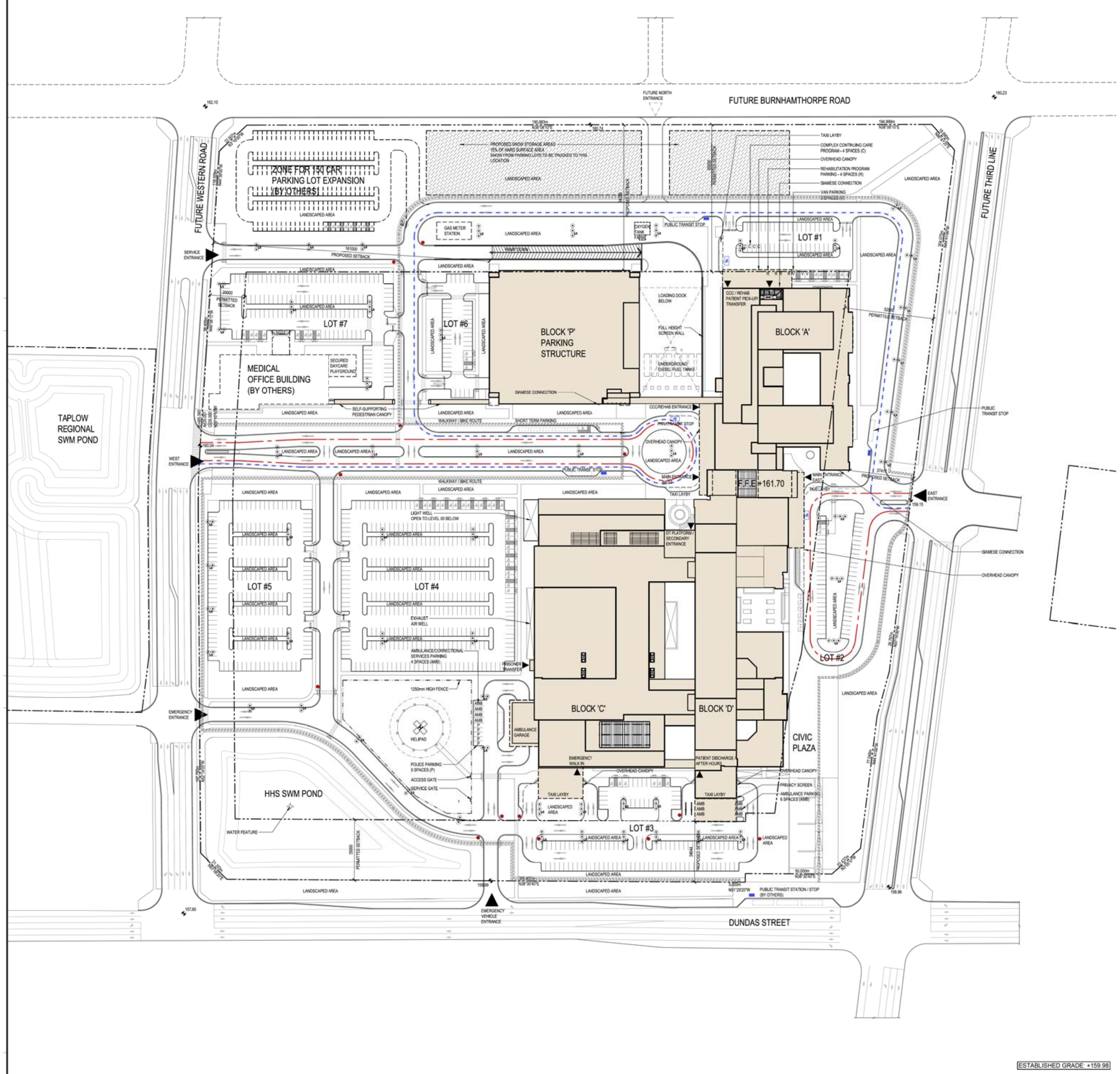
APPENDIX A

NOH Design Drawings



SITE AND BUILDING STATISTICS

ADDRESS:	3000 THIRD LINE
OWNER:	HALTON HEALTHCARE SERVICES
APPLICANT:	ELLIS DON CARILLION (NOH) JOINT VENTURE
ZONING CATEGORY:	I-2-H1
LOT AND PLAN NUMBER:	PART OF LOTS 25, 26 AND 27 AND PART OF THE ROAD ALLOWANCE BETWEEN LOTS 25 AND 26 CONCESSION 1 NORTH OF DUNDAS STREET GEOGRAPHIC TOWNSHIP OF TRAFALGAR NOW IN THE TOWN OF OAKVILLE REGIONAL MUNICIPALITY OF HALTON
CURRENT USE:	VACANT LAND
SITE AREA:	177,798m² (17.78 ha)

COVERAGE	PERMITTED	PROPOSED
	160,018.20m² (90%)	34,718.88m² (19.5%)
LANDSCAPE AREA	REQUIRED	PROPOSED
	17,779.80m² (10%)	38,293m² (21.5%)
BUILDING HEIGHT	PERMITTED	PROPOSED
	11m MIN., 15-STY MAX.	39.52m, 8-STY
BUILDING SETBACKS	PERMITTED	PROPOSED
FUTURE THIRD LINE	MIN. 0m - 52m MAX.	37.42m
DUNDAS STREET	MIN. 0m - 35m MAX.	34.64m
FUTURE WESTERN ROAD	MIN. 0m - 20m MAX.	161.00m
FUTURE BURNHAMTHORPE ROAD	MIN. 0m - 85m MAX.	84.26m
REQUIRED PARKING SPACES	PERMITTED	PROPOSED
	2100	2100
LOCATION		
PARKING STRUCTURE (5% ACCESSIBLE PARKING: 60 SPACES)	1178	
LOT #1 - SURFACE LOT (10% ACCESSIBLE PARKING: 6 SPACES)	53	
LOT #2 - SURFACE LOT (5% ACCESSIBLE PARKING: 3 SPACES)	54	
LOT #3 - SURFACE LOT (5% ACCESSIBLE PARKING: 6 SPACES)	109	
LOT #4 - SURFACE LOT (5% ACCESSIBLE PARKING: 17 SPACES)	330	
LOT #5 - SURFACE LOT (5% ACCESSIBLE PARKING: 10 SPACES) NOTE: ACCESSIBLE STALLS RELOCATED TO LOT #4 FOR CLOSER PROXIMITY TO HOSPITAL BUILDING	188	
LOT #6 - SURFACE LOT (5% ACCESSIBLE PARKING: 3 SPACES)	41	
LOT #7 - SURFACE LOT (5% ACCESSIBLE PARKING: 8 SPACES)	141	
SHORT TERM PARKING (5% ACCESSIBLE PARKING: 1 SPACE)	6	
REQUIRED BICYCLES SPACES	REQUIRED	PROPOSED
	147 (7% OF 2100)	147

GROSS FLOOR AREA	158,342.54m²
NOTE: ALL AREAS ARE CALCULATED TO THE FACE OF BUILDING. NO DEDUCTIONS ARE CONSIDERED).	
HOSPITAL BUILDING	BUILDING FLOOR AREA, m²
LEVEL 1	27,843.25
LEVEL 2	26,324.36
LEVEL 3	17,720.83
LEVEL 4	15,894.99
LEVEL 5	8,076.28
LEVEL 6	5,213.69
LEVEL 7	5,213.73
LEVEL 8	5,213.73
LEVEL 9	4,235.09
LEVEL 10	2,075.65
SUB-TOTAL	117,811.60
PARKING STRUCTURE	BUILDING FLOOR AREA, m²
LEVEL 1	6,694.92
LEVEL 2	6,694.92
LEVEL 3	6,694.92
LEVEL 4	6,694.92
LEVEL 5	6,694.92
LEVEL 6	6,694.92
SUB-TOTAL	40,169.52
HOSPITAL LINK	BUILDING FLOOR AREA, m²
LEVEL 1	180.71
LEVEL 2	180.71
SUB-TOTAL	361.42

LEGEND

- FIRE ROUTE
- STOP SIGN
- TRANSIT ROUTE
- BUILDING ENTRANCE
- PEDESTRIAN SIDEWALK
- BICYCLE PATH (TWO WAY) 2.4m WIDE LANE
- BICYCLE RACK
- DETECTABLE HAZARD INDICATOR 600mm WIDE
- DETECTABLE HAZARD INDICATOR AND ACCESS AISLE
- HYD FIRE HYDRANT
- LS LIGHT STANDARD
- PEDESTRIAN CROSSING MARKING
- ACCESSIBLE RAMP
- PARATRANSIT STOP
- BUS SHELTER (BY OTHERS)

NOTES

1. SURVEY INFORMATION TAKEN FROM PLAN OF SURVEY OF PART OF LOTS OF 25, 26 AND 27 AND PART OF THE ROAD ALLOWANCE BETWEEN LOTS 25 AND 26 CONCESSION 1 NORTH OF DUNDAS STREET, BY J.D BARNES LIMITED, DATED JULY 20th, 2011.
2. REFER TO CIVIL DRAWINGS FOR ALL EXISTING ROADBED INFRASTRUCTURE, EASEMENTS, EXISTING GRADES, WATERCOURSES, ROAD, SITE SERVICES, DRAINAGE, SIDEWALK AND GRADING INFORMATION.
3. REFER TO LANDSCAPE DRAWINGS FOR ALL PLANTING, WATER FEATURES, DECORATIVE SIDEWALK AND CIVC PLAZA INFORMATION.
4. REFER TO ELECTRICAL DRAWINGS FOR ALL ELECTRICAL DEVICES.
5. REFER TO SIGNAGE PACKAGE FOR LOCATION OF SITE AND BUILDING SIGNAGE.

