g/bhp-hr) and the engine work output (in bhp). PM_{10} emission factors were obtained from MTU Detroit Diesel, the generator manufacturer. Hourly emissions were calculated based upon a full load engine work output rate of 3,350 bhp. Annual emissions were calculated for the 100% and 15% load conditions from the corresponding hourly emissions and the 50-hour-per-year CARB maintenance and testing operating limit (excluding District-required emissions testing) for emergency generators pursuant to the Airborne Toxic Control Measure for Stationary Compression Ignition Engines. DPM emissions from an emergency generator are summarized in Table 2. A Spreadsheet containing detailed emission calculations is presented in Appendix B.

Table 6 **DPM Emissions from an Emergency Generator**					
		DPM Emissions			
Engine Load [a]		g/kW-hr [a]	g/bhp-hr	lb/hr	lb/yr
100%	3,350	0.065	0.049	0.36	17.9
75%	2,513	0.092	0.069	0.38	19.0
50%	1,675	0.185	0.138	0.51	25.5
25%	838	0.382	0.285	0.53	26.3

Notes:
[a] Obtained from MTU Detroit Diesel, the engine manufacturer.

3. NO_2 AIR QUALITY IMPACT ANALYSIS

An AQIA for one-hour NO_2 impacts was performed, in accordance with District modeling guidelines, to characterize ambient one-hour NO_2 concentrations associated with non-emergency, emergency, and commissioning emissions from the proposed SC1 data center and to determine whether these ambient concentrations, when added to background levels in the case of impacts from non-emergency operation, comply with the AAQS. The District previously performed a dispersion modeling analysis of the proposed SC1 data center project, which evaluated one-hour NO_2 impacts. The District provided Sierra with electronic copies of its modeling input files, which subsequently formed the basis for Sierra's analysis. This section describes the methods used to perform the AQIA and the subsequent results. Other pollutants (e.g., carbon monoxide) and other averaging periods (e.g., annual NO_2 impacts) were beyond the scope of this analysis, which focused only upon one-hour NO_2 impacts.

A. Project Location

SC1 will be located on approximately 17.3 acres west of the San Jose International Airport, at the intersection of DeLa Cruz Boulevard and Reed Street, as illustrated previously in Figure 1. The UTM coordinates (NAD 27) of this intersection are approximately 593,816 meters Easting and 4,135,220 meters Northing. The nominal site elevation is approximately 52 feet above mean sea level at this location. The area surrounding the project site can be characterized as urban with a mix of land uses including industrial, residential, and commercial property. There are no prominent terrain features in the vicinity as SC1 is located in the Santa Clara Valley.

The climate of the Santa Clara Valley is characterized by warm summers with cool nights, mild winters, and modest amounts of precipitation. At the northern end of the Santa Clara Valley (i.e., the San Jose Airport), mean maximum temperatures range from the high 70s to the low 80s during the summer to the high 50s-low 60s during the winter, and mean minimum temperatures range from the high 50s during the summer to the low 40s during the winter. Rainfall amounts are modest, ranging from 13 inches in the lowlands to 20 inches in the hills. The major climatic controls in the Santa Clara Valley are the Santa Cruz Mountains to the west, the Diablo Range to the east, the convergence of the Gabilan Range and Diablo Range to the south, the San Francisco Bay to the north, and the semi-permanent Pacific High pressure system over the eastern Pacific Ocean.

The Pacific High is centered between the 140°W and 150°W meridians, and oscillates in a north-south direction seasonally. Its position governs California's weather. In the summer, the high moves to its northernmost position, which results in strong northwesterly flow and negligible precipitation. A thermal low pressure area from the Sonoran-Mojave Desert also causes air to flow onshore over the San Francisco Bay area much of the summer. In the winter, the Pacific High moves southwestward toward Hawaii, allowing storms originating in the Gulf of Alaska to reach northern California, bringing wind and rain. During the winter rainy periods, inversions are weak or nonexistent, winds are often moderate, and the air pollution potential is very low. During summer and fall, when the Pacific High is dominant, inversions become strong and often are surface-based; winds are light and the pollution potential is high. These periods are often characterized by winds that flow out of the Central Valley into the Bay Area and often include tule fog.

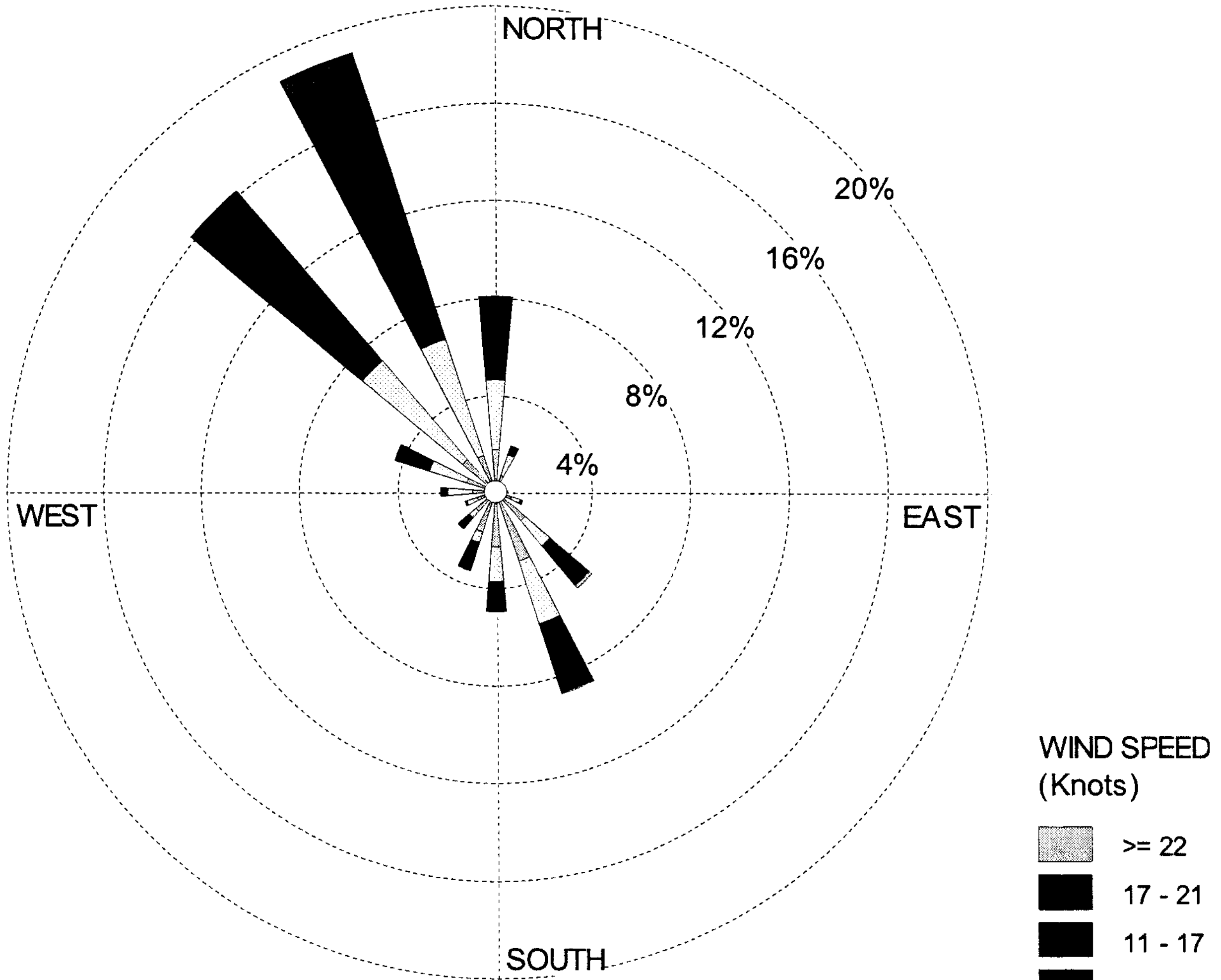
The wind patterns in the Santa Clara Valley are influenced greatly by the terrain, resulting in a prevailing flow roughly parallel to the Valley's northwest-southeast axis with a north-northwesterly sea breeze extending up the valley during the afternoon and early evening and a light south-southeasterly drainage flow occurring during the late evening and early morning. In summer a convergence zone is sometimes observed in the southern end of the Valley between Gilroy and Morgan Hill, when air flowing from the Monterey Bay through the Pajaro Gap gets channeled northward into the south end of the Santa Clara Valley and meets with the prevailing north-northwesterlies. Speeds are greatest in the spring and summer, and least in the fall and winter. Nighttime and early morning hours have light winds and are frequently calm in all seasons, while summer afternoon and evenings are quite breezy. Strong winds are rare, coming only with an occasional winter storm. The winds in the San Jose area are light (20% calm conditions) and predominantly bimodal. On an annual basis, approximately 43% of the winds come from the northwest through north, and approximately 19% from southeast through the south. Figure 3 depicts the wind direction and wind speed frequency distribution ("wind rose") recorded at the San Jose Airport meteorological station during calendar year 2004.

The mixing heights of the area are affected by the eastern Pacific high pressure system and marine influences. The base of the inversion is often found at the top of a layer of marine air, at mixing heights that generally provide favorable conditions for the dispersion of pollutants, because of the cooler nature of the marine environment. Inland areas, where the marine influence is weaker, often experience strong ground-based inversions during cold weather periods. These inversions inhibit dispersion of low-lying sources of air pollution, such as cars, trucks and buses, and can result in high pollutant concentrations. No terrain or other steering mechanisms that would have an effect on the meteorology exist at the project site. The surface roughness, height, and length of large-scale terrain features are consistent throughout the area, and play a large role in the effect on the horizontal and vertical wind patterns. There is no slope or topographical aspect in the vicinity of the site that would significantly affect meteorological conditions.

B. Dispersion Model

The ambient air quality dispersion modeling analysis was performed using the AERMOD (Version 07026) model to evaluate one-hour impacts on ambient concentrations of NO_2 associated with emissions from non-emergency operation, emergency operation, and commissioning of the proposed SC1 data center. The AERMOD model allows the selection of a number of options that affect model output. The District primarily used the regulatory default model options in its preliminary dispersion modeling analysis, except that the District used the plume volume molar ratio method (PVMRM) to evaluate the effects of ozone limiting, with 2004 ambient ozone data obtained from the San Jose

Figure 3
Wind Rose – San Jose Airport Meteorological Station



Jackson Street meteorological station and an assumed NO_2-to-NOx ratio of 10%. Sierra used the identical model options for this AQIA. The AERMOD data files are included on compact disks enclosed with this report.

C. Source Data

Stack characteristics and hourly NOx emissions were established for non-emergency operation, emergency operation, and commissioning, as discussed in the following sections.

1. Non-Emergency Operation

DFT has designed SC1 so that only one generator will be operated during non-emergency use. A screening modeling analysis identified emergency generator EG9 to be the single engine with the worst-case hourly impacts. Therefore, non-emergency impacts were modeled only for emergency generator EG9.[1] Stack characteristics and NOx emission rates for non-emergency operation are summarized in Table 7. Exhaust temperatures and exhaust flow rates, from which exhaust velocities were calculated, were obtained from MTU Detroit Diesel, the generator manufacturer. The following operating scenarios were assumed for the determination of impacts, with respect to the California 1-hour NO_2 AAQS, associated with non-emergency operation of the emergency generators:

- 30-minute test runs at 75%/50%/25% loads;
- Load-banked startup at 100%/75%/50% loads;
- Uncontrolled startup at 25% load; and
- Controlled operation (i.e., with SCR fully operational) at 100%/75%/50%/25% loads.

[1] Although each engine has identical stack parameters and emission rates, the slight differences in stack locations result in slightly different impacts when individual engines are evaluated.

Table 7 Stack Characteristics and NOx Emission Rates – Non-Emergency Operation					
Source	Stack Height (m)	Exhaust Temperature (°K)	Exhaust Velocity (m/sec)	Stack Diameter (m)	Emission Rate (g/sec)
Non-Emergency – 30 Minutes					
100% Load [a]	N/A	N/A	N/A	N/A	N/A
75% Load [b]	16.6	698	44.5	0.46	1.47
50 % Load [b]	16.6	643	34.2	0.46	0.90
25% Load [b]	N/A	N/A	N/A	N/A	N/A
Non-Emergency – Startup					
100% Load [c]	16.6	778	51.3	0.46	1.62
75% Load [c, d]	16.6	778	51.3	0.46	1.47
50 % Load [c, d]	16.6	778	51.3	0.46	1.38
25% Load [e]	16.6	598	14.0	0.46	0.82
Non-Emergency – Controlled					
100% Load [f]	16.6	778	51.3	0.46	0.50
75% Load [f]	16.6	698	44.5	0.46	0.29
50 % Load [f]	16.6	643	34.2	0.46	0.18
25% Load [f]	16.6	598	14.0	0.46	0.08

Notes:

[a] The emergency generators will not be tested at full load or 25% load for less than 30 minutes.

[b] NOx emission rates were derived from Table 5 for uncontrolled operation for 30 minutes.

[c] Stack conditions reflect 100% load because most startup emissions will occur during load-banking at 100% load.

[d] NOx emission rates were derived from Table 4 for load-banked operation.

[e] Reflects an uncontrolled startup because load-banking preparatory to a operation at 25% load would yield greater emissions than uncontrolled operation at 25%. NOx emission rate was derived from Table 4 for uncontrolled operation.

[f] NOx emission rates were derived from Table 3.

2. Emergency Operation

Under emergency conditions, DFT estimates that as many as all 32 emergency generators will operate between approximately 50% and 75% load. Full load emergency operation is not anticipated; neither is emergency operation of all engines at 25% load. Although DFT does not anticipate emergency operations at either of these conditions, DFT cannot accept restrictions on emergency operations which, by their nature, are not predicable. Stack characteristics and NOx emission rates for emergency operation are summarized in Table 8. All 32 engines were modeled under these conditions. The following operating scenarios were assumed for the determination of impacts, with respect to the California 1-hour NO_2 AAQS, associated with emergency operation of the emergency generators:

- 30-minute emergencies 75%/50% loads;
- Emergency startup at 75%/50% loads; and
- Controlled emergency operation (i.e., with SCR fully operational) at 75%/50% loads.

Table 8 Stack Characteristics and NOx Emission Rates – Emergency Operation					
Source	Stack Height (m)	Exhaust Temperature (°K)	Exhaust Velocity (m/sec)	Stack Diameter (m)	Emission Rate (g/sec)
Emergency – 30 Minutes					
100% Load [a]	N/A	N/A	N/A	N/A	N/A
75% Load [b]	16.6	698	44.5	0.46	1.47
50 % Load [b]	16.6	643	34.2	0.46	0.90
25% Load [a]	N/A	N/A	N/A	N/A	N/A
Emergency – Startup					
100% Load [a]	N/A	N/A	N/A	N/A	N/A
75% Load [c]	16.6	698	44.5	0.46	1.61
50 % Load [c]	16.6	643	34.2	0.46	1.80
25% Load [a]	N/A	N/A	N/A	N/A	N/A
Emergency – Controlled					
100% Load [a]	N/A	N/A	N/A	N/A	N/A
75% Load [d]	16.6	698	44.5	0.46	0.29
50 % Load [d]	16.6	643	34.2	0.46	0.18
25% Load [a]	N/A	N/A	N/A	N/A	N/A

Notes:
[a] The emergency generators are not expected to operate at 25% or 100% load under emergency conditions.
[b] NOx emission rates were derived from Table 5 for uncontrolled operation.
[c] NOx emission rates were derived from Table 4 for uncontrolled startup.
[d] NOx emission rates were derived from Table 3.

3. Commissioning

During commissioning, DFT estimates that as many as a full block of 16 emergency generators will operate over the full range of loads. Stack characteristics and NOx emission rates for commissioning activities are summarized in Table 9. Two separate blocks of 16 engines were modeled under these conditions. Commissioning activities must simulate emergency operation. Consequently, uncontrolled startup emissions are evaluated. The following operating scenarios were assumed for the determination of impacts, with respect to the California 1-hour NO_2 AAQS, associated with commissioning of the emergency generators:

- Uncontrolled (i.e., not load-banked) startup at 100%/75%/50%/25% loads; and
- Controlled operation (i.e., SCR) at 100%/75%/50%/25% loads.

Table 9 Stack Characteristics and NOx Emission Rates – Commissioning					
Source	Stack Height (m)	Exhaust Temperature (°K)	Exhaust Velocity (m/sec)	Stack Diameter (m)	Emission Rate (g/sec)
Commissioning – Startup					
100% Load [a]	16.6	778	51.3	0.46	1.62
75% Load [a]	16.6	698	44.5	0.46	1.61
50 % Load [a]	16.6	643	34.2	0.46	1.80
25% Load [a]	16.6	598	14.0	0.46	0.82
Commissioning – Controlled					
100% Load [b]	16.6	778	51.3	0.46	0.50
75% Load [b]	16.6	698	44.5	0.46	0.29
50 % Load [b]	16.6	643	34.2	0.46	0.18
25% Load [b]	16.6	598	14.0	0.46	0.08

Notes:
[a] NOx emission rate was derived from Table 4 for uncontrolled startup .
[b] NOx emission rates were derived from Table 3.

D. Building Downwash

Buildings or structures, located sufficiently close to a stack, can cause downwash effects that yield high fenceline impacts. The District evaluated downwash effects of the proposed SC1 data center building, whose dimensions are summarized in Table 10, in its preliminary dispersion modeling analysis but did not consider any other buildings or structures. The District used USEPA's Building Profile Input Program (BPIP) within Bowman's modeling software to determine direction-specific building dimensions so that downwash effects of the SC1 data center building could be evaluated. Sierra used the District's BPIP output files, without any modifications, in this AQIA.

Table 10 Building/Structure Dimensions	
Dimension	Distance
Length	1,100 feet
Width	280 feet
Height	48 feet

E. Meteorological Data

In its preliminary dispersion modeling analysis, the District used surface meteorological data collected in 2004 from the San Jose Airport meteorological station, located approximately 1 km east-southeast of the proposed SC1 data center, and upper air meteorological data collected in 2004 at the Oakland sounding station to model the impacts associated with emissions from the proposed emergency generators. Sierra used the identical meteorological data for this AQIA. The BAAQMD provided the modeling input files that already contained the processed meteorological data. Sierra did not further modify the data set.

F. Receptor Grids

In its preliminary dispersion modeling analysis, the District placed boundary receptors at 20 meter intervals along the fenceline. The District generated a fine receptor grid, also spaced at 20 meters, to a distance of approximately 750 meters from the midpoint of the emergency generators at the proposed SC1 data center. Sierra did not further modify the receptor grid. Sierra also did not further modify the elevation data contained in the District's modeling input files.

G. Ambient Air Quality Impacts

The modeled impacts associated with emissions from non-emergency operation, emergency operation, and commissioning of the proposed SC1 data center are summarized in Table 11. The AERMOD data files are included on compact disks enclosed with this report.

Table 11
Project Air Quality Impacts

Source	Ambient Impacts (μg/m³) [a]			
	100% Load	75% Load	50% Load	25% Load
Non-Emergency (EG9)				
30 Minutes [b]	N/A	164	144	115
Startup	169	166	165	135
Controlled	79	50	35	23
Emergency (32 engines) [c]				
30 Minutes	N/A	595	503	N/A
Startup	N/A	626	704	N/A
Controlled	N/A	372	348	N/A
Commissioning				
Startup (EG1 – EG16)	598	575	620	613
Startup (EG17 – EG32)	697	692	562	548
Controlled (EG1 – EG16)	399	401	366	371
Controlled (EG17 – EG32)	348	322	243	221

Notes:
[a] Reflects modeled impacts of emissions associated with non-emergency operation, emergency operation, and commissioning. Does not include background concentrations.
[b] The emergency generators will not be tested at full load for less than 30 minutes.
[c] The emergency generators will not operate at 25% or 100% load under emergency conditions.

The modeled impacts associated with emissions from non-emergency operation of the SC1 data center were added to the background concentrations to obtain the total impacts for non-emergency operation. Background hourly NO_2 concentrations for 2004–2008 from the San Jose Central monitoring station were reviewed. The maximum one-hour NO_2 concentration during this five-year period was 80 ppb, or 139 $\mu g/m^3$. The total impacts associated with emissions from non-emergency operation of the SC1 data center are summarized in Table 12. The AQIA indicates that emissions associated with non-emergency operation of the proposed SC1 data center would not cause an exceedance of the one-hour NO_2 AAQS.

Table 12
Total Impacts to Ambient Air Quality – Non-Emergency Operation

Source	Ambient Impacts ($\mu g/m^3$) [a]			
	100% Load	75% Load	50% Load	25% Load
30 Minutes	N/A [b]	303	283	254
Startup	308	305	304	274
Controlled	218	189	174	162

Notes:
[a] Reflects background concentration (139 $\mu g/m^3$) plus modeled impacts of emissions associated with non-emergency operation of EG9.
[b] The emergency generators will not be tested at full load for less than 30 minutes.

4. DIESEL PARTICULATE SCREENING RISK ASSESSMENT

District Rule 2-5 (New Source Review of Toxic Air Contaminants) requires that a screening risk assessment (SRA) be performed for new projects whose emissions of toxic air contaminants (TACs) exceed the District's risk screening thresholds. For Diesel engines, the District requires only the evaluation of DPM, which has a screening threshold of 0.58 lb/yr. As presented previously in Section II.B, the maximum annual DPM emissions from the proposed emergency generators are 229 lb/yr and exceed the District's risk screening thresholds. Therefore, an SRA was conducted to demonstrate that the health risks associated with DPM emissions from the emergency generators would not exceed District risk thresholds. For Diesel emergency generators, the District requires only the evaluation of the incremental cancer risk and chronic health hazards associated with DPM emissions via the inhalation pathway.

A. Dose-Response Assessment

The dose-response assessment characterizes both the potential carcinogenic and non-carcinogenic health effects resulting from exposure to DPM. Dose-response values for DPM were obtained from the Consolidated Table of OEHHA/CARB Approved Risk Assessment Health Values (February 2009). Dose-response relationships for carcinogens use potencies, expressed as inverse doses, to indicate the probability or risk of cancer associated with a given exposure level (e.g., per 1 $\mu g/m^3$ ambient concentration). A potency slope (in kg-day/mg) characterizes multiple exposure pathway scenarios while a unit risk factor (URF, in m^3/ug) characterizes only the inhalation pathway. OEHHA defines the URF as the estimated probability of a 70-kg person contracting cancer as a result of constant exposure to an ambient concentration of 1 ug/m^3 over a 70-year lifetime. OEHHA has established a URF of $3.0x10^{-4}$ $m^3/\mu g$ for DPM. Reference exposure levels (RELs) represent levels above which adverse non-carcinogenic health effects are anticipated. OEHHA has established a chronic REL of 5.0 $\mu g/m^3$ for long-term exposure to DPM, but has not developed an acute REL for short-term exposures.

B. Exposure Assessment

The exposure assessment estimates the extent of public exposure to DPM. Section II.B previously presented annual TAC emissions from the proposed emergency generators. Since the DPM emissions from each source (i.e., emergency generator) are identical, the emergency generators were modeled using an emission rate of 1 g/sec to obtain annual unit impacts (i.e., in $\mu g/m^3$ per g/sec). The engines were modeled under full load conditions and 25% load conditions, which represents both the worst-case hourly emissions and the worst-case dispersion characteristics. Stack characteristics for 100% load and 25% load, which were derived from information presented previously in Table 7, are summarized Table 13.

Table 13 Stack Characteristics		
	100% Load	25% Load
Stack Height (m)	16.6	16.6
Stack Diameter (m)	0.46	0.46
Stack Exhaust Velocity (m/sec)	51.3	14.0
Exhaust Temperature (°K)	778	598

The SRA modeling analysis was performed using the AERMOD model (Version 07026) to evaluate annual concentrations of DPM as a result of emissions associated with operation of emergency generators for 50 hours per year. The AERMOD model allows the selection of a number of options that affect model output. The District used the regulatory default model options in its preliminary dispersion modeling analysis; Sierra used the identical model options for this SRA. As with the AQIA, the downwash effects of the SC1 data center building were considered as part of the modeling analysis. The maximum annual unit impacts (in $\mu g/m^3$ per g/sec) corresponding to the unit emission rate of 1 g/sec for the 32 emergency generators are summarized in Table 14 at the locations of the residential maximum exposed individual (MEI) and the workplace MEI. The annual average ambient concentrations resulting from the annual emissions for the 32 emergency generators, calculated as the product of the annual emission rate (in g/sec) and the annual unit impact (in $\mu g/m^3$ per g/sec), are also summarized in Table 14. The locations of the residential and workplace MEIs are shown in Figure 4. The residential MEI is located 2,600 feet south from the midpoint of the proposed emergency generators) for both 100% and 25% load conditions. Concentrations for the residential MEI are slightly overstated because the residential MEI is located approximately 100 meters south of the southern edge of the modeling grid.
The workplace MEI is located along the west fenceline for the 100% load condition and the south fenceline for the 25% load condition.