PROJECT

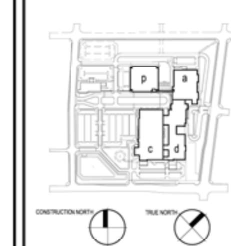
Ontario Infrastructure Ontario

Halton Healthcare

New Oakville Hospital

HIP

KEY PLAN



DRAWING STATUS

NOT FOR CONSTRUCTION

NO.	ISSUED	DATE
A	ISSUED FOR SITE PLAN APPROVAL	26 AUG 2011

REVISIONS

PROGRESS 23 Aug 2011

ALL DIMENSIONS ARE SHOWN IN METRIC.

ARCHITECTS IN JOINT VENTURE

PARKIN ARCHITECTS LIMITED + adamson ASSOCIATES | ARCHITECTS A Partnership of Corporations

STAMP

STAMP

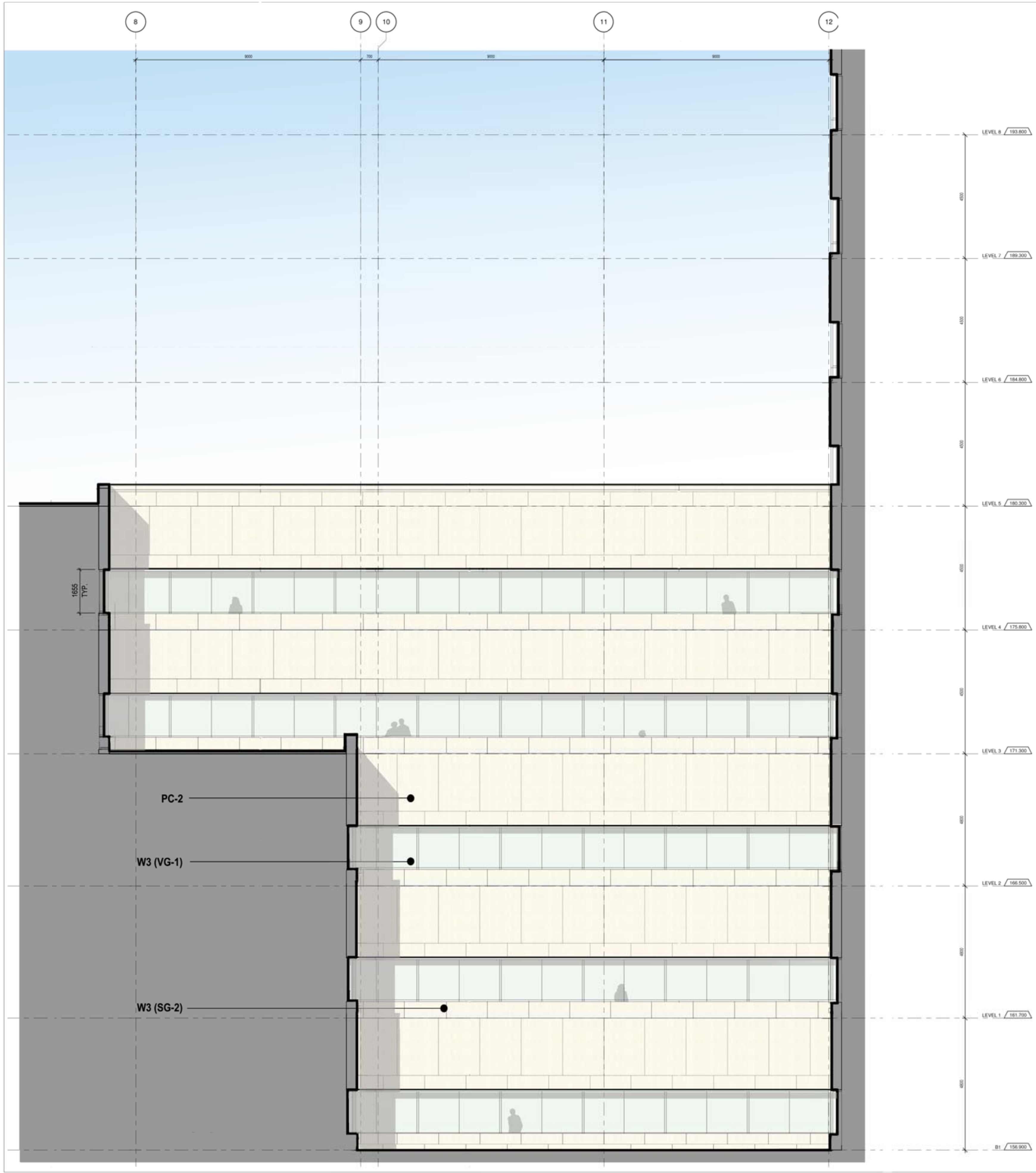
DRAWING TITLE

SITE PLAN

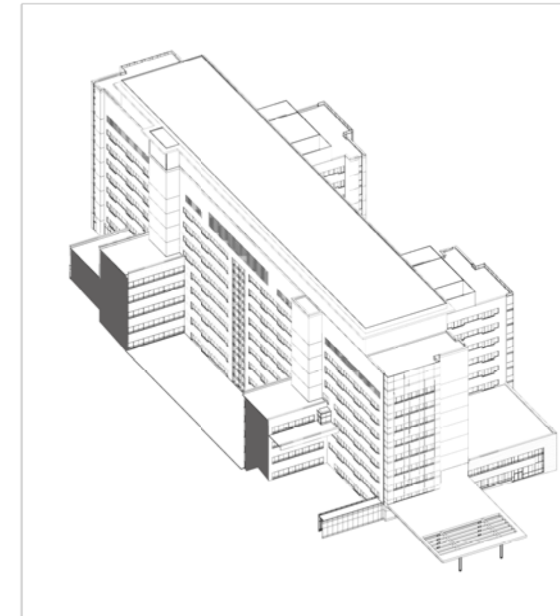
DRAWN	CHECKED
SG	CW / RS
SCALE	DATE
1:750	19 JUL 2011

PROJECT NO. **1005 / 1003**

DRAWING NO. **Ax1-001** REVISION NO. **A**



4 PARTIAL NORTH COURTYARD ELEVATION
1 : 50



3 SOUTHWEST AERIAL VIEW

2 VIEW LOOKING NORTHEAST

1 PERSPECTIVE

PROJECT

Ontario
Infrastructure Ontario

Halton Healthcare

New Oakville Hospital

HIP

KEY PLAN

DRAWING STATUS

PROGRESS
02 Nov 2011

NO.	ISSUED	DATE
01	ISSUED FOR 50% DD SUBMISSION	21 SEP 2011

REVISIONS

Discrepancies must be reported immediately to the Architect before proceeding. Only figured dimensions are to be used. Contractors must check all dimensions on site. This drawing is protected by copyright.

ALL DIMENSIONS ARE SHOWN IN METRIC.

ARCHITECTS IN JOINT VENTURE

PARKIN ARCHITECTS LIMITED
+
adamson ASSOCIATES | ARCHITECTS

STAMP | STAMP

DRAWING TITLE

BLOCK D

COURTYARD ELEVATION

OPTION 1

DRAWN	CHECKED
TEAM	CW / RS
SCALE @ A0: 1 : 50	DATE: 10/18/11

PROJECT NO. 1005 / 1003

DRAWING NO. **SKA-052** REVISION **00**

APPENDIX B

Equipment Specifications and Manufacturer Guarantees

CANADIAN STANDARDS ASSOCIATION

The PDF copy of this document will expire on June 18th, 2009. Users should consider printing a copy of the pages on which they wish to comment for future reference.

Public Review Comment Closing Date: May 19th, 2009

DRAFT STANDARD
C282
Emergency Electrical Power Supply for Buildings

Note: *This draft is under development and subject to change; it should not be used for reference purposes.*

Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

Please submit comments to:
Tony Joseph
Fax : (416) 401-6807
Tony.Joseph@csa.ca

Canadian Standards Association
5060 Spectrum Way, Suite 100
Mississauga, Ontario
Canada L4W 5N6

Doc: C282 Pulbic Review Draft
PUBLIC REVIEW DRAFT – April 1, 2009
Consists of 53 pages

11.1.1 Operation and maintenance

The emergency electrical power supply equipment shall be operated and maintained in accordance with the manufacturer's recommendations and instruction manuals and the requirements of Clauses 11.1.2 to 11.5.

Note: *See Clause B.20 for commentary on this Clause.*

11.1.2 Inspection, testing, and maintenance log

A permanent log of the inspection, testing, and maintenance of the emergency electrical power supply system shall be maintained in accordance with the manufacturer's manual of operating and maintenance instructions and cover at least the items specified in Tables 2 to 6.

This log shall be kept on site and shall include

(a) the date on which an inspection, testing, and maintenance exercise was carried out;

(b) the name(s) of the person(s) who performed the inspection, testing, and maintenance;

(c) notes on any unsatisfactory conditions observed or discovered and the steps taken to correct such conditions; and

(d) copies of the design and installation performance test certificates.

11.2 Instructions, tools, and spare parts

11.2.1 Manual of operating and maintenance instructions

11.2.1.1

At least two copies of a manual containing mechanical and electrical drawings and instructions for the operation and maintenance of the emergency generator equipment shall be provided. It shall cover all of the elements affecting the reliable operation of the emergency electrical power supply, including the engine generator set and associated accessories, the generator control panel, the protective devices, and the transfer switch(es).

11.2.1.2

The manual should be available in both English and French.

11.2.1.3

One copy of the manual shall be kept in the safe custody of the person responsible for overall control of the operation and maintenance program.

11.2.1.4

Copies of the manual to be used by the operating and maintenance staff shall be kept in a location convenient for staff use.

11.2.2 Tools

Any special tools and gauges needed for routine maintenance shall be kept in a secure location accessible to the operating and maintenance staff when necessary.

Note: *A possible suitable location is the area where the engine generator set is installed.*

11.3 Annual test

The emergency generator set shall be subjected annually to a 2 h full-load test (see Table 5) in accordance with Clauses 10.3.1 to 10.3.4. In parallel generator set installations, each generator may be load tested individually if synchronization and load sharing is demonstrated. All inspection covers shall be opened or removed, as necessary, to provide access to all electrical connections during this test.