Table 14 Modeled Impacts				
	Residential MEI		Workplace MEI	
Criteria	100% Load	25% Load	100% Load	25% Load
Maximum Annual Unit Impact ($\mu g/m^3$ per g/sec)	28.2	38.9	331	571
Maximum Annual Emissions (g/sec)	$2.58x10^{-4}$	$3.79x10^{-4}$	$2.58x10^{-4}$	$3.79x10^{-4}$
Maximum Annual Impact ($\mu g/m^3$)	0.0727	0.0147	0.0853	0.216

0.0073

50 HR @ 0.049 g/bhp-hr

C. Risk Characterization

The risk characterization integrates the results of the dose-response assessment with the exposure assessment to determine the potential carcinogenic and non-carcinogenic health effects. Potential health risks were calculated for the residential and workplace MEIs.

The excess cancer risks and chronic hazard index resulting from the annual DPM emissions from the 32 emergency generators are summarized in Table 15. The excess cancer risks was calculated as the product of the annual average DPM concentration ($\mu g/m^3$) and the DPM URF ($3.0x10^{-4}$ $m^3/\mu g$). The chronic hazard indices (HIs) were calculated from the annual average DPM concentration ($\mu g/m^3$) and the chronic DPM REL (5.0 $\mu g/m^3$). Risks/hazards for the residential MEI are slightly overstated because the residential MEI is located approximately 100 meters south of the southern edge of the modeling grid.

Table 15
Risk Characterization

Criteria	Residential MEI		Workplace MEI	
	100% Load	25% Load	100% Load	25% Load
Excess Cancer Risk (in a million)	2.2	4.4	3.3	8.3
Chronic Hazard Index	0.0015	0.0029	0.017	0.043

D. Conclusions

Rule 2-5 establishes allowable risks for new sources of TAC emissions. The policy specifies limits for excess cancer risk and non-carcinogenic chronic hazards for new sources of TAC emissions. Project risks are compared with the District's risk thresholds in Table 15. The health risks for the proposed SC1 data center project are below the District's risk thresholds.

Figure 4
Location of Maximum Exposed Individuals

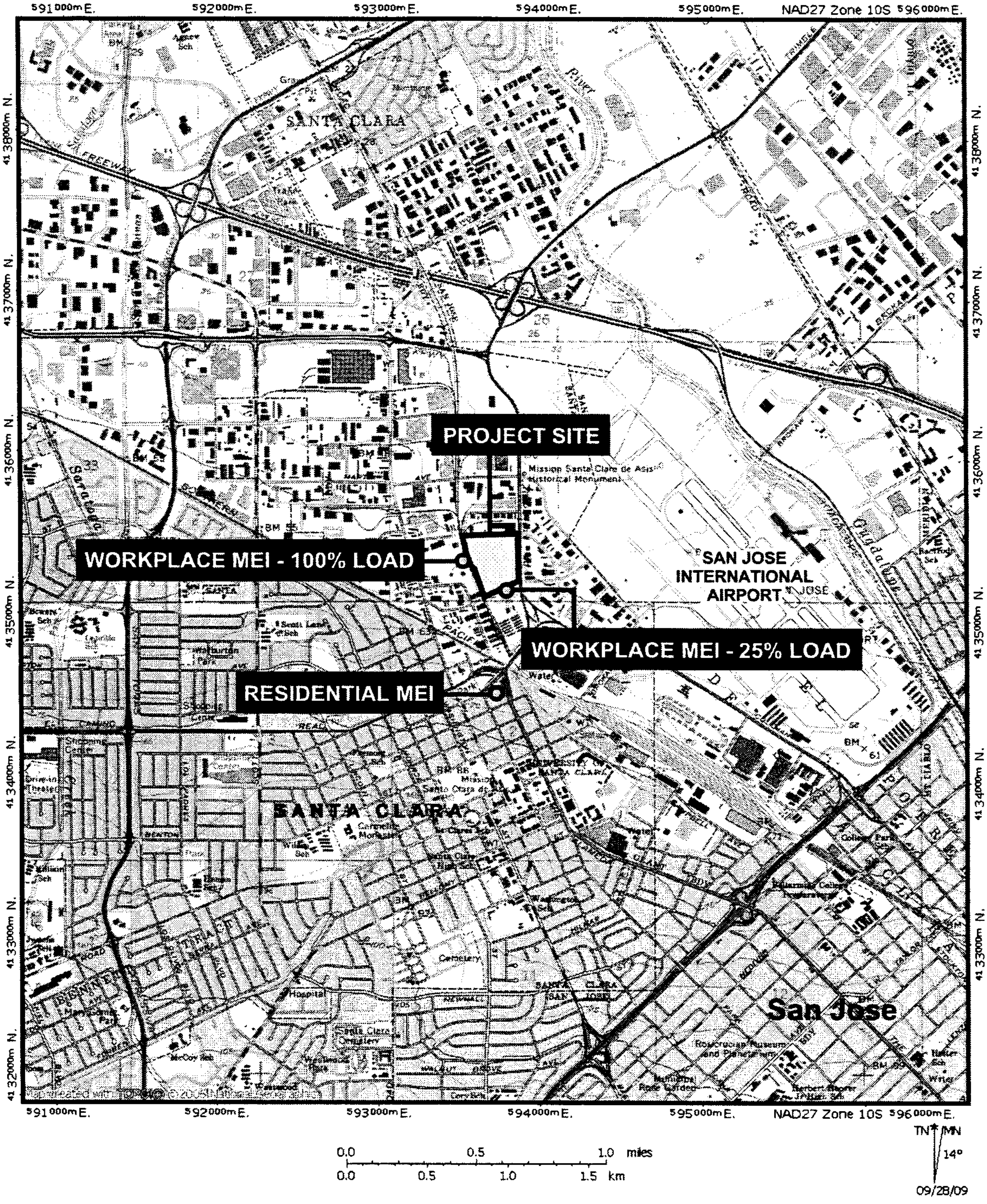


Table 14 Project Health Risks				
Receptor	Risk Criteria	Load Scenario	Project Risk	Risk Threshold
Nearest Resident	Excess Cancer Risk	100%	2.2 in a million	10 in a million
		25%	4.4 in a million	10 in a million
	Chronic Hazard Index	100%	0.0015	1
		25%	0.0029	1
Nearest Offsite Worker	Excess Cancer Risk	100%	3.3 in a million	10 in a million
		25%	8.3 in a million	10 in a million
	Chronic Hazard Index	100%	0.017	1
		25%	0.043	1

Appendix A

Equipment Specifications

DETROIT DIESEL

16V4000G83 3D - EPA Tier II Exhaust Temperature and Flow

Engine Power	kWm	2500	1875	1250	625
Percent Load	%	100	75	50	25
Engine Speed	1/min	1800	1800	1800	1800
Exhaust Mass Flow	m^3/s	8.4	7.3	5.6	2.3
Exhaust Temperature	°C	505	425	370	325

TKF-Nr. 1014-07
Anlage

Emissionsdaten Baumuster 03 Genset EPA Tier 2

Emission (Nominal)[1]

Engine	Unit	16V4000G43			
		3D			
		2280 kW	1710 kW	1140 kW	570 kW
NOx	g/kWh	6,933	5,456	4,640	4,549
HC	g/kWh	0,134	0,170	0,236	0,494
CO	g/kWh	0,799	0,631	0,905	1,883
PM	g/kWh	0,074	0,114	0,182	0,427

Emission (Nominal)[1]

Engine	Unit	16V4000G83			
		3D			
		2500 kW	1875 kW	1250 kW	625 kW
NOx	g/kWh	7,174	5,631	5,175	4,747
HC	g/kWh	0,120	0,170	0,237	0,476
CO	g/kWh	0,943	0,740	0,742	1,547
PM	g/kWh	0,065	0,092	0,185	0,382

Emission (Nominal)[1]

Engine	Unit	20V4000G43			
		3D			
		2740 kW	2055 kW	1370 kW	685 kW
NOx	g/kWh	6,163	4,958	4,678	4,59
HC	g/kWh	0,177	0,182	0,277	0,577
CO	g/kWh	0,737	0,884	1,018	2,144
PM	g/kWh	0,082	0,109	0,171	0,278

[1] Emission data measurement procedures are consistent with those described in EPA CFR 40 Part 89, and ISO 8178-1 for measuring NOx, HC, CO and PM. Data shown is based on steady state operating conditions of 25 °C and 960 mbar and diesel fuel due to EN 590. The nominal emission data shown is subject to instrumentation, measurement, facility, and engine-to-engine variations. Field emission test data are not guaranteed to these values.
Emission data cannot be used to compare to EPA regulations which use values based on weighted cycle.

Appendix B

Emission Calculations

XERES VENTURES, LLC
SANTA CLARA DATA CENTER
AUTHORITY TO CONSTRUCT APPLICATION

MAXIMUM EMISSIONS - EMERGENCY GENERATOR (ROUTINE OPERATION)

Parameter	100%	75%	50%	25%
Engine Work Output (kW)	2,500	1,875	1,250	625
Engine Work Output (bhp)	3,350	2,513	1,675	838
Exhaust Temperature (deg C)	505	425	370	325
Exhaust Temperature (deg F)	940	796	697	616
Exhaust Flow (wacfm)	17,809	15,477	11,873	4,876
Exhaust Flow, wet actual (m3/sec)	8.4	7.3	5.6	2.3
Annual Operating Hours	50	50	50	50

Pollutant	Emission Factors			
	100%	75%	50%	25%
NOx (g/kW-hr)	7.174	5.631	5.175	4.747
PM10 (g/kW-hr)	0.065	0.092	0.185	0.382

Pollutant	Emission Factors			
	100%	75%	50%	25%
NOx (g/bhp-hr)	5.35	4.20	3.86	3.54
PM10 (g/bhp-hr)	0.049	0.069	0.138	0.285

Pollutant	Hourly Emissions (lb/hr)			
	100%	75%	50%	25%
NOx	39.5	23.3	14.2	6.53
PM10	0.36	0.38	0.51	0.53

Pollutant	Annual Emissions (lb/yr)			
	100%	75%	50%	25%
NOx	1,975	1,163	712	327
PM10	17.9	19.0	25.5	26.3

Notes

Engine work output (in kW), exhaust temperature (in deg F), exhaust flow rate (in m3/sec), and emission factors (in g/kW-hr) were obtained from MTU Detroit Diesel, the generator manufacturer.

Annual operating hours reflect the maintenance and testing limits of the ATCM for Stationary Compression Ignition Engines.

Hourly emissions (in lb/hr) were calculated from the emission factors (in g/bhp-hr) and engine work output (in bhp).

Annual emissions (in lb/yr) were calculated from the hourly emissions (in lb/hr) and annual operating hours (in hr/yr).

XERES VENTURES, LLC
SANTA CLARA DATA CENTER
AUTHORITY TO CONSTRUCT APPLICATION

MAXIMUM NOx EMISSIONS - EMERGENCY GENERATOR

Description	Engine Load			
	100%	75%	50%	25%
Engine Work Output (kW)	2,500	1,875	1,250	625
Engine Work Output (bhp)	3,350	2,513	1,675	838
NOx Emission Factor (g/kW-hr)	7.174	5.631	5.175	4.747
NOx Emission Factor (g/bhp-hr)	5.35	4.20	3.86	3.54
Uncontrolled Emissions (lb/hr)	39.5	23.3	14.2	6.53
SCR Control Efficiency	90%	90%	90%	90%
Controlled Emissions (lb/hr)	3.95	2.33	1.42	0.65
Startup Duration (min)	15	30	60	60
Controlled SU Emissions (lb/hr)	12.8	12.8	14.2	6.53
w/ Load Bank (lb/hr)	12.8	11.6	10.9	10.4
30-min Emissions, Uncontrolled (lb)	N/A	11.6	7.12	3.27
30-min Emissions, Controlled (lb)	N/A	11.0	10.6	10.2

Notes
Uncontrolled emissions reflect no use of the SCR system.
Controlled emissions reflect the use of the SCR system once its operating temperature is reached.

Attachment B

One-Hour NO_2 Air Quality Impact Analysis
March 12, 2010

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March 12, 2010

Memo to: Tamiko Endow
Bay Area Air Quality Management District

From: Dan Welch

Subject: One-Hour NO_2 Air Quality Impact Analysis and Health Risk Assessment for Xeres Ventures Santa Clara Data Center

In November 2007, Xeres Ventures LLC filed an application with the Bay Area Air Quality Management District (District) for Authority to Construct (ATC) permits for a new data center (SC1) to be constructed in Santa Clara, California. Xeres Ventures proposed to install 32 diesel emergency generators and 4 permit-exempt space heaters at this facility.

The City of Santa Clara (City) assumed the role of Lead Agency with respect to the California Environmental Quality Act (CEQA) review. The City prepared an Initial Study and issued a Mitigated Negative Declaration in March 2008. The November 2007 ATC application contained an air quality impact analysis (AQIA), even though the District does not require an AQIA as part of its permitting process for a project of this type and size. While the AQIA demonstrated compliance with the annual average national ambient air quality standard (AAQS) for nitrogen dioxide (NO_2), the AQIA showed an apparent exceedance of the California one-hour NO_2 AAQS. Furthermore, the original permit application did not contain a health risk assessment (HRA) demonstrating that health risks associated with diesel particulate matter (DPM) emissions from the emergency generators would comply with the District's risk thresholds.

In October 2009, Sierra Research submitted to the District, on behalf of Xeres Ventures, a report that further evaluated compliance of the proposed SC1 project with the California one-hour NO_2 AAQS and with the District's health risk thresholds. The District reviewed this report and raised the following issues:

- The report suggested that NOx emissions from SC1 associated with emergency operations could result in exceedances of the California one-hour NO_2 AAQS and such exceedances might warrant further evaluation and/or mitigation under CEQA.

- The District's calculations of excess cancer risk at the location of the workplace maximum exposed individual (MEI) would exceed the District's risk threshold.

This memorandum presents the results of further analyses to address both of these issues. Based on a more refined analysis, prepared in consultation with District staff, we believe that NOx emissions during emergency operation would only result in exceedances of the California one-hour NO_2 AAQS infrequently, and only if the event triggering emergency operation were to coincide with adverse meteorological conditions. We further conclude that a limit on non-emergency operation of the engines of 25 hours per year per engine (on average) would yield a calculated excess cancer risk at the workplace MEI that would not exceed the District's risk threshold.

One-Hour NO_2 Air Quality Impact Analysis

After reviewing our October 2009 submission, the District expressed concern regarding the potential NOx impacts associated with emergency operation of the generators, as related to the California one-hour NO_2 AAQS. To address this concern, and after consulting with District staff, Sierra prepared a refined AQIA with revised assumptions for emergency operation, as outlined below.

- The exponential decay option within AERMOD was used to account for the reduced rate of NO_2 formation from ozone-oxidized NO at nearby receptors because sufficient time has not lapsed to allow the reaction to be driven to completion. This method does not use PVMRM to account for ozone limiting and further assumes that sufficient ozone is available to fully oxidize all NO, given sufficient reaction time. As recommended by District staff, an NO half-life of 12 minutes was used in the analysis, which provides a conservative estimate of the reaction rate (see Attachment 1).

- As was the case with our prior AQIA, 10% of the NOx emissions were assumed to be in the form of NO_2 and the remaining 90% to be NO.

- Project NO_2 impacts were determined using a four-step process:

    1. Project impacts were modeled using AERMOD, without any ozone limiting options, thus assuming that all of the NOx emissions form NO_2.
    2. Project impacts were modeled using AERMOD with the exponential decay option, and a half-life of 12 minutes. This provides an estimate of NO concentrations, expressed as NO_2.
    3. The results of the second step were multiplied by 0.9, reflecting the assumption that 90% of the NOx emissions are emitted in the form of NO, and 10% in the form of NO_2.
    4. The results of the third step were subtracted from the results of the first step to determine the rate-limited NO_2 concentrations on an hour-by-hour, receptor-by-receptor basis.

- An hour-by-hour analysis was performed, calculating the maximum total NO_2 impact for each hour by adding the maximum project NO_2 impact for each hour to the corresponding background NO_2 concentration for that hour. Background NO_2 data were taken from the San Jose – Jackson Street monitoring station.

- For each emergency operating scenario, the frequency (number of hours per year) during which an exceedance was calculated to occur was determined.

The total impacts associated with NOx emissions from emergency operation of the proposed SC1 data center obtained in the refined analysis are summarized in Table 1. The AERMOD data files are included on compact disks provided under separate cover. The AQIA indicates that emissions associated with emergency operation of the proposed SC1 data center would not cause an exceedance of the California one-hour NO_2 AAQS of 339 $\mu g/m^3$ for the 30-minute emergency and fully controlled emergency scenarios. Exceedances of the California one-hour NO_2 AAQS were calculated only for the first hour during which the engines were started up for an emergency (i.e., a full hour of operation, including the simultaneous startup of all 32 engines). As an indication of the frequency with which such a violation might occur, the model results suggest that if such an emergency startup occurred during each hour of the year, there would be 205 exceedances per year if the subsequent engine operation was at 50% load, and only 5 exceedances per year if the subsequent engine operation was 75%. Accordingly, the probability of an emergency startup aligning with the necessary meteorology and background NO_2 concentrations to yield a violation of the California one-hour NO_2 AAQS is less than 2.5% in the 50% load case, and less than 0.06% in the 75% load case.

Table 1
Total Impacts to Ambient Air Quality –Emergency Operation
Refined Analysis

Source	Ambient Impacts ($\mu g/m^3$) [1]		Annual Exceedances [2]	
	75% Load	50% Load	75% Load	50% Load
30 Minutes	330	307	0	0
Startup	366	439	5	205
Controlled	175	160	0	0

Notes:
[1] Reflects background NO_2 concentration for each hour plus the maximum modeled impacts of NOx emissions associated with emergency operation of all 32 engines, as determined using the exponential decay option within AERMOD.
[2] Where the modeled startup emissions for a given hour, plus the background NO_2 concentration for the same hour, yield a total impact in excess of the California 1-hour NO_2 AAQS.

Health Risk Assessment

In reviewing the October 2009 HRA, the District determined the appropriate multi-pathway worker unit risk factor (URF) was 6.29×10^{-5} $m^3/\mu g$ using CARB's Hotspots Analysis and Reporting Program (HARP) computer program (see Attachment 2). This worker URF reflects exposure for 8 hours per day, 5 days per week, 49 weeks per year over a 40-year exposure period. The District further discounted this URF to reflect the likelihood that non-emergency emissions would occur concurrently, at times when workplace MEI was present at the worksite (i.e., during workday hours, Monday through Friday), resulting in an effective URF of 2.81×10^{-4} $m^3/\mu g$. At the maximum annual unit impact of 0.216 $\mu g/m^3$ for the workplace MEI, as shown in Table 14 of Sierra's report, the District calculated an excess cancer risk of 60.7 in a million at the workplace MEI, which exceeds the District's excess cancer risk threshold of 10 in a million.

Sierra performed a refined unit impact modeling analysis (i.e., 1 g/sec emission rate) with the following additional assumptions:

- Emissions were restricted to the hours between 8:00 am and 5:00 pm (9 hours) to match the likely simultaneous exposure of nearby workers; and

- Fenceline receptors not immediately adjacent to a neighbor were excluded from the modeling analysis. In particular, fenceline receptors that were located adjacent to a rail line and roadway were deleted; the nearest receptors modeled were those on the distant sides of the street and rail line.

The maximum annual unit impacts (in $\mu g/m^3$ per g/sec) corresponding to the unit emission rate of 1 g/sec for the 32 emergency generators are summarized in Table 2 at the locations of the residential maximum exposed individual (MEI) and the workplace MEI. Maximum annual emissions associated with non-emergency operation were recalculated at 25 hours per year. The annual average ambient concentrations resulting from the annual emissions for the 32 emergency generators, calculated as the product of the annual emission rate (in g/sec) and the annual unit impact (in $\mu g/m^3$ per g/sec), are also summarized in Table 2. The excess cancer risks resulting from the annual DPM emissions from the 32 emergency generators are also summarized in Table 2. The excess cancer risk was calculated as the product of the annual average DPM concentration ($\mu g/m^3$) and the effective DPM URF (2.81×10^{-4} $m^3/\mu g$) for workers concurrently exposed to non-emergency emissions (i.e., the exposure was not discounted for 8 hours per day or 5 days per week or 49 weeks per year). The workplace excess cancer risks for the proposed SC1 data center project are below the District's risk thresholds. Furthermore, the maximum excess cancer risk for the workplace MEI is overstated because the 25% load operating scenario that was evaluated provides a conservative estimate of the impacts associated with non-emergency operation (i.e., non-emergency operation would not be limited to the worst-case emission, worst-case dispersion scenario of 25% load).

Table 2
Refined Worker Health Risk Assessment

Criteria	Workplace MEI	
	100% Load	25% Load
Maximum Annual Unit Impact ($\mu g/m^3$ per g/sec)	119	186
Maximum Annual Emissions (lb/yr)	8.9	13.1
Maximum Annual Emissions (g/sec)	1.29E-04	1.89E-04
Maximum Annual Impact ($\mu g/m^3$)	0.0153	0.0351
URF ($m^3/\mu g$) [1]	$2.81 x 10^{-4}$ $m^3/\mu g$	$2.81 x 10^{-4}$ $m^3/\mu g$
Excess Cancer Risk	4.3 in a million	9.9 in a million
Risk Threshold	10 in a million	10 in a million

Note: [1] Reflects the HARP-derived worker URF of $6.29 x 10^{-5}$ $m^3/\mu g$ further adjusted to reflect concurrent exposure to non-emergency emissions (i.e., the exposure was not discounted for 8 hours per day or 5 days per week or 49 weeks per year).

Chronic and acute hazard indices were not re-calculated for this analysis because the original values, presented on Page 24 of the October 2009 report, are well below the District's hazards thresholds.

If you have any questions about this memorandum, please call me at (916) 273-5130.

Attachments

Attachment 1

Peradi-Robinson Memo (June 7, 1976)

OFFICE MEMORANDUM
June 7, 1976

TO: L. ROBINSON

FROM: T. PERARDI

SUBJECT: NO/NO_2 CONVERSION CALCULATIONS IN PERMIT ANALYSES

The fractional conversion of source NO to ambient NO_2 can be estimated with the equation

$$F = 1 - e^{-.0577t}$$

where F is the fraction of original NO which will be converted to NO_2 at time t (minutes) after leaving the emission point. Thus, at any given location and time,

$$F = \frac{\text{concentration } NO_2 \text{ (by volume)}}{\text{concentration } NO_x \text{ (by volume)}}$$

where $NO_x = NO + NO_2$.

The important element in the equation is the exponential argument -.0577. When t is in minutes, the factor F provides a half-life of 12 minutes, as suggested by Davis et al. (Science 186/733; 22 Nov 1974). This equation is directly applicable when NO_x emissions are essentially all in the NO form, as from many high temperature combustion sources. If a source emits significant quantities of both NO_2 and NO, this analysis would apply only to the portion originally emitted as NO. Davis found 50% conversion times in plumes to be in the 12 to 60 minute range. Using a worst case scenario with unstable conditions and 60 ppb ambient ozone, the 12 minute half-life applies.

In R&P permit evaluations, the degree of NO/NO_2 conversion is calculated with the BASIC computer program NONOX (TEP Feb 1976). The program requires input of a series of ground level NO_x concentrations, along with the corresponding downwind distances from the source. The wind speed is also required so that elapsed time can be calculated from distance data. These input data are normally obtained from Gaussian modeling of NO_x dispersion. The region near the GLC_{max} for NO_x is investigated for degree of conversion to NO_2. For any given distance (and corresponding time) the concentration of NO_2 is equal to F times the concentration of NO_x. The NO_2 maximum generally occurs a moderate distance downwind from the NO_x maximum.

The GLC_{max} for NO_2 can then be compared to the state and federal air quality standards, which were promulgated in terms of nitrogen dioxide (NO_2) alone.