Note: *See Clause B.19 for commentary on this Clause.*

11.4 Periodic operational tests

The emergency electrical power supply system shall be completely tested as specified in Table 3 at least once a month in all facilities. Where a generator is intended for use in a health care facility in accordance with Z32, it shall be completely tested in accordance with Tables 2 and 3 at least once a week.

11.5 Maintenance

11.5.1 General

The emergency electrical power supply shall be maintained as specified in the manufacturer's manual of operating and maintenance instructions, provided that the manual covers at least the items specified in Tables 2 to 6. The owner's representative shall ensure that qualified personnel with appropriate training, experience, and supervision perform the maintenance work.

11.5.2 Frequency of procedures

The minimum frequency of inspection, testing, and maintenance procedures shall be as specified in Tables 2 to 6. Additional requirements may be specified by manufacturers, operators, or authorities having jurisdiction and shall be permanently recorded in the manual of operating and maintenance instructions and the log.

Note: *See Clause B.22 for commentary on this Clause.*

11.5.3 Records

A permanent log of the maintenance work (including inspections and tests) shall be maintained in accordance with the manufacturer's manual of operating and maintenance instructions (see Clause 11.5.1). The permanent log shall be kept on site and shall include at least the following:

(a) the date on which the work was done;
(b) a note of parts replaced;
(c) a note of any unsatisfactory condition discovered and the steps taken to correct it;
(d) the name of the person who performed the work; and
(e) a note verifying that any switches or controls that were deactivated for safety purposes during maintenance have been restored to their intended operating condition.

Note: *A permanent logbook meeting all of the requirements of this Standard is available from CSA (C282 Logbook).*

11.5.4 Safety

11.5.4.1

If a maintenance procedure involves a risk of injury because of moving parts or energized electrical parts, steps shall be taken before the work is begun to deactivate all automatic and manual control devices for the parts with which contact will be made.

11.5.4.2

Signs shall be installed on the equipment at the entrance to the enclosure and on the door to the room housing the equipment stating that the equipment is automatically controlled and could start at any time.

Table 3
Monthly inspection, test, and maintenance requirements
(See Clauses 10.7, 11.1.2, 11.4, 11.5.1, and 11.5.2 and Tables 4 and 5.)

1. All items specified in Table 2.
2. Test and verify the entire system as follows: (a) Simulate a failure of the normal electrical supply to the building. (b) Operate the system under at least 30% of the rated load for 60 min. (c) Operate all automatic transfer switches under load. (d) Inspect brush operation for sparking. (e) Inspect for bearing seal leakage. (f) Inspect for correct operation of all auxiliary equipment, e.g., radiator shutter control, coolant pumps, fuel transfer pumps, oil coolers, and engine room ventilation system(s). (g) Record the readings for all instruments in the log (see Clause 11.5.3) and verify that they are normal. (h) Drain the exhaust system condensate trap.
3. Inspect block heater hoses and wires.
4. Correct all defects found during inspections and tests.
5. Record all inspections, tests, and corrective actions in the log (see Clause 11.5.3).

Note: *The person performing the work described in this Table shall have received appropriate training and be qualified to perform the specified tasks.*

Table 4
Semi-annual inspection, test, and maintenance requirements
(See Clauses 10.7, 11.1.2, 11.5.1, and 11.5.2 and Table 5.)

1. All items specified in Tables 2 and 3.
2. Inspect and clean engine crankcase breathers.
3. Inspect and clean all engine linkages.
4. Lubricate the engine governor and ventilation system.
5. Test protective devices for proper operation.
6. Before start-up, perform two full cranking cycles (as specified in Clauses 10.4.1 and 10.4.2). Near the end of each cycle (and while still cranking), measure and record the lowest indicated battery voltage. If the measured voltage is less than 80% of the battery's rated voltage, replace the battery. Alternatively, perform a battery load test using a suitable load tester.
7. Inspect ventilation system belt(s).
8. Correct all defects found during inspections and tests.
9. Record all inspections, tests, and corrective actions in the log (see Clause 11.5.3).

Note: *Items 2 to 9 require special skill and shall be carried out by a qualified contractor, the system manufacturer, or individuals trained and certified by the system manufacturer.*

GEN SET PACKAGE PERFORMANCE DATA [516DE5T]

SEPTEMBER 03, 2010

For Help Desk Phone Numbers Click here

Performance Number: DM8266

Change Level: 04

Sales Model: 3516CDITA

Combustion: DI

Aspr: TA

Engine Power:
2500 W/F EKW
3,634 HP

Speed: 1,800 RPM

After Cooler: ATAAC

Manifold Type: DRY

Governor Type: ADEM3

After Cooler Temp(F): 122

Turbo Quantity: 4

Engine App: GP

Turbo Arrangement: Parallel

Hertz: 60

Application Type: PACKAGE-DIE

Engine Rating: PGS

Strategy:

Rating Type: STANDBY

Certification: EPA TIER 2 2006 - 2010

General Performance Data 1

GEN W/F EKW	PERCENT LOAD	ENGINE POWER BHP	ENGINE BMEP PSI	FUEL BSFC LB/BHP-HR	FUEL RATE GPH	INTAKE MFLD TEMP DEG F	INTAKE MFLD P IN-HG	INTAKE AIR FLOW CFM	EXH MFLD TEMP DEG F	EXH STACK TEMP DEG F	EXH GAS FLOW CFM
2,500	100	3633	335.48	0.33	173.51	122	78.12	7,211.26	1,235.66	915.26	19,582
2,250	90	3283	303.28	0.34	157.13	119.3	71.31	6,833.39	1,189.94	881.24	17,982.25
2,000	80	2935	270.93	0.34	142.26	116.96	64.32	6,406.09	1,158.8	863.96	16,562.6
1,875	75	2760	254.84	0.34	134.94	115.7	60.74	6,173.01	1,145.66	858.56	15,895.15
1,750	70	2586	238.74	0.35	127.62	114.62	57.04	5,929.34	1,133.24	856.58	15,234.76
1,500	60	2237	206.54	0.35	112.99	112.64	49.45	5,413.74	1,112.36	854.6	13,882.21
1,250	50	1889	174.48	0.36	98.38	111.02	41.28	4,845.18	1,091.84	851.18	12,413.12
1,000	40	1546	142.86	0.37	82.47	109.4	31.42	4,121.23	1,061.42	850.64	10,612.07
750	30	1203	111.1	0.39	66.18	107.96	21.71	3,421.99	1,010.3	848.12	8,765.11
625	25	1029	95	0.39	57.93	107.24	17.18	3,104.16	968.18	831.02	7,846.93
500	20	854	78.9	0.4	49.19	106.34	12.7	2,789.86	901.94	796.1	6,822.8
250	10	497	45.83	0.44	31.3	104	4.74	2,238.95	700.7	647.24	4,799.27

Engine Heat Rejection Data

GEN W/F EKW	PERCENT LOAD	REJ TO JW BTU/MN	REJ TO ATMOS BTU/MN	REJ TO EXHAUST BTU/MN	EXH RCOV TO 350F BTU/MN	FROM OIL CLR BTU/MN	FROM AFT CLR BTU/MN	LHV ENERGY BTU/MN	HHV ENERGY BTU/MN

2,500	100	46,974.5	9,156.0	142,288.4	79,902.2	19,847.6	44,699.7	372,384.0	396,724.3
2,250	90	44,244.8	8,530.5	127,957.2	70,461.8	17,970.9	39,354.0	337,181.5	359,190.2
2,000	80	41,458.1	8,189.3	116,867.6	63,580.5	16,264.8	34,178.8	305,334.4	325,238.8
1,875	75	40,093.3	8,018.6	111,578.7	60,509.6	15,411.7	31,619.7	289,638.3	308,519.1
1,750	70	38,671.5	7,848.0	106,289.8	57,666.1	14,615.6	29,060.5	273,885.3	291,742.5
1,500	60	35,771.2	7,677.4	95,712.0	52,206.6	12,909.5	24,226.6	242,493.2	258,303.0
1,250	50	32,643.3	7,506.8	85,191.1	46,633.3	11,260.2	19,392.6	211,101.0	224,920.4
1,000	40	29,231.1	7,279.3	72,679.7	40,150.1	9,440.4	13,876.2	176,979.1	188,523.7
750	30	25,477.7	6,767.5	59,429.0	32,700.2	7,563.7	8,701.1	142,061.0	151,330.8
625	25	23,373.5	6,426.3	52,547.8	28,548.7	6,596.9	6,483.2	124,317.6	132,450.0
500	20	20,985.0	5,971.3	44,756.6	23,657.9	5,630.1	4,549.6	105,607.4	112,488.6
250	10	15,753.0	5,004.5	27,809.4	12,397.6	3,582.8	1,933.6	67,163.3	71,542.3

EMISSIONS DATA

EPA TIER 2 2006 - 2010 ** 00

No notes were found for this certification...