Attachment 2

HARP Output for Worker Exposure to DPM

This file: C:\HARP\PROJECTS\DieselPM\WkrCancer.txt

Created by HARP Version 1.4a Build 23.07.00
Uses ISC Version 99155
Uses BPIP (Dated: 04112)
Creation date: 6/11/2009 9:21:50 AM

EXCEPTION REPORT
(there have been no changes or exceptions)

INPUT FILES:
Source-Receptor file:
Averaging period adjustment factors file: not applicable
Emission rates file: none
Site parameters file: C:\HARP\PROJECTS\DieselPM\project.sit

GLC DATA SOURCE:
concentrations loaded from file c:\HARP\STARTUP.CML
chemicals and/or concentrations have been edited by the user
User memo:
CHEMICALS ADDED/DELETED BY USER:
ADDED: DieselExhPM

Screening mode is OFF

Exposure Duration: Standard work schedule (49 wks/yr, 5 days/wk, 8 hrs/day, 40 yrs)
Analysis Method: Point estimate
Health Effect: Cancer

SITE PARAMETERS

DEPOSITION

Deposition rate (m/s)   0.05

DRINKING WATER

*** Pathway disabled ***

FISH

*** Pathway disabled ***

PASTURE

*** Pathway disabled ***

HOME GROWN PRODUCE

*** Pathway disabled ***

PIGS, CHICKENS AND EGGS

*** Pathway disabled ***

DERMAL ABSORPTION

*** Pathway disabled ***

SOIL INGESTION

*** Pathway disabled ***

MOTHER'S MILK

*** Pathway disabled ***

CHEMICAL GROUND LEVEL CONCENTRATIONS (micrograms/m^3) (*** indicates not a multipathway chemical)

ABBREV	CAS	GLC Avrg	GLC Max	GLC Water	GLC Pasture	GLC Fish
DieselExhPM	9901	1.000E+00	1.000E+00	***	***	***

CHEMICAL CROSS-REFERENCE TABLE

CHEM	CAS	ABBREVIATION	POLLUTANT NAME	BACKGROUND (ug/m^3)
0001	9901	DieselExhPM	Diesel engine exhaust, particulate matter (Diesel PM)	0.000E+00

EMISSIONS DATA SOURCE:
CHEMICALS ADDED OR DELETED: none

EMISSIONS FOR FACILITY FAC= DEV= PRO= STK= NAME=
SOURCE MULTIPLIER=

CAS	ABBREV	MULTIPLIER	BG (ug/m^3)	AVRG (lbs/yr)	MAX (lbs/hr)

AVERAGE DOSE BY PATHWAY (mg/(kg-d)) FOR CANCER CALCULATIONS

CHEM	INHAL	DERM	SOIL	MOTHER	FISH	WATER	VEG	DAIRY	BEEF	CHICK	PIG	EGG
0001	5.72E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

AVERAGE CANCER RISK

CHEM	INHAL	DERM	SOIL	MOTHER	FISH	WATER	VEG	DAIRY	BEEF	CHICK	PIG	EGG	MEAT	ORAL	TOTAL
0001	6.29E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.29E-05
SUM	6.29E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.29E-05

Technical Area: Visible Plume and Plume Velocity Analysis
Author: Joseph Hughes

IC Engines Plume Vertical Velocity Analysis
BACKGROUND

The proposed project is located 0.4 miles west of the San Jose International Airport. Given the close proximity of the project to the airport, and the potential for low flying aircraft such as helicopters and/or planes to be in the area of the plant, a thermal plume velocity analysis may have to be conducted, based on information you provide, for the 32 diesel-fired internal combustion engines (IC engines). Thermal plumes are a concern to aircraft safety due to the potential for causing unexpected near-ground turbulence. Staff will need the applicant to verify and/or provide several necessary operational and design values for the 32 diesel-fired IC engines to complete the modeling analysis. The information provided should be based on full load operations (i.e., emergency cases when all IC engines are running full load).

CLARIFICATION ISSUE

1. Please provide or verify the following necessary modeling input values:

Parameter	Diesel Fired Internal Combustion Engines
Number of Exhaust Stacks[1]	1 or 32?
Stack Height	16.6 (m) [54.5(ft)]
Stack Diameter[2]	0.4572(m) or 0.6096(m) [1.5(ft) or 2(ft)]?
Stack Exit Velocity[3]	17.3489(m/s) to 28.3461(m/s)?
Stack Exit Temperature[3]	643.1500(K) to 778.7056(K)?

(1) amec modeling assumed all emissions (including boilers) emit from one stack.
(2) Values differ from the amec modeling results and the amec Table 2 “Summary of emission characteristics SC-1”.
(3) Provide values for full load emergency situation cases.

***RESPONSE**: The stack parameters used in the modeling of full load operating scenarios by Sierra Research are summarized below:*

Parameter	*Diesel Fired Internal Combustion Engines*
Number of Exhaust Stacks	*32*
Stack Height	*16.6 (m) [54.5(ft)]*
Stack Diameter	*0.4572(m) [1.5(ft))]*
Stack Exit Velocity	*51.2 m/s*
Stack Exit Temperature	*778 K*

2. Please provide a description of the IC engines exhaust stacks including; location, orientation and quantity (i.e., to-scale drawing that shows all engine stacks, new and existing).

***RESPONSE**: All 32 stacks were modeled. The stack locations and elevations were obtained from the ISCST3 model input file that the Bay Area Air Quality Management District provided to Sierra Research. Sierra confirmed that the location of these stacks fit the location of the engine block area on the DFT site plan. A copy of the site plan is included as Attachment A. The UTM coordinates (NAD 27) used to model emissions from the 32 emergency generators are summarized below:*

Source ID	*X (m)*	*Y (m)*	*Base Elevation (m)*
S1	*593673.1*	*4135321.2*	*15.5*
S2	*593674.9*	*4135313.5*	*15.6*
S3	*593677.9*	*4135307.0*	*15.7*
S4	*593680.4*	*4135300.2*	*15.8*
S5	*593683.4*	*4135294.2*	*15.8*
S6	*593686.4*	*4135287.8*	*15.9*
S7	*593688.2*	*4135282.2*	*15.9*
S8	*593690.6*	*4135276.8*	*15.9*
S9	*593692.9*	*4135272.0*	*15.9*
S10	*593695.4*	*4135266.0*	*15.9*
S11	*593697.8*	*4135259.5*	*15.9*
S12	*593700.2*	*4135254.0*	*15.9*
S13	*593702.6*	*4135248.0*	*16.0*
S14	*593705*	*4135242.5*	*16.0*
S15	*593708*	*4135236.5*	*16.1*
S16	*593710.4*	*4135230.0*	*16.1*
S17	*593601.6*	*4135474.0*	*14.9*
S18	*593603.4*	*4135467.2*	*14.9*
S19	*593605.8*	*4135462.0*	*14.9*
S20	*593608.2*	*4135455.2*	*14.9*
S21	*593611.8*	*4135448.0*	*14.9*
S22	*593614.8*	*4135441.5*	*14.9*
S23	*593617.9*	*4135434.2*	*15.0*
S24	*593620.9*	*4135427.0*	*15.1*
S25	*593624.4*	*4135421.0*	*15.1*
S26	*593626.9*	*4135413.2*	*15.2*

Source ID	*X (m)*	*Y (m)*	*Base Elevation (m)*
S27	*593630.4*	*4135406.8*	*15.2*
S28	*593633.5*	*4135399.5*	*15.2*
S29	*593636.5*	*4135394.0*	*15.2*
S30	*593638.9*	*4135388.0*	*15.2*
S31	*593641.9*	*4135382.0*	*15.2*
S32	*593644.3*	*4135376.0*	*15.3*

Cooling Tower Visible Plume and Vertical Velocity Analysis
BACKGROUND

A thermal plume vertical velocity analysis may need to be conducted, based on the information you provide, for the cooling towers for the same reasons as the IC engines. In addition, a visible plume analysis may also need to be conducted to show that the project would comply with the potential significant threshold for visual resources and not interfere with traffic. Water vapor plumes can occur when the plume is more saturated with water than the carrying capacity of the ambient air. A determination is made whether a combination of exhaust and ambient air mixes to become supersaturated, where the water content is greater than the carrying capacity of the air at given temperatures and pressure, and a visible plume forms due to condensation of the water into droplets. Little information was provided on the cooling tower, so staff will need the design and operational criteria to complete the modeling analysis.

CLARIFICATION ISSUE

3. Please confirm that there will be two cooling towers on site. Provide a description of the location and orientation of the cooling towers (i.e., to-scale drawing that shows the layout of the cooling towers).

   RESPONSE: *Upon completion of Phase I and Phase II of the project, there would be two cooling towers for computer server room cooling, each with eight (8) cells. Two of the eight cells would be redundant and only operate in case of failure of other cells. Cooling tower locations are shown in Attachment A. The dimensions of the cooling tower units are shown in Attachment B of this information response document.*

4. Please provide the assumptions for the cooling towers operations (i.e., hours per day, month and year).

   RESPONSE: *Water will continually flow to the cells from the chiller plant. The fan for each cell will operate as needed. Fans will speed up or down based on the temperature of the water leaving the cell and going back to the chiller. The* *cooler and drier the outside air, the less the fans have to work. See Response 5 below.*

5. Please summarize for the cooling towers the conditions that affect vapor plume formation including cooling tower heat rejection, exhaust temperature, and exhaust mass flow rate. Please provide values to complete the table below, and additional data as necessary for staff to determine how the heat rejection load varies with ambient conditions and also determine at what ambient conditions cooling tower cells may be shut down. If the cooling load does not change for ambient conditions and the heat rejection remains stable, then inputs are only needed for one operating condition (e.g., ambient temperature and relative humidity). Please include appropriate design safety margins for the heat rejection, exhaust flow rate and exhaust temperature in consideration that the air flow per heat rejection ratio is often used as a Condition of Certification confirmation of design limit.

RESPONSE: *As noted in Response 3, upon completion of both phases of the project, there would be two cooling towers for building and computer server room cooling, each with eight (8) cells. Six cells operate per cooling tower. The other two cells in each cooling tower are redundancies, or spares in case of failure. When the computer server rooms are fully occupied, the cooling load would not substantially change with ambient conditions and the heat rejection would remain stable. About three (3) percent of the building cooling load would be influenced by outdoor ambient conditions.*

Parameter	Cooling Tower(s) Exhausts			
Number of Cells	8 (8 x1) per phase; 2 cells per phase redundant (only 6 cells operate per phase at one time)			
Cell Height	See Attachment B			
Cell Diameter	See Attachment B			
Tower Housing Length	See Attachment B			
Tower Housing Width	See Attachment B			
Ambient Temperature	85.3°F DB	30°F	65°F	100°F
Ambient Relative Humidity	50%	90%	40%	15%
Number of Cells in Operation	1 of 6	1 of 6	1 of 6	1 of 6
Heat Rejection (MW/hr)	4.72	4.74	4.73	4.72
Exhaust Temperature (°F)	86.8	59.3	73.6	83.6
Exhaust Flow Rate (lb/hr)	1,039,000	1,139,600	1,073,900	1,011,000
Exhaust Velocity (m/s)	9.03	8.85	8.94	8.99

6. Please provide the cooling tower manufacturer and model number information and a fogging frequency curve from the cooling tower vendor for the cooling towers

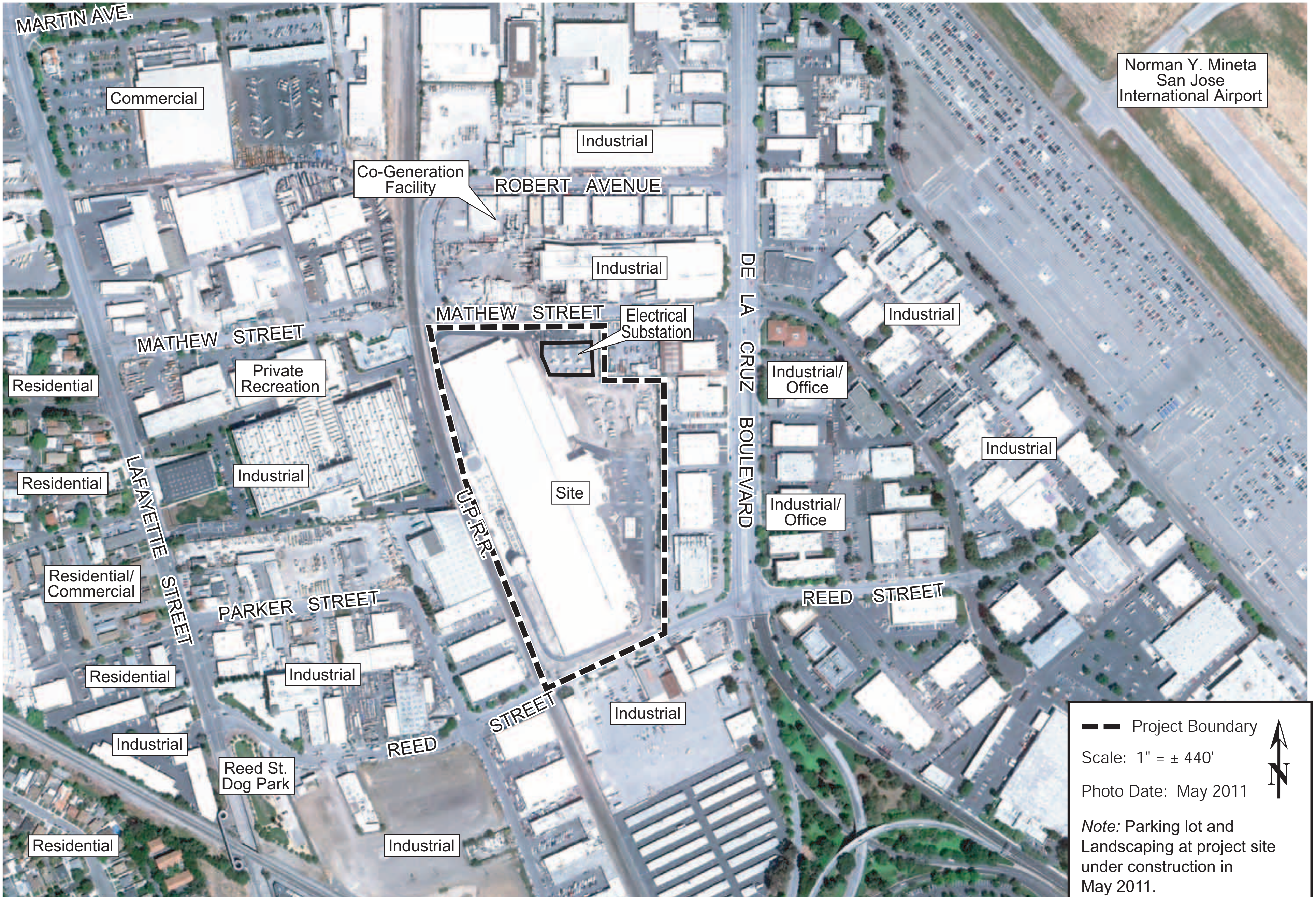
RESPONSE: *The manufacturer is Marley and the model number is NC8412TAS-01. Attachment C is a "Fogging Frequency Estimate Curve" for one cell of NC8412TAS-01 operating with 3240 gpm/cell at 91.4/81.4/71°F.*

7. Please identify if the cooling tower fan motors will be dual speed or have variable speed/flow controllers for either of two cooling towers.