REFERENCE EXHAUST STACK DIAMETER	12 IN
WET EXHAUST MASS	--
WET EXHAUST FLOW (-- STACK TEMP)	--
WET EXHAUST FLOW RATE (32 DEG F AND 29.98 IN HG)	--
DRY EXHAUST FLOW RATE (32 DEG F AND 29.98 IN HG)	--
FUEL FLOW RATE	--

RATED SPEED "Not to exceed data"

GEN PWR EKW	PERCENT LOAD	ENGINE POWER BHP	TOTAL NOX (AS NO2) LB/HR	TOTAL CO LB/HR	TOTAL HC LB/HR	PART MATTER LB/HR	OXYGEN IN EXHAUST PERCENT	DRY SMOKE OPACITY PERCENT	BOSCH SMOKE NUMBER
2,592.8	100	3633	50.5900	.6100	1.1000	.4100	9.4000	1.4000	.5800
1,967.7	75	2760	3.1900	2.8800	1.1000	.2700	10.4000	1.7000	.4900
1,342.4	50	1889	15.4400	2.4100	1.2000	.2900	11.3000	1.9000	.6200
715.4	25	1029	7.8700	3.3000	.9000	.3100	12.2000	2.5000	.9200
338.7	10	497	.7200	4.6200	.9600	.3100	14.4000	3.8000	1.2700

RATED SPEED "Nominal Data"

GEN PWR EKW	PERCENT LOAD	ENGINE POWER BHP	TOTAL NOX (AS NO2) LB/HR	TOTAL CO LB/HR	TOTAL HC LB/HR	PART MATTER LB/HR	OXYGEN IN EXHAUST PERCENT	DRY SMOKE OPACITY PERCENT	BOSCH SMOKE NUMBER
2,592.8	100	3633	42.1600	3.3400	.8300	.2900	9.4000	1.4000	.5800
1,967.7	75	2760	25.9100	1.6000	.8300	.1900	10.4000	1.7000	.4900
1,342.4	50	1889	12.8700	1.3400	.9000	.2100	11.3000	1.9000	.6200
715.4	25	1029	6.5600	1.8300	.6800	.2200	12.2000	2.5000	.9200
338.7	10	497	5.8500	2.5700	.7200	.2200	14.4000	3.8000	1.2700

Altitude Capability Data(Corrected Power Altitude Capability)

Ambient Operating Temp. / Altitude	50 F	68 F	86 F	104 F	122 F	NORMAL
0 F	3,634.16 hp	3,634.16 hp	3,634.16 hp	3,634.16 hp	3,634.16 hp	3,634.16 hp
820.21 F	3,634.16 hp	3,634.16 hp	3,634.16 hp	3,634.16 hp	3,634.16 hp	3,634.16 hp
1,640.42 F	3,634.16 hp	3,634.16 hp	3,634.16 hp	3,634.16 hp	3,525.54 hp	3,634.16 hp
2,460.63 F	3,634.16 hp	3,634.16 hp	3,634.16 hp	3,525.54 hp	3,416.92 hp	3,634.16 hp
3,280.84 F	3,634.16 hp	3,634.16 hp	3,529.56 hp	3,416.92 hp	3,310.98 hp	3,634.16 hp
4,101.05 F	3,634.16 hp	3,536.27 hp	3,419.6 hp	3,309.64 hp	3,207.72 hp	3,563.09 hp
4,921.26 F	3,545.66 hp	3,424.97 hp	3,310.98 hp	3,205.04 hp	3,105.8 hp	3,470.56 hp
5,741.47 F	3,433.01 hp	3,316.34 hp	3,206.38 hp	3,104.46 hp	3,007.91 hp	3,379.37 hp
6,561.68 F	3,323.05 hp	3,210.4 hp	3,104.46 hp	3,005.23 hp	2,911.35 hp	3,289.52 hp
7,381.89 F	3,215.77 hp	3,107.14 hp	3,003.88 hp	2,908.67 hp	2,817.48 hp	3,202.36 hp
8,202.1 F	3,112.51 hp	3,005.23 hp	2,907.33 hp	2,813.46 hp	2,726.29 hp	3,116.53 hp
9,022.31 F	3,010.59 hp	2,907.33 hp	2,812.12 hp	2,722.27 hp	2,637.79 hp	3,032.05 hp
9,842.52 F	2,911.35 hp	2,812.12 hp	2,719.59 hp	2,632.42 hp	2,550.62 hp	2,948.9 hp
10,662.73 F	2,814.8 hp	2,718.25 hp	2,629.74 hp	2,545.26 hp	2,466.14 hp	2,868.44 hp
11,482.94 F	2,720.93 hp	2,628.4 hp	2,541.23 hp	2,459.43 hp	2,384.33 hp	2,787.98 hp
12,303.15 F	2,629.74 hp	2,539.89 hp	2,455.41 hp	2,377.63 hp	2,303.87 hp	2,710.2 hp

The powers listed above and all the Powers displayed are Corrected Powers

Identification Reference and Notes

Engine Arrangement:	2666136	**Lube Oil Press @ Rated Spd(PSI):**	--
Effective Serial No:	SBK00001	**Piston Speed @ Rated Eng SPD(FT/Min):**	2,539.4
Primary Engine Test Spec:		**Max Operating Altitude(FT):**	2,952.8
Performance Parm Ref:	DM9600	**PEEC Elect Control Module Ref**	
Performance Data Ref:	DM8266	**PEEC Personality Cont Mod Ref**	
Aux Coolant Pump Perf Ref:			
Cooling System Perf Ref:		**Turbocharger Model**	GT6041BN-48T-1.10
Certification Ref:		**Fuel Injector**	
Certification Year:	2006	**Timing-Static (DEG):**	--
Compression Ratio:	14.7	**Timing-Static Advance (DEG):**	--
Combustion System:	DI	**Timing-Static (MM):**	--
Aftercooler Temperature (F):	122	**Unit Injector Timing (MM):**	--

Crankcase Blowby Rate(CFH):	--	**Torque Rise (percent)**	--
Fuel Rate (Rated RPM) No Load(Gal/HR):	16.2	**Peak Torque Speed RPM**	0
Lube Oil Press @ Low Idle Spd(PSI):	--	**Peak Torque (LB/FT):**	0.0

APPLICATION AND INSTALLATION GUIDE

ELECTRIC POWER APPLICATIONS, ENGINE & GENERATOR SIZING

CATERPILLAR®

primary concern. The LE engines use lean burn technology. Lean burn means that excess air is forced into the cylinder to cool the combustion process. This process reduces the NOx in the exhaust. LE engines can sustain higher loads without detonating. Because of this, LE engines have a higher rating than STD engines, given the same compression ratio and separate circuit aftercooler temperature.

Some measures that improve emissions levels will affect other areas for sizing considerations. Either kW are reduced or the response rate value may be higher in some instances. Of course, this can affect engine ratings and the performance of the engine.

Correction Factors

Emission levels are affected by the engine rating, speed, turbocharger, timing, fuel and ambient conditions. Higher ambient temperature and higher altitudes increase nitrogen dioxide and particulate emissions. When engines are tested in the lab, they are tested to specific standards outlined in ISO 8178-1 in regards to temperature, barometric pressure and fuel density. The nominal level of emissions data is derived under these conditions. The specific conditions can be accessed through TMI.

Nominal vs. Not to Exceed

Engine emissions information is typically published in one of two formats. The first is nominal, which is what emissions levels would be expected from a nominal engine; while the second level is not to exceed, which is the maximum emissions output expected for an engine. It is important to understand these levels when comparing competitive information and when providing information to engineering consultants and end users.

"Not to Exceed" data includes a "Tolerance Factor" to account for paralleling and instrumentation and facility variations. If the "Not to Exceed" value is exceeded during field measurements, it is likely that the test equipment is at fault or that the engine has a problem.

Caterpillar engines, at rated speed, will not exceed the values specified in **Table 11**.

Emission g/bhp-h	Diesel			Natural Gas	
	NA	TA	T	Catalytic Converter	Low Emission
Nitrogen Oxide (NOx)	12.0	15.0	19.0	1.2	2.0
Carbon Monoxide (CO)	3.5	2.0	1.5	1.0	1.7
Hydrocarbons (NMHC)	0.4	1.5	1.5	0.5	0.35

Table 11

Note: Depending on configuration and rating, many engines emit considerably less emissions. Specific emission data is available from the specific product TMI.

Heat Balance

Before a cooling system is designed, the designer must understand how much heat is being rejected through each of the cooling circuits. The following guide will help interpret and apply the heat rejection data.

Estimated Emissions - HDS and HDSX Burners

The following emissions apply to all HDS and HDSX burners from 200 to 1200 hp firing the fuels shown and at the emission levels indicated.

Estimated Emission Levels Firing Natural Gas

Pollutant		Model HDS	Model HDSX			
		NO FGR	60 ppm	30 ppm	25 ppm	20 ppm
NOx [(B)]	ppm lb/mmbtu	100 0.12	60 0.07	30 0.035	25 0.03	20 0.024
CO [(A)]	ppm lb/mmbtu	200 0.15	200 [(A)] 0.15 [(A)]	200 [(A)] 0.15 [(A)]	200 [(A)] 0.15 [(A)]	200 [(A)] 0.15 [(A)]
SOx [(C)]	ppm lb/mmbtu	1 0.001	1 0.001	1 0.001	1 0.001	1 0.001
HC / VOC	ppm lb/mmbtu	40 0.016	40 0.016	40 0.016	40 0.016	40 0.016
PM	ppm lb/mmbtu	na 0.01	na 0.01	na 0.01	na 0.01	na 0.01

Estimated Emission Levels Firing #2 Oil [(D)]

Pollutant		Model HDS	Model HDSX			
		NO FGR	60 ppm	30 ppm	25 ppm	20 ppm
NOx [(B)]	ppm lb/mmbtu	185 0.25	185 0.25	140 0.176	140 0.176	140 0.176
CO [(A)]	ppm lb/mmbtu	90 0.07	90 0.07	90 0.07	90 0.07	90 0.07
SOx [(C)]	ppm lb/mmbtu	278 0.52	278 0.52	278 0.52	278 0.52	278 0.52
HC / VOC	ppm lb/mmbtu	50 0.025	60 0.03	60 0.03	60 0.03	60 0.03
PM	ppm lb/mmbtu	na 0.025	na 0.025	na 0.025	na 0.025	na 0.025

A. CO varies with firing rate. Lower levels available, contact sales.
B. The ppm levels are corrected to 3% Oxygen (15% excess air) and dry volume basis.
C. Maximum sulfur in natural gas is 0.0006% wt.
D. ASTM #2 fuel, 0.05% by weight Nitrogen, 0.5% by weight Sulfur and 0.01% by weight Ash.
E. All levels are above backround (ambient) conditions.
F. Emission levels are based on a properly maintained and tuned burner.

THERMOGENICS INC.
6 Scanlon Court, Aurora, Ontario L4G 7B2

Tel.(905) 727-1901
Fax(905) 727-8656

EMAIL

Date: April 30, 2012
To: Eric Vainio
Geo. A. Kelson Company Limited
Email: eric.vainio@kelson.on.ca
From: Bryan Heppell
Subject: Halton Health Care
New Oakville Hospital

Hi Eric,

Further to your email to Dave Bright this letter is to confirm the three (3) 500 HP Thermocoil boilers quoted for the above project will have NO_x emissions of less than 30 ppm (corrected to 3%).

We trust this meets with your approval and if you have any questions at all, please do not hesitate to call.

Yours very truly,

THERMOGENICS INC.

Bryan Heppell
President

Gustian, Nancy

From: Anderson Kong [anderson.kong@cel.ca]
Sent: May 4, 2012 11:30 AM
To: Lau, Emily
Cc: Paul Biddiss (biddissp@HHAngus.COM); John Guillem
Subject: FW: New oakville hospital

Emily,

Please see below re the conductivity or TDS for cooling towers. Thanks.

Anderson Kong, P.Eng., LEED® AP
Principal
CROSSEY ENGINEERING LTD.
2255 Sheppard Avenue East Suite E-331
Toronto, Ontario, M2J 4Y1
Phone: (416) 497-3111 ext. 246 Fax: (416) 497-7210
Email: anderson.kong@cel.ca **Web:** www.cel.ca

From: Paul Biddiss [mailto:Paul.Biddiss@hhangus.com]
Sent: Friday, May 04, 2012 11:20 AM
To: Anderson Kong
Subject: Fw: New oakville hospital

From: Radu Petroianu
To: Paul Biddiss
Sent: Fri May 04 11:17:54 2012
Subject: FW: New oakville hospital

FYI

Radu Petroianu, C.E.T.
Mechanical Designer
H.H. Angus & Associates Limited Consulting Engineers

1127 Leslie Street
Toronto, Ontario, M3C 2J6
Main: 416-443-8200 x448
Fax: 416-443-8290

From: Pierre Beausoleil [mailto:pierre.beausoleil@klenzoid.com]
Sent: Friday, May 04, 2012 11:15 AM
To: Radu Petroianu
Subject: Re: New oakville hospital

Hello Radu,

The inlet water conductivity is ~320 umhos and we cycle that up into our control limits of 950-1050. If you are looking at TDS in ppm, it would be ~180 cycling up to up ~590.

Pierre Beausoleil, P.Eng.
Manager of Support Services

Klenzoid Company Ltd.
Tel: 888-712-4000 x316
Fax: 905-712-4001
E-mail: pierre.beausoleil@klenzoid.com
Website: http://www.klenzoid.com

On Fri, May 4, 2012 at 11:05 AM, Radu Petroianu <Radu.Petroianu@hhangus.com> wrote:

Pierre,

Could you please send me what concentration of total dissolved solids you designed for on the New Oakville hospital cooling tower water?

Thank you!

Radu Petroianu, C.E.T.

Mechanical Designer

H.H. Angus & Associates Limited Consulting Engineers

1127 Leslie Street

Toronto, Ontario, M3C 2J6

Main: 416-443-8200 x448

Fax: 416-443-8290

SPX

COOLING TECHNOLOGIES

Floval Equipment Ltd
250 Rayette Road, Unit 1
Concord, ON L4K 2G6
(905) 669-4500 / fax: (905) 669-4905
email: llemick@floval.com

Proposal to: Geo. A. Kelson

Project: Halton 4CT REV 1

Engineer:

Opportunity / Quote No. (Ver): Lorne Lemick_120410_091203848 / Lorne Lemick_120410_091356988 (1)
Rep Quote No.: LLMAR-10042012REV1

April 10, 2012

Marley NC8400 Tower

TOWER MODEL	PERFORMANCE CONDITIONS	MOTOR DATA	TOWER DIMENSIONS	WEIGHTS
Quantity of (4) Marley NC Class model **NC8411VLN** factory assembled 1-Cell crossflow cooling tower(s)	Per 1-cell tower: 2,400 gpm 100.0 °F Hot Water 85.0 °F Cold Water 76.0 °F Entering WB	NEMA 60 HP 1 speed / 1 wind 3 phase / 60 Hz / **575v** 1.15sf / TEFC 1200 RPM Premium Efficiency Inverter duty nameplated	Each cell: (without options) Length 11' - 10 3/4" Width 22' - 5" Height 18' - 10 1/8" Per 1-cell tower: (with options) Length 15' - 1 7/16" Width 22' - 5" Height 21' - 11 3/16"	Per cell: Shipping: 20,793 lb Operating: 40,518 lb Per 1-cell tower: Shipping: 20,793 lb Operating: 40,518 lb Heaviest Lift: 11,369 lb

Quantities shown below are per tower.

Base Tower Construction/Equipment:

Galvanized Steel casing.
Galvanized Steel structure.
Galvanized Steel collection basin.
Galvanized Steel distribution basin.
Anchorage design selected to meet customer specified design requirements for wind load of 30.0 psf.
Quiet fan with aluminum blades.
Marley designed Geareducer® with 5-year warranty.
15 mil PVC film fill with integral louvers and drift eliminators designed and manufactured by Marley.
Drift rate guaranteed to be no greater than .005% of the design flow rate.
CTI certification per STD-201. , including fill pack partition.
HDG steel fan guard.

Collection Basin Connections and Accessories:

All flanges are to Class 125 ANSI B16.1 standard.
All threads are to American Standard Pipe Taper Thread.
(1) 10 in (254 mm) diameter flanged cased face outlet(s) with trash screen(s).
14 in (356 mm) diameter hole and bolt circle(s) for equalization, One per Cell
4 in (102 mm) diameter combination drain and overflow in each cell
(1) 1 in (25.4 mm) water make-up float valve
15 kW per cell 575/3 volt/phase electric immersion heater for freeze protection of the collection basin during cold weather system shutdown
Includes heater elements, water temperature sensor probe and control box

Distribution Basin Inlet and Accessories:

(1) self-balancing 12 in (305 mm) diameter PVC bottom inlet connection per cell.
All internal piping is PVC. External piping is PVC.

Maintenance & Maintenance Access Features:

Tower is designed in accordance with OSHA safety standards.
This quotation does not include features which are available to allow safe access on the fan deck while the fan is still operating. If this is a desired feature for your intended operation, please contact your sales representative.
External lube line with dipstick
Full face horizontally mounted air inlet screens for easy access to collection basin
Convenient access to the collection basin and plenum area is provided via a large access door located on each endwall
Galvanized Steel plenum walkway in each cell
Easy fitting perimeter guardrail, kneerail & toeboard
(1) Cased face ladder
Easy fitting ladder safety cage(s)
Self closing safety gate(s) included at the top of the access ladder(s)

APPENDIX C

Emission Rate Calculations

Sources A1 to A6

Diesel Generators

Source Description: Six Caterpillar diesel emergency generators each rated at 2,500 kW. Only one emergency generator will be tested at a time.

Operating Rate: The generators are tested on a weekly basis for a 1 hour period at 30% load.

52 hr/yr
6 units

Specifications:

750.0 kW at 30% load
2,561,384.0 BTU/hr

Methodology: Emission Factor

Source: Tables 3.4-1, 3.4-2 and 3.4-3, U.S. EPA AP-42 Section 3.4 Large Stationary Diesel and All Stationary Dual-fuel Engines (dated 10/96)
Caterpillar manufacturer's specifications provided in Appendix C.

Sample Calculation:

$$\text{Nitrogen oxides} = \frac{7.822\ \text{lb}}{\text{hr}} \left| \frac{454\ \text{g}}{\text{lb}} \right| \frac{1\ \text{hr}}{3600\ \text{s}}$$

$$\text{Nitrogen oxides} = 9.86E{-}01\ \frac{\text{g}}{\text{s}}$$

$$\text{Sulphur dioxide} = \frac{0.505\ \text{lb}}{1{,}000{,}000\ \text{Btu}} \left| \frac{2{,}561{,}384\ \text{BTU}}{\text{hr}} \right| \frac{454\ \text{g}}{\text{lb}} \left| \frac{1\ \text{hr}}{3600\ \text{s}} \right.$$

$$\text{Sulphur dioxide} = 1.63E{-}01\ \frac{\text{g}}{\text{s}}$$

Emission Summary

Contaminant	CAS	Emission Factor [lb/hr]	Emission Factor [lb/MMBtu]	US EPA Emission Factor Rating	Hourly Emissions Per Generator [g/s]	Worst Case Annual Operations	Annual Emissions [kg/yr]
Nitrogen oxides	11104-93-1	7.822	-	B	9.86E-01	N/A	1.11E+03
Particulate matter	PM	0.218	-	B	2.75E-02	N/A	3.09E+01
Sulphur dioxide	7446-09-5	-	0.505	B	1.63E-01	N/A	1.83E+02
Benzene	71-43-2	-	0.000776	C	2.50E-04	N/A	2.81E-01
Toluene	108-88-3	-	2.81E-04	E	9.07E-05	N/A	1.02E-01
Xylene	1330-20-7	-	1.93E-04	E	6.23E-05	N/A	7.00E-02
Propylene	115-07-1	-	2.79E-03	E	9.00E-04	N/A	1.01E+00
Formaldehyde	50-00-0	-	7.89E-05	E	2.55E-05	N/A	2.86E-02
Acetaldehyde	75-07-0	-	2.52E-05	E	8.13E-06	N/A	9.13E-03
Acrolein	107-02-8	-	7.88E-06	E	2.54E-06	N/A	2.86E-03
Naphthalene	91-20-3	-	1.30E-04	E	4.20E-05	N/A	4.71E-02
TOTAL VOCs	**VOC**	**-**	**-**	**-**	**1.38E-03**	**-**	**1.55E+00**

Made by: EKL
Checked by: JM/KSA

Sources B1 and B2

Steam and Hot Water Boilers

Source Description: The Facility operates up to three steam boilers and five hot water boilers each rated at 16,740,000 BTU (500 HP). All boilers primarily operate on natural gas but No. 2 fuel oil may be used in the event of an emergency. Fuel oil is only used in emergency situations and will not be used during normal operation; therefore, fuel oil combustion emissions are not considered. All boilers are equipped with low NOx burners.