RESPONSE: *Premium efficiency inverters provide for variable fan speeds.*

Attachment A

Aerial Photograph with Street Names
Facility Plot Plans
Facility Site Plan

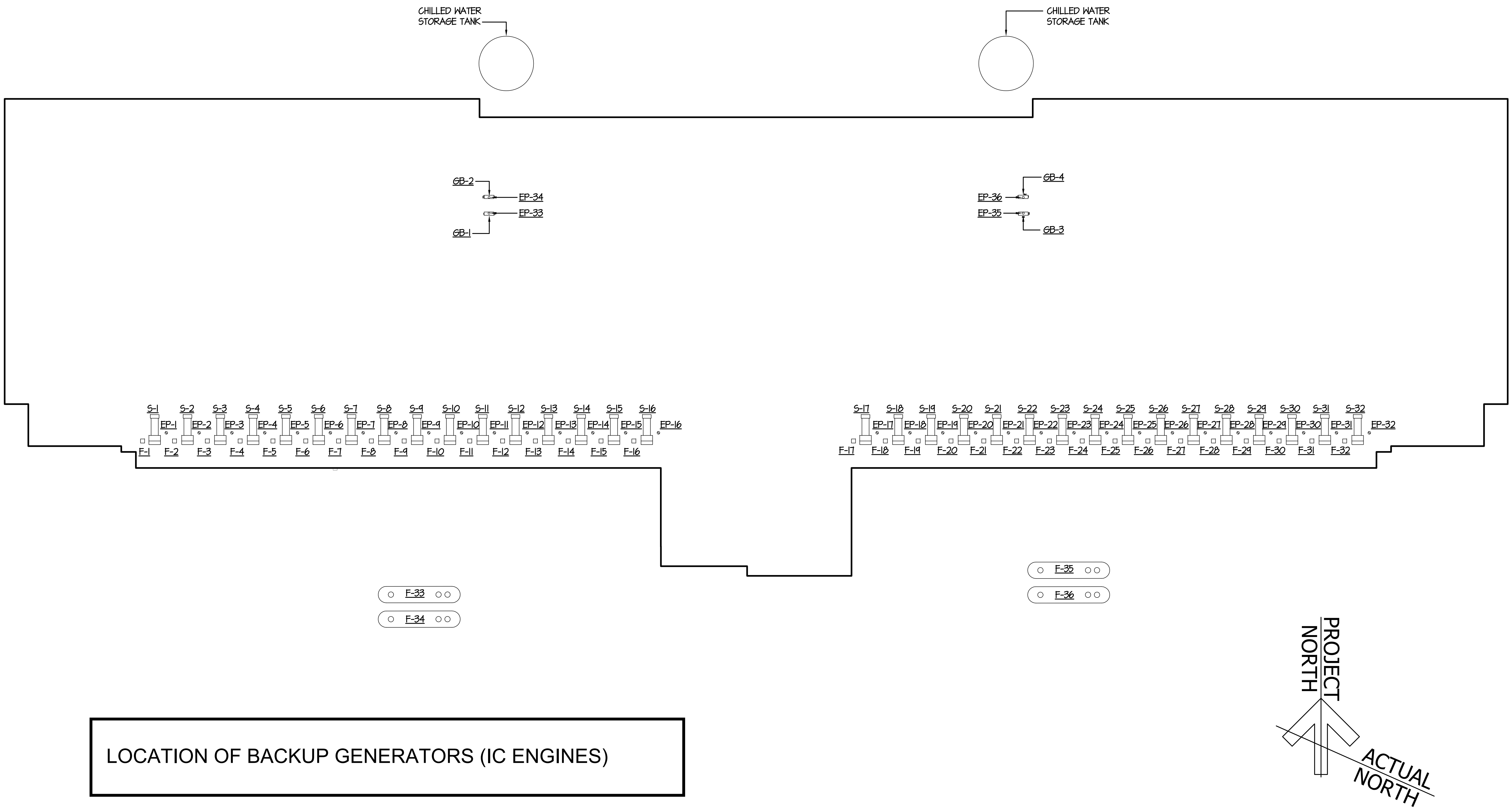


AERIAL PHOTOGRAPH WITH SURROUNDING LAND USES

FIGURE 2-3

ABBREVIATIONS

EP-*	STACK/EMISSION POINTS
F-*	FUEL STORAGE
GB-*	GAS-FIRED BOILERS
S-*	ENGINES



LOCATION OF BACKUP GENERATORS (IC ENGINES)

CCG
FACILITIES INTEGRATION
INCORPORATED

NO.	DATE	REVISION
NO.	DATE	ISSUE

DuPont Fabros Technology

SANTA CLARA
DATA CENTER

CCG
FACILITIES INTEGRATION
INCORPORATED

1500 S. EDGEWOOD STREET
BALTIMORE, MARYLAND 21227
(410)525-0010 FAX (410)525-1570

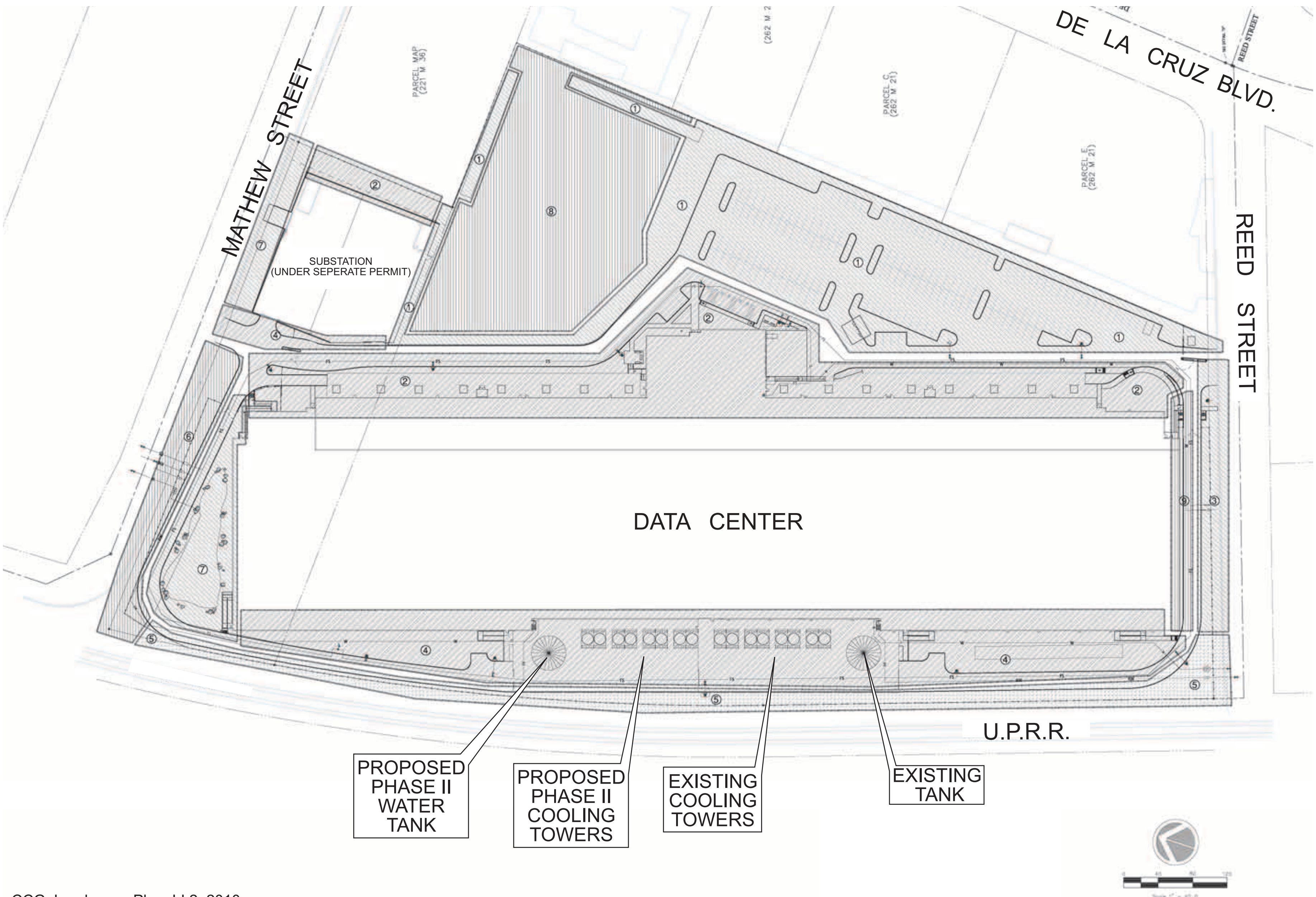
SEAL

FACILITY
PLOT PLAN

TITLE

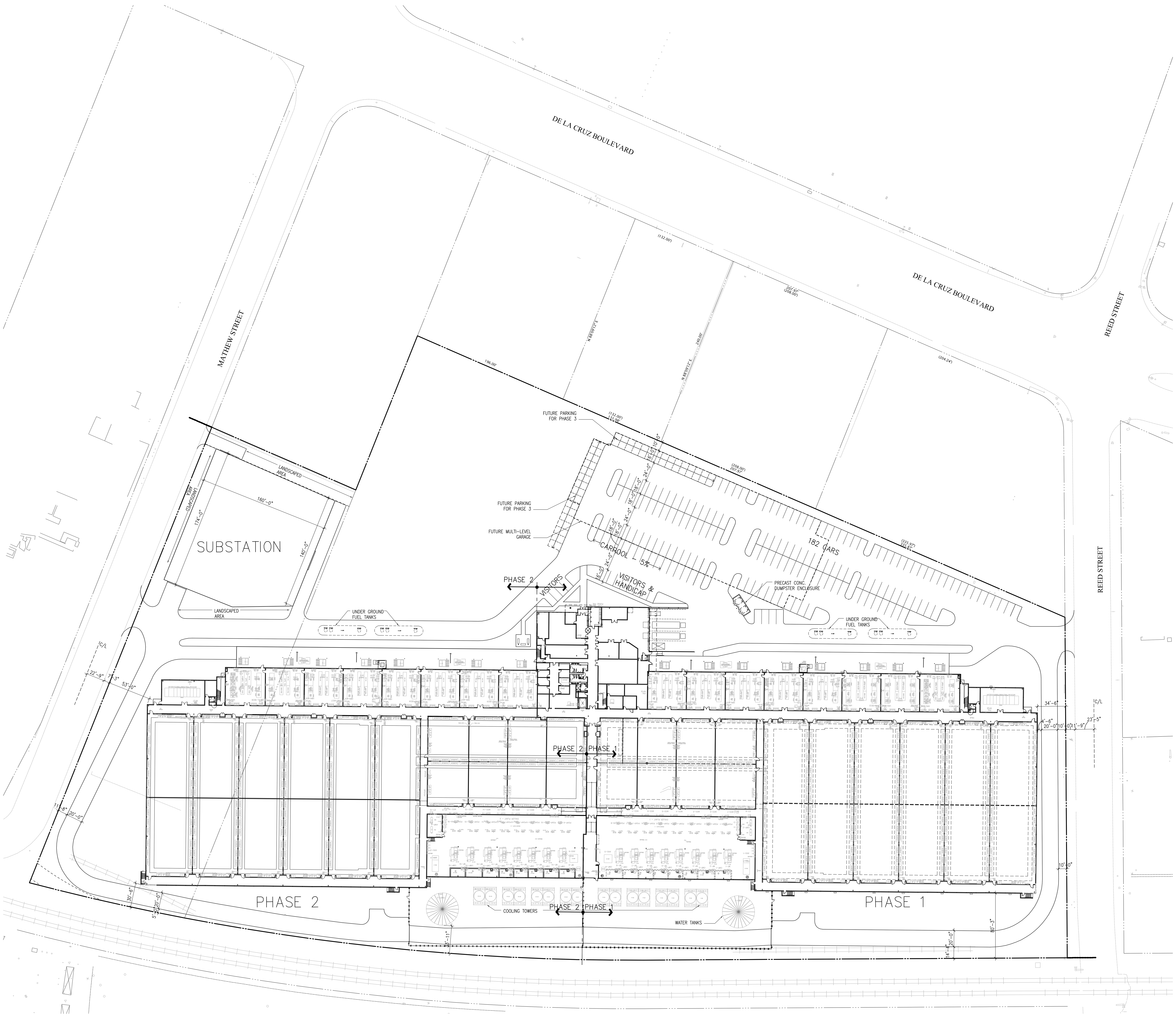
DRAWING NO.