Operating Rate: Variable emissions were used as input data into CALPUFF. Emissions were calculated based on typical natural gas fuel consumption for each month. The maximum scenario is assumed to be a 25% increase in natural gas consumption.

Month	Fuel Consumption (MJ)	Fuel Consumption (ft^3)
JAN	22,537,069	20,942,176
FEB	20,419,888	18,974,823
MAR	17,458,768	16,223,254
APR	12,579,556	11,689,332
MAY	9,835,883	9,139,822
JUN	7,232,216	6,720,410
JUL	7,391,529	6,868,449
AUG	7,418,328	6,893,351
SEP	7,703,298	7,158,155
OCT	10,816,663	10,051,194
NOV	12,958,954	12,041,881
DEC	19,123,435	17,770,117
Total	**155,475,588**	**144,472,962**

January Fuel Consumption = $\frac{22{,}537{,}069\ \text{MJ}}{} \times \frac{947.8171\ \text{BTU}}{1\ \text{MJ}} \times \frac{1\ ft^3}{1020\ \text{BTU}}$

January Fuel Consumption = 20,942,176 ft^3

Annual facility-wide natural gas consumption 144,472,962 ft^3

Percentage cosumed in steam boilers 50%

Factor for Converting from Average to Maximal Scenario 125%

Methodology: Emission Factor

Source: Tables 1.4-1 and 1.4-2 in U.S. EPA AP-42 Section 1.4 Natural Gas Combustion (dated 7/98)

Contaminant	CAS	Emission Factor [lb/1,000,000scf]	US EPA Emission Factor Rating
Nitrogen oxides	11104-93-1	50	D
Particulate matter	N/A	7.6	D
Sulphur dioxide	7446-09-5	0.6	A
VOC	VOC	5.5	C
Toluene	108-88-3	3.40E-03	C

Sample Calculation:

Nitrogen oxides = (January; Average Case)	20,942,176 ft³ / yr	50 lb / 1,000,000 ft³	454 g / 1 lb	1 month / 31 day	1 day / 24 hr	1 hr / 3600 s	50%

Nitrogen oxides = (January; Average Case) 8.87E-02 g / s

Nitrogen oxides = (January; Maximal Case) 8.87E-02 g / s | 125%

Nitrogen oxides = (January; Maximal Case) 1.11E-01 g / s

Emission Summary:

Emission Rates (g/s) Per Exhaust

Month	Day/Month	Average Operating Scenario Emissions [g/s]					Maximum Operating Scenario Emissions [g/s]				
		Nitrogen oxides	Particulate matter	Sulphur dioxide	VOC	Toluene	Nitrogen oxides	Particulate matter	Sulphur dioxide	VOC	Toluene
JAN	31	8.87E-02	1.35E-02	1.06E-03	9.75E-03	6.03E-06	1.11E-01	1.68E-02	1.33E-03	1.22E-02	7.54E-06
FEB	28	8.89E-02	1.35E-02	1.07E-03	9.78E-03	6.05E-06	1.11E-01	1.69E-02	1.33E-03	1.22E-02	7.56E-06
MAR	31	6.87E-02	1.04E-02	8.24E-04	7.56E-03	4.67E-06	8.59E-02	1.31E-02	1.03E-03	9.44E-03	5.84E-06
APR	30	5.11E-02	7.77E-03	6.14E-04	5.63E-03	3.48E-06	6.39E-02	9.72E-03	7.67E-04	7.03E-03	4.35E-06
MAY	31	3.87E-02	5.88E-03	4.64E-04	4.26E-03	2.63E-06	4.84E-02	7.35E-03	5.80E-04	5.32E-03	3.29E-06
JUN	30	2.94E-02	4.47E-03	3.53E-04	3.23E-03	2.00E-06	3.68E-02	5.59E-03	4.41E-04	4.04E-03	2.50E-06
JUL	31	2.91E-02	4.42E-03	3.49E-04	3.20E-03	1.98E-06	3.63E-02	5.53E-03	4.36E-04	4.00E-03	2.47E-06
AUG	31	2.92E-02	4.44E-03	3.50E-04	3.21E-03	1.98E-06	3.65E-02	5.55E-03	4.38E-04	4.01E-03	2.48E-06
SEP	30	3.13E-02	4.76E-03	3.76E-04	3.44E-03	2.13E-06	3.91E-02	5.95E-03	4.70E-04	4.31E-03	2.66E-06
OCT	31	4.26E-02	6.47E-03	5.11E-04	4.68E-03	2.89E-06	5.32E-02	8.09E-03	6.38E-04	5.85E-03	3.62E-06
NOV	30	5.27E-02	8.01E-03	6.32E-04	5.80E-03	3.58E-06	6.59E-02	1.00E-02	7.90E-04	7.24E-03	4.48E-06
DEC	31	7.52E-02	1.14E-02	9.03E-04	8.28E-03	5.12E-06	9.40E-02	1.43E-02	1.13E-03	1.03E-02	6.39E-06
Average Emission Rate* [g/s]		-	**7.92E-03**	-	-	-	-	-	-	-	-
Annual Total for Both Exhausts [kg/yr]		**3276.6**	**498.0**	**39.3**	**360.4**	**0.2**	**4095.7**	**622.5**	**49.1**	**450.5**	**0.3**

* The average particulate matter value is used to assess self-contamination at the NOH.

Made by: EKL
Checked by: JM/KSA

Sources C1 to C5

Cooling Towers

Source Description: The Facility operates four single cell 1,300 ton Marley NC8411 cooling towers.

Operating Rate: Average and Maximal Scenarios: Four BAC cooling towers operating simultaneously. Assuming maximum flow rate of 2400 gpm (9085 L/min] and max recommended TDS concentration.

5136 hr/yr

Methodology: Emission Factor

Source: Manufacturer guarantee

Sample Emission Rate Calculation:

$$\text{Drift Emission Rate from Circulating Water [g/s]} = \frac{9{,}085\ \text{L}}{\text{min}} \times \frac{590\ \text{mg}}{\text{L}} \times 0.005\% \times \frac{1\ \text{g}}{1000\ \text{mg}} \times \frac{1\ \text{min}}{60\ \text{s}}$$

$$= 4.47\text{E-}03\ \frac{\text{g}}{\text{s}}$$

Emission Summary:

Source	Source ID	Description	Circulating Water Flow Rate [L/min]	TDS Concentration [mg/L]	Drift % of Circulating Water Capacity* [10^{-2} L drift/L water flow]	Particulate Matter Emission Rate [g/s]	Annual Emissions [kg/yr]
Cooling Tower 1	C1	Marley NC8411	9085	590	0.005%	4.47E-03	8.26E+01
Cooling Tower 2	C2	Marley NC8411	9085	590	0.005%	4.47E-03	8.26E+01
Cooling Tower 3	C3	Marley NC8411	9085	590	0.005%	4.47E-03	8.26E+01
Cooling Tower 4	C4	Marley NC8411	9085	590	0.005%	4.47E-03	8.26E+01
TOTAL	-	-	-	-	-	**1.79E-02**	**3.30E+02**

APPENDIX D

Energy Model Report

ENERMODAL ENGINEERING
Creating energy and resource efficient buildings

New Oakville Hospital – 50%CD AET Energy Model Report

Jun / 2012

Prepared by

Enermodal Engineering Limited
582 Lancaster St. W
Kitchener, ON N2K 1M3
tel: 519-743-8777
fax: 519-743-8778
e-mail: office@enermodal.com
web site: www.enermodal.com

Table of Contents

1. INTRODUCTION

The New Oakville Hospital is a 1,529,550 ft^2 building in Oakville, Ontario. The project was modeled using eQUEST-3.64. A summary of energy consumption for the 100%DD AET Model is shown below.

Table 1: Summary of Energy Consumption

Fuel	Consumption (MJ)
Electricity	90,239,569
NG	125,062,803
Diesel	1,041,904
TOTAL	216,344,276

2. ENERGY EFFICIENCY MEASURES

The following are the primary energy efficiency measures resulting in energy savings in the proposed design:

- Heat recovery ventilation on multiple HVAC systems
- Pumps and fans are premium efficiency, variable speed
- Heat recovery chiller
- High performance assemblies
- High performance windows
- Efficient lighting design and use of occupancy sensors and daylighting controls
- Low-flow plumbing fixtures

The details of the energy efficiency measures are discussed throughout the report.

3. MODELING STRATEGY AND METHODOLOGY

The building is modeled using the space type method. However, since eQUEST only recognizes zones, spaces were created within each zone and zone characteristics were modeled as an area-weighted average of space characteristics. To minimize data entry, each space type was not made into its own zone.

Elevator shafts and duct shafts have been included in the model to be the same space type as their adjacent space (typically M&E spaces or corridor spaces).

The selected location for the model was set to Toronto, Ontario and the associated weather file was used per the RFP. Design days for winter and summer were added to the model as outlined in the RFP.

4. ENVELOPE CONSTRUCTION

The exterior wall R-values were provided RJC. RJC provided the average R-value for each construction based on a thorough analysis of the building envelope components. From this, an area weighted R-value was determined for each block. The average R-value for opaque construction for each block is listed below.

Table 2: Average R-Values for Opaque Constructions

Block	Average R-Value*
Block A	23.0
Block C	22.9
Block D	25.2
Mechanical Penthouse	12.0

* Note that the R-values account for the effects of thermal bridging

5. WINDOWS AND GLAZINGS

The windows for the building consist of Guardian glazing with a soft low-e coating, argon fill, thermally broken frame and stainless steel spacers. The proposed glazing is not available in the eQUEST glazing library. Window5 does not include this glazing in its library enabling the assembly to be created. Therefore, the closet match from the library was modeled (LoE2-138 Clr/Arg/Clr 6). Data in the table below compares the proposed glazing to that modeled.

Table 3: Actual and Modeled Window Performance Specifications

	Proposed Guardian Glazing (Manufacturer Data)	Modeled Glazing (eQUEST data)
CoG U-Value (BTU/hr-ft2-°F)	0.24	0.25
SHGC	0.21	0.23
Visible Trans.	0.45	0.27

Note that in terms of energy consumption for this building, it is important to match the U-value and solar heat gain coefficient (SHGC) as these two parameters have a large impact on the heating and cooling loads for the building. The visible transmittance (VT) affects the available daylighting to the space therefore a conservative estimate of the impacts of daylighting is currently modeled.

6. INTERIOR LIGHTING

Based on the 100%DD drawings and fixture schedules, the building installed lighting power density is 0.87 W/ft^2.

Patient room lighting has been reduced to account for four modes of operation; sleep, reading, ambient and examination. The following table outlines the assumed number of hours in each mode.

Table 4: Patient Room Lighting Run Hours

Mode	Run Hours	
Sleep	8	33%
Reading	6	25%
Ambient	2	8%
Examination	8	33%
Total	24	100%

Only the main lighting fixture installed in each patient room has dedicated 3 different lighting levels for reading, ambient light and examination. Other patient room fixtures were assumed to be off during 'sleep mode'. Any designated night light fixture was assumed to be on only during 'sleep mode'.

Occupancy sensors have been modelled as reflected on the drawings.

Daylighting sensors have been modeled in public areas, open offices and circulation spaces which have daylighting exposure, as indicated on the drawings. They are incorporated by using eQUEST's daylighting sensor options.

7. HEATING PLANT

The heating plant consists of three 500 HP steam boilers and three 500 HP hot water boilers. The boiler plant was first modeled based on information provided by the design team, the steam boilers have been modeled with an efficiency of 84% and the hot water boilers have been modeled with an efficiency of 85%. The part load curve for the hot water boilers is illustrated below.

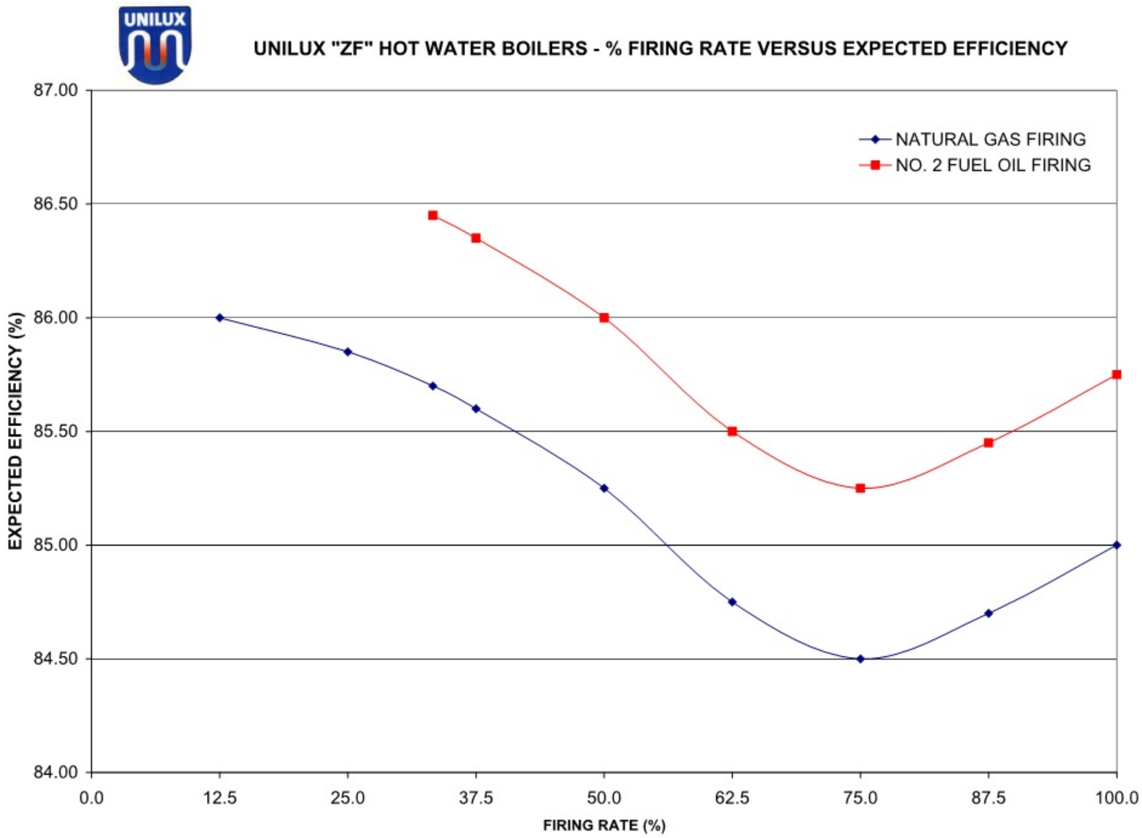


Figure 1: Firing Rate vs. Expected Efficiency

An iteration of the model was run which included an approximate autoclave load. Including the autoclaves increases the annual efficiency of the boiler plant as it is more efficient at higher part load conditions. The AEM input boiler efficiencies were improved to match the annual boiler average efficiency from the iterative results.

Each steam boiler has a primary pump with 323 ft of head and a flow rate of 69 GPM. The pumps are constant speed with a high efficiency motor and an impeller efficiency of 65%. Each hot water boiler has a primary pump with 75 ft of head and a flow rate of 744 GPM. The pumps are constant speed with a high efficiency motor and an impeller efficiency of 65%. The hot water loop pump is modeled with a pumping power of 398 kW, variable speed with a high efficiency motor and an impeller efficiency of 65%.

8. COOLING PLANT

The cooling plant consists of four 1200 ton chillers and one 400 ton heat recovery chiller. Based on information provided by the design team, the 1200 ton chillers have been modeled with a COP of 7.87 which is based on the integrated part load data provided. The 400 ton chiller has been modeled with a COP of 6.5.

Each chiller has a primary pump with 80 ft of head and a flow rate of 1800 GPM. The pumps are constant speed with a high efficiency motor and an impeller efficiency of 65%. The chilled water loop pump is modeled with a pumping power of 236 kW, variable speed with a high efficiency motor and an impeller efficiency of 65%.

Each cooling tower has a primary pump with 70 ft of head and a flow rate of 2400 GPM. The pumps are constant speed with a high efficiency motor and an impeller efficiency of 65%.

9. SPACE HEATING AND COOLING SYSTEMS

9.1 HVAC Systems

There are a number of systems serving the building. Some systems have been combined in the model, where they serve similar zones and have similar design features. The supply flows, motor horse powers, outdoor air rates, and other system characteristics were based on the equipment schedules provided by the mechanical designers. All motors will be NEMA premium efficiency. All systems are equipped with hydronic heating and cooling coils at the system level, reset based on the zone of greatest demand. Hydronic reheat is provided at air delivery terminals.

All systems are constant volume systems. They have been modeled as VAV systems in eQUEST, then through the zone level airflow inputs are forced to operate as constant volume systems.

All systems have air-side economizers with outdoor air temperature controls, enabling 100% outdoor air to be delivered to meet cooling demand.

Unit heaters with hydronic heat have been modeled in mechanical and storage spaces as well as Shell spaces which are not served by the air handlers. Based on direction from the design team, the unit heater integral fans are modeled to overcome a TSP of 0.25".

Humidification was added to all air handlers, via the hot water loop, with a minimum relative humidity set point of 30%. The maximum relative humidity was defined as 60%.

9.2 Thermal Zones

Zones were formed based on space functions, HVAC system zoning and building configuration.

9.3 Schedules

Occupancy, lighting and receptacle schedules were changed from MNECB default schedules to reflect the actual expected building operation. The heating schedules for office areas include a 20°C setback when unoccupied.

9.4 Equipment Loads

The equipment loads have been calculated based on information provided in the Output Specifications. The equipment power density was calculated on a department basis, and then assigned a diversity factor representing how often the equipment operates and distributed to zones in each department. It has been modeled as a space level equipment load, on a sub-meter, to exclude all costs.

The IT equipment listed in the RFP has been added to spaces C12-4, C12-5, and C12-6. It follows a 24/7 schedule, 100% load.

10. OCCUPANCY AND OUTDOOR AIR RATES

Occupancy was increased from the MNECB default occupancy of 4,725 occupants to the mechanical engineer's design value of approximately 7,000 occupants. Departmental occupancy was correlated to eQUEST zoning to assign occupancy density.

The minimum ventilation rate for all systems combined is approximately 562,000 CFM. This is based off of the flow rates and outdoor air fraction for each system. The mechanical designer has provided detailed ventilation calculations during the development of the design showing the combined CSA and ASHRAE ventilation allowance for the building is 688,814 CFM. Therefore, the design rate is less than the respective standards allow and there is no penalty in the simulation for over-ventilating.

11. HEAT RECOVERY EQUIPMENT

Table 5 below indicates the systems that have heat recovery and their effectiveness.

Table 5: Summary of Heat Recovery

System	Effectiveness
A503	0.781
A506	0.779
C009A	0.75
C009B	0.75
C013	0.75
D902	0.75
D903	0.765
D904	0.752
D905	0.759
D906	0.754
D907	0.761
D908	0.765
D912	0.75
D911/D913	0.30

There are five systems for which exact effectiveness values have not been provided (C009A, C009B, C013, D902, D912), as such an effectiveness of 0.75 has been assumed. Additionally, a run-around loop transfers heat from D913 to D911 and an effectiveness of 0.30 has been assumed.

ERVs use temperature sensors as well as mixed air temperature reset to modulate wheels and avoid overheating or overcooling of ventilation.

12. DOMESTIC HOT WATER EQUIPMENT

Domestic hot water use is per MNECB space function defaults. The total wattage was converted into a flow rate for entry in eQUEST.