01482 PROJECT NO.	AGB DRAWN BY
NONE SCALE	TB DESIGNED BY
FILE	TB APPROVED BY



Source: CCG, Landscape Plan, LI.2, 2010.

LOCATION OF EXISTING AND PROPOSED COOLING TOWERS



PHASE 1 & 2 PLAN

ZONE
MH - HEAVY INDUSTRIAL

SITE AREA

PARCEL A (2.622 ACRES)	= 114,213.4 SF
PARCEL D (13.461ACRES)	= 586,356.6 SF
TOTAL SITE AREA	= 700,570.0 SF
LOT COVERAGE	= 297,857.33SF
	= 0.43%

PROPOSED BUILDING AREA

FIRST FL	= 297,857.33 SF
SECOND FL	= 14,087.00 SF
(office = 12,812.00 SF	
circulation = 1,275.00 SF)	
TOTAL	= 311,944.33 SF

(note: rooftop mechanical equipment rooms area totalling 52,891.45 SF are not included in F.A.R.)

F.A.R = 0.445

LOADING
PROVIDED - 12' X 55' each - 3 SPACES

PARKING

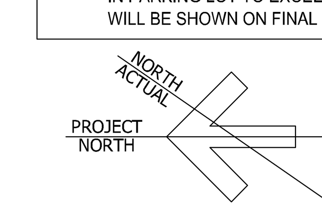
REQUIRED @ 1/2000	= 182
PROVIDED	= 182

(note: 31 dotted spaces shown to be provided only upon phase 3 construction)

BUILDING HEIGHT

ALLOWED	= 70'
PROPOSED	= 48'

LANDSCAPE AREA
IN PARKING LOT TO EXCEED 10%
WILL BE SHOWN ON FINAL PLANS



8' 0 8' 16' 32' 64' 128'

CCG
FACILITIES INTEGRATION
INCORPORATED

NO.	DATE	REVISION

NO.	DATE	ISSUE
1	09-14-07	PRELIMNARY SITE PLAN SUBMISSION

DUPONT FABROS

SC-1
DATA CENTER SANTA CLARA

CCG
FACILITIES INTEGRATION
INCORPORATED
1500 S. EDGEWOOD STREET
BALTIMORE, MARYLAND 21227
(410)525-0010 FAX (410)525-1570

DVA
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301-590-8900■ Fax 301-590-8620 ■
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SEI STRUCTURAL ENGINEERS INCORPORATED
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Los Altos, CA 94022
(650) 938-2200 FAX (650) 938-5538
WWW.STRUCTURALENGINEERSINC.COM

SEAL

PROPOSED
PHASE 1&2
SITE PLAN

TITLE

DRAWING NO.

A.00615	
PROJECT NO.	DESIGNED BY
P:\A00615 SANTA CLARA	
FILE	DRAWN BY
1" = 40'0"	RD
SCALE	APPROVED BY

Attachment B

Cooling Tower Cell Dimensions

UPDATE™ Version 4.14.2
Product Data: 3/3/2010 (Current)

5/25/2010 6:53:26 AM

Job Information

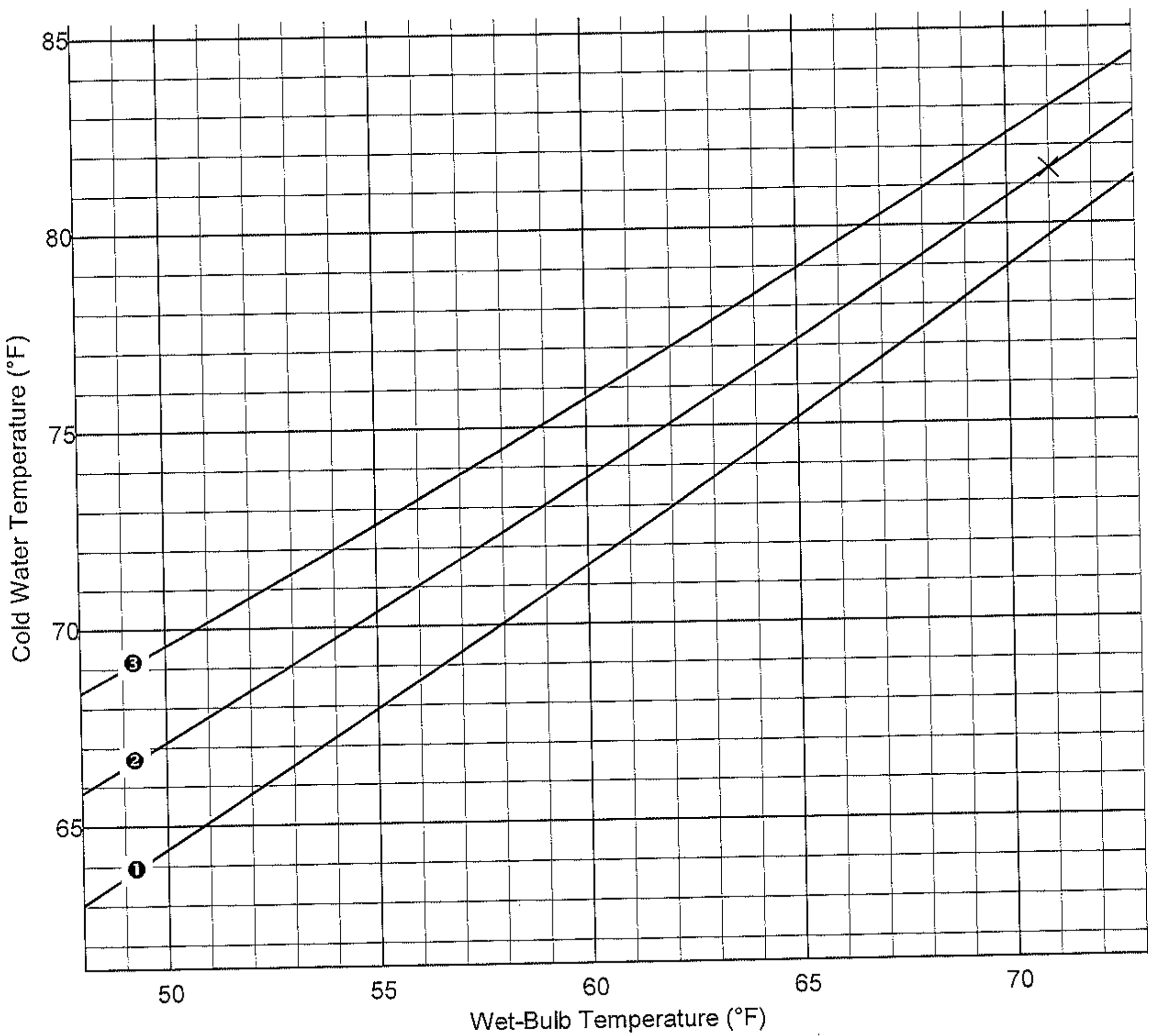
Selected by

Cummins-Wagner
10901 Pump House Road
Annapolis Junction, MD 20701
GGilpin@Cummins-Wagner.com

Gary Gilpin
Tel 410-792-4230
Fax 301-490-7156

Cooling Tower Definition

Manufacturer	Marley
Product	NC Steel
Model	NC8412TAS2
Cells	2
Fan	12.00 ft, 6 Blades
Fans per cell	1
Fan Motor Capacity per cell	40.00 BHp



Design Conditions

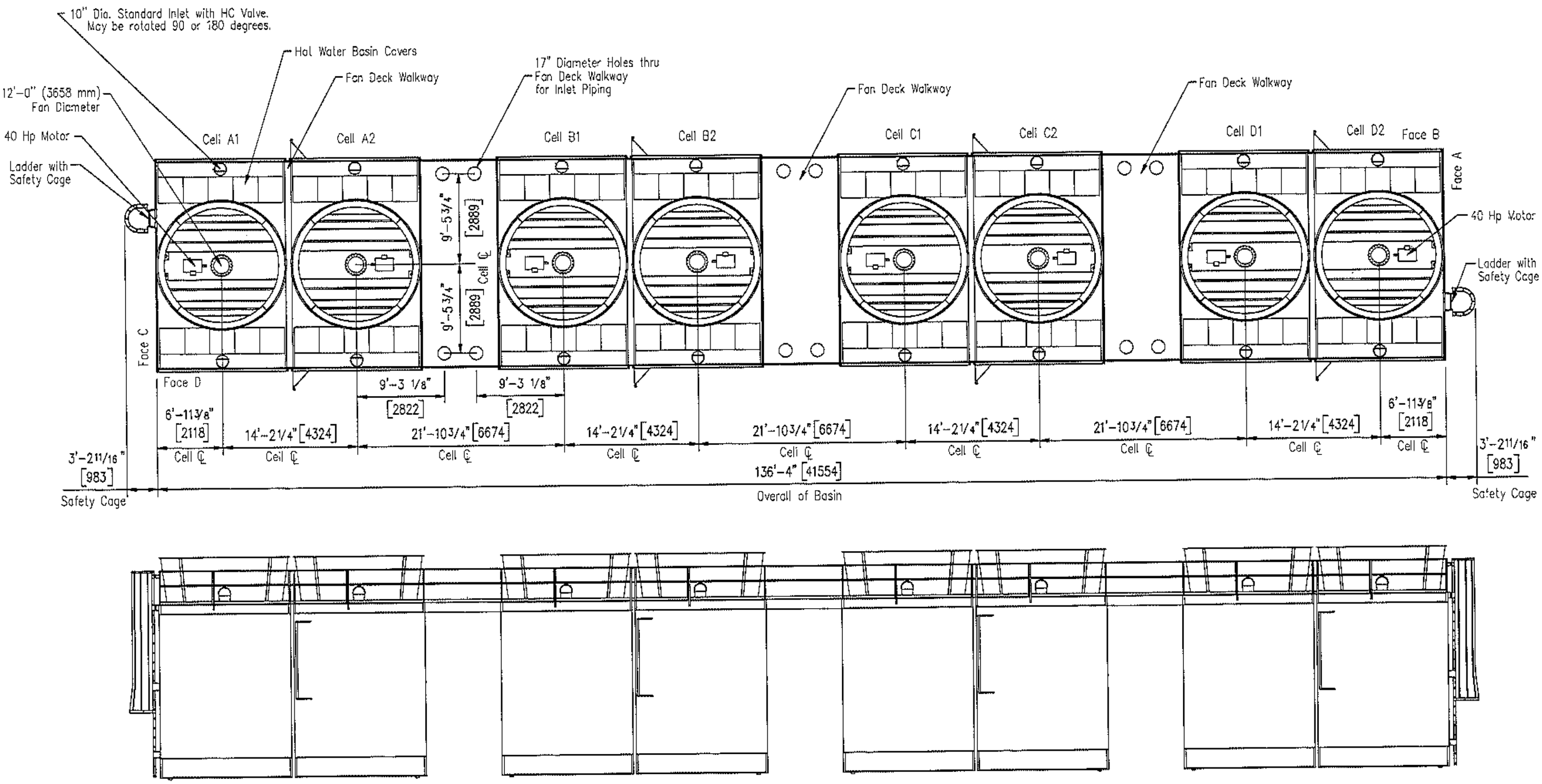
Tower Water Flow	6480 gpm
Hot Water Temperature	91.40 °F
Cold Water Temperature	81.40 °F
Wet-Bulb Temperature	71.00 °F

Curve Conditions

Tower Water Flow (100.0 %)	6480 gpm
Fan Speed (100.0 %)	242 rpm
Fan Motor Speed (100.0 %)	1800 rpm
Fan Motor Output per cell	40.00 BHp
Fan Motor Output total	80.00 BHp

Legend

❶ 8 °F Range
❷ 10 °F Range
❸ 12 °F Range
╳ Design Point



NOTES

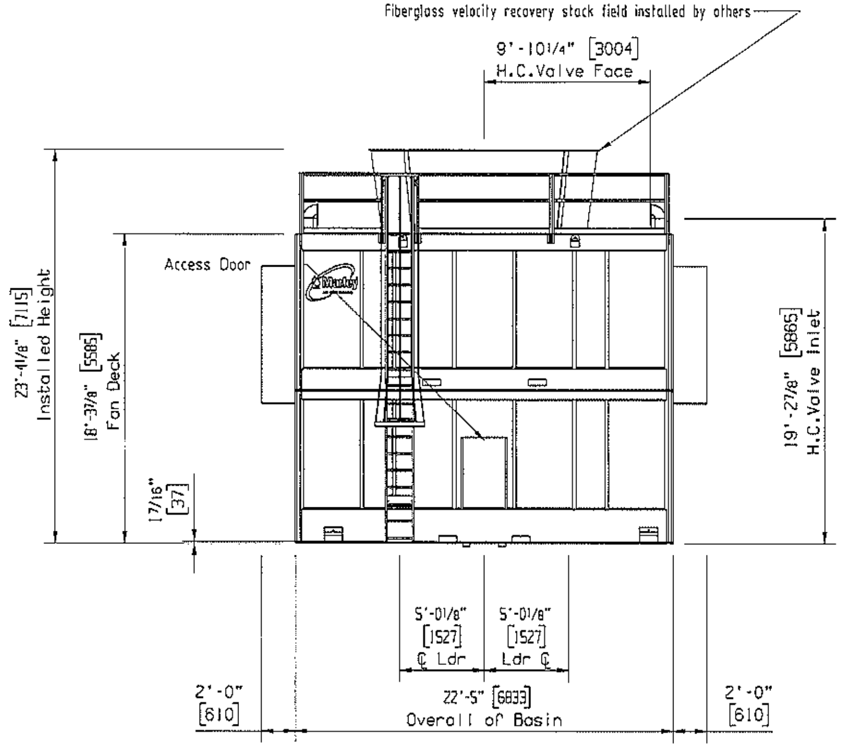
1. The tower assembly tolerance applicable to all dimensions is + or – 1/8" (3 mm). Consult suppliers of supporting structure for construction tolerances.
2. The units of measure are in IP (SI) units unless otherwise noted.
3. See Schematic Cased Elevation and Notes drawing for additional notes.

NC8412TAS2SGF – Schematic Plan and Louver Elevation
SC-1 Data Ctr – 40HP / 76 dbA
SANTA CLARA, CA, United States

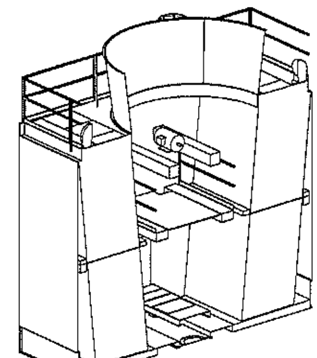
Marley AN SPX BRAND

ECO NUMBER	REV. BY	CHECKED	REV. DATE
	WES	DJ	06/22/10

DRAWN BY	DATE	CHECKED	APPROVED	ORDER NUMBER	PLOT	DRAWING NUMBER	REV.
GARY GILPIN_100520_073509066 V1	06/14/10	QTC	SYS	10025862	1=1	GG381772S	A



Cased Face C



Interior View

NOTES

1. The fan motor must be locked out and inoperable before entering the tower. This warning has been placed on the access door.
2. Flanged connections conform to class 125 of the ANSI B16.1 specification. The bolt holes straddle the centerlines.
3. Horizontal Control (HC) valves can withstand a maximum static shutoff pressure of 25 psi (172 kPa)
4. Full flat face flange gaskets are supplied by SPX CT.
5. An incoming riser and manifold must allow clearance for entry to the tower access doors. 4'-2" (1270 mm) is the minimum clearance needed to clear the optional access door or motor access platform.
6. To insure maximum thermal performance the cooling tower must be installed level and plumb. Both of the air inlet faces must have adequate air supply. If obstructions exist, consult your SPX CT representative.
7. Hoisting clips are provided for ease of unloading and positioning. For overhead lifts or where additional safety precautions are prudent, add slings beneath the tower. Adequate space has been provided for removal of the shackles and the 5 1/4" (133 mm) long pins from the hoist clips between the cells of a multi-cell tower. If the pin used is longer than 5 1/4" (133 mm), the cell may be slid into it's final position by using come-alongs at the base of the unit, after removal of shackle pins. See Hoisting Details drawing.
8. The vertical weight of the piping illustrated within the tower perimeter may be supported by the tower structure. All other piping shall be supported independent of the tower (see section A-A for specific details). The piping, their supports, the design of both piping and supports, and the lateral restraint of piping loads shall be supplied by others.
9. Construction of the ladder and guardrail: The guardrail is fabricated from galvanized structural tubing. Top rail, middle rail and posts are 1 1/2" (38 mm) square tube 1/8" (3 mm) thick. Toeboards are 12 gauge heavy mill galvanized steel. The ladder is aluminum 3" (76 mm) x 1 1/8" (29 mm) I-beam side rails and 1 1/4" (32 mm) serrated rungs.
10. The ladder and guardrail are field installed by others. The tower is shop modified to accept this option. The clips and hardware are provided by SPX CT for the field installation. The installation detail drawings are included in the literature package shipped with the tower.
11. O.S.H.A. standards recommend the use of a Safety Cage when the length of a single ladder exceeds 20'-0" (6096 mm).
12. The Plenum Walkway consists of 11 gauge heavy mill galvanized steel supports and hot dip galvanized bar grating utilizing 1" (25 mm) x 5/16" (8 mm) bearing bars. The elevation of the Plenum Walkway is above the overflow water level of the collection basin. The distance from the top of the Plenum Walkway to the fan is 14'-9 11/16" (4514 mm).
13. The Interior Mechanical Equipment Platform consists of the Plenum Walkway plus an elevated platform for access to the mechanical equipment. A ladder is provided from the Plenum Walkway to the elevated platform along with a handrail system for the elevated platform.
14. The distance from the elevated platform to the fan exceeds 7'-1 3/4" (2178 mm).
15. The tower assembly tolerance applicable to all dimensions is + or - 1/8" (3 mm). Consult suppliers of supporting structure for construction tolerances.
16. The units of measure are in IP (SI) units unless otherwise noted.

ECO NUMBER		NC8412TAS2SGF - Schematic Cased Elevation and Notes SC-1 Data Ctr - 40HP / 76 dbA SANTA CLARA, CA, United States							
REV. BY	CHECKED								
REV. DATE		DRAWN BY	DATE	CHECKED	APPROVED	ORDER NUMBER	PLOT	DRAWING NUMBER	REV.
		GARY GILPIN_100520_073509066 V2	06/23/10	QTC	SYS	10025862 C01	1=1	GG382634M	

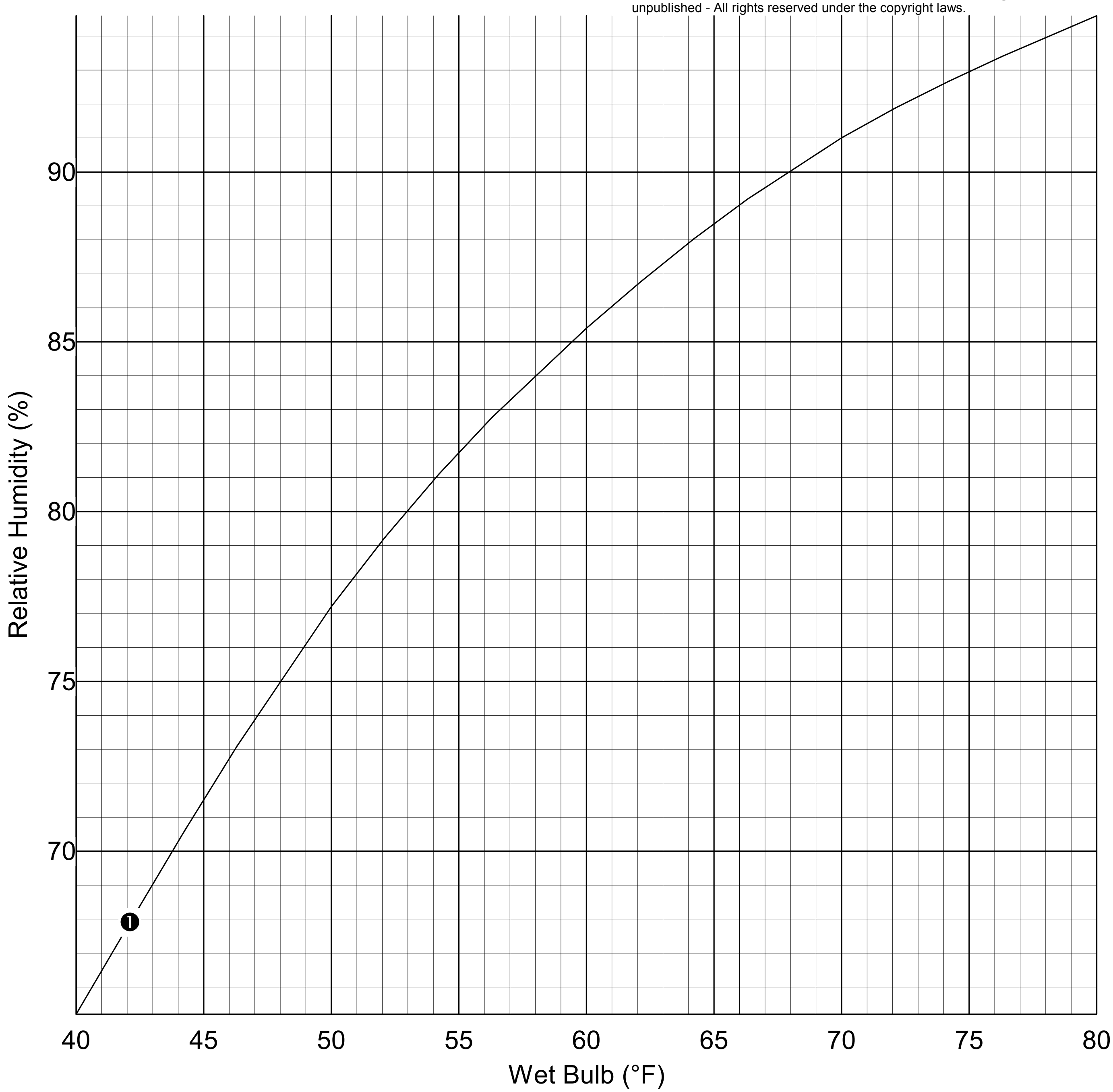
Marley AN SPX BRAND

Attachment C

Fogging Frequency Estimate Curve

Estimated Fogging Frequency Curve for
Holder - SC1- Data Center

SPX Cooling Technologies
TRACS Version 30-JUNE-10



Model NC8412TAS-01
Number of Cells 1
Motor Output 40HP
Motor RPM 1800
Fan 144" 6-Blade
Fan RPM 242
(Full Speed)

Design Conditions:
Flow Rate 3240GPM
Hot Water 91.40°F
Cold Water 81.40°F
Wet-Bulb 71.00°F

Curve Conditions:
Fan Pitch Constant
Flow Rate 3240GPM
(100% Design Flow)

OO# 10025862 100.0%
Tangency

FOGGING FREQUENCY CURVE: The curve shown to the left is referred to as a 'Fogging Freqency Curve'. The Fogging Freqency Curve separates entering cooling tower conditions that produce fog at the discharge (Top-Left region of chart) from those that do not produce fog (Bottom-Right region of chart)

➊ 10 °F Range
X Design Point

Time: 16:18:58 Date: 10-05-2011 Drawn By: MP