The domestic hot water is provided by the boiler plant and is therefore modeled as a load on the hot water loop. This is achieved by converting the hourly demand of

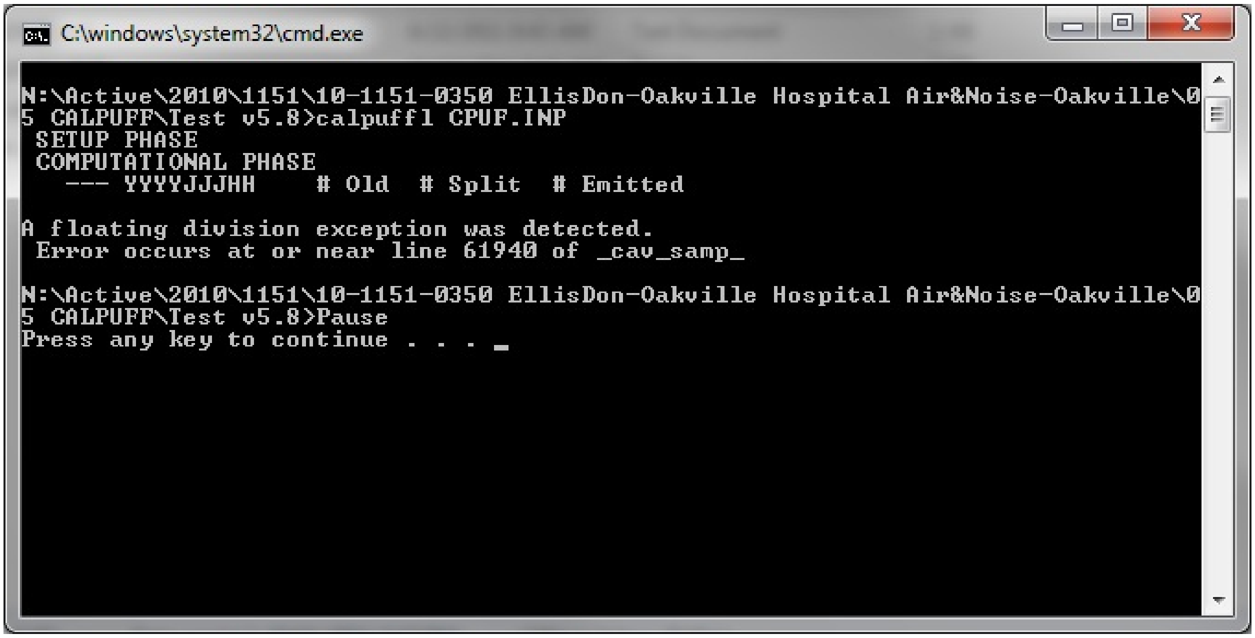
27.97 GPM to a demand of 1.1188 MBTU/hr and modeling it as a process load following the same DHW schedule.

13. WATER FIXTURES

The domestic hot water fixtures include low-flow faucets and showers. Credit has been taken through a reduction in the proposed building DHW flow rate.

APPENDIX E

CALPUFF BPIP-Prime Error Message


C:\windows\system32\cmd.exe
N:\Active\2010\1151\10-1151-0350 EllisDon-Oakville Hospital Air&Noise-Oakville\05 CALPUFF\Test v5.8>calpuffl CPUF.INP
SETUP PHASE
COMPUTATIONAL PHASE
--- YYYYJJJHH # Old # Split # Emitted
A floating division exception was detected.
Error occurs at or near line 61940 of _cav_samp_
N:\Active\2010\1151\10-1151-0350 EllisDon-Oakville Hospital Air&Noise-Oakville\05 CALPUFF\Test v5.8>Pause
Press any key to continue . . .

APPENDIX F

CALPUFF 6.263 Source Code, Dispersion Modelling Files, Exhaust Re-entrainment Study and CALMET Data Analysis (on CD)

APPENDIX G

Self-Contamination Sample Calculations

Sources A1 to A6

Diesel Generators

Self-Contamination Sample Calculation

PM Emission Rate	0.218	lb/hr	30% load
Operating Time	1	hr	
Exit P_{exit}	101.325	kPa	
Exit T_{exit}	848.12	°F	
	726.55	K	
Exit V_{exit}	8765.11	cfm	
	4.14	m^3/s	
T0	293.15	K	
D =	1620	dilution factor	

$V0 = V_{exit}(T0/T_{exit})$

$$V0 = \frac{4.14\ m^3}{s} \cdot \frac{293.15\ K}{726.55\ K}$$

$$V0 = \frac{1.67\ m^3}{s}$$

$$\text{PM Emission Rate} = \frac{0.218\ lb}{hr} \cdot \frac{1\ hr}{3600\ s} \cdot \frac{453.59\ g}{lb} \cdot \frac{1\ hr}{1\ hr}$$

$$\text{PM Emission Rate} = \frac{0.027\ g}{s}$$

$$\text{PM C0} = \frac{0.027\ g}{s} \cdot \frac{1\ s}{1.67\ m^3} \cdot \frac{1000000\ \mu g}{g}$$

$$\text{PM C0} = \frac{16456.7\ \mu g}{m^3}$$

D = C0/C

C = C0/D

$$\text{C annual} = \frac{16457\ \mu g/m^3}{1620}$$

$$\text{C annual} = \frac{10.16\ \mu g}{m^3} \cdot 0.079$$

$$\text{C annual} = \frac{0.803\ \mu g}{m^3}$$

The above value assumes continuous operation for the entire year. In reality, the generator will operate 1 hour per week for testing.

$$\text{C adjusted} = \frac{0.803\ \mu g}{m^3} \cdot \frac{52\ hr}{8760\ hr}$$

$$\text{C adjusted} = \frac{0.005\ \mu g}{m^3}$$

Sources B1 to B2

Steam and Hot Water Boilers

Self-Contamination Sample Calculation

Exit P_{exit}	101.325	kPa
Exit T_{exit}	221	°C
	494.15	K
Exit V_{exit}	10.30	m³/s
T0	293.15	K
D =	550	

$V0 = V_{exit}(T0/T_{exit})$

$$V0 = \frac{10.30\ m^3}{s} \cdot \frac{293.15\ K}{494.15\ K}$$

$$V0 = \frac{6.11\ m^3}{s}$$

$$\text{PM Emission Rate} = \frac{0.008\ g}{s}$$

$$\text{PM } C0 = \frac{0.008\ g}{s} \cdot \frac{1\ s}{6.11\ m^3} \cdot \frac{1000000\ \mu g}{g}$$

$$\text{PM } C0 = \frac{1296.8\ \mu g}{m^3}$$

D = C0/C

C = C0/D

$$C\ annual = \frac{1297\ \mu g/m^3}{550}$$

$$C\ annual = \frac{2.36\ \mu g}{m^3} \cdot 0.079$$

$$C\ annual = \frac{0.186\ \mu g}{m^3}$$

Sources C1 to C4

Cooling Towers

Self-Contamination Sample Calculation

Exit P_{exit}	101.325	kPa
Exit T_{exit}	20	°C
	298.15	K
Exit V_{exit}	120.70	m³/s
T0	293.15	K
D =	60	

$$V0 = \frac{120.70\ m^3}{s}$$

$$\text{PM Emission Rate} = \frac{0.004\ g}{s}$$

$$\text{PM C0} = \frac{0.004\ g}{s} \times \frac{1\ s}{120.70\ m^3} \times \frac{1000000\ \mu g}{g}$$

$$\text{PM C0} = \frac{37.0\ \mu g}{m^3}$$

D = C0/C

C = C0/D

$$\text{C annual} = \frac{37\ \mu g/m^3}{60}$$

$$\text{C annual} = \frac{0.62\ \mu g}{m^3} \times 0.079$$

$$\text{C annual} = \frac{0.049\ \mu g}{m^3}$$

The above value assumes continuous operation for the entire year. In reality, the cooling tower will operate from March to September, inclusive (approximately 5136 hours per year).

$$\text{C adjusted} = \frac{0.049\ \mu g}{m^3} \times \frac{5136\ hr}{8760\ hr}$$

$$\text{C adjusted} = \frac{0.029\ \mu g}{m^3}$$

Self-Contamination Summary

Exhaust Stack Conditions

Emission Source	ID	FPM Emission Rate	Exhaust Temperature [K]	Exhaust Flow [m³/s]	Normalized Exhaust Flow [m³/s]	In-Stack Concentration [µg/m³]
Emergency Generators	A1- A6	0.027	726.55	4.1	1.67	1.65E+04
Boilers	B1	0.008	494.15	10.3	6.11	1.30E+03
	B2	0.008	461.15	12.5	7.94	9.98E+02
Cooling Towers	C1 -C4	0.004	298	120.7	118.67	3.76E+01

Dilution Factors

Emission Source	ID	Receptor Location Dilution Factor			
		Air Intakes	Entrances	Terrace/Courtyard	Windows
Emergency Generators	A1- A6	1620	2500	2420	3400
Boilers	B1 - B2	750	1340	550	1790
Cooling Towers	C1 -C4	80	60	80	70

Conversion Factor 0.0787
1 hr to annual

Receptor FPM Concentrations

Emission Source	ID	Operating Hours Per Year	In-Stack Concentration [µg/m³]	Concentration at Receptor [µg/m³]			
				Air Intakes	Entrances	Terrace/Courtyard	Windows
Emergency Generators	A1	52	16465.10	0.005	0.003	0.003	0.002
	A2	52	16465.10	0.005	0.003	0.003	0.002
	A3	52	16465.10	0.005	0.003	0.003	0.002
	A4	52	16465.10	0.005	0.003	0.003	0.002
	A5	52	16465.10	0.005	0.003	0.003	0.002
	A6	52	16465.10	0.005	0.003	0.003	0.002
Boilers	B1	8760	1297.48	0.136	0.076	0.186	0.057
	B2	8760	997.72	0.105	0.059	0.143	0.044
Cooling Towers	C1	5136	37.64	0.022	0.029	0.022	0.025
	C2	5136	37.64	0.022	0.029	0.022	0.025
	C3	5136	37.64	0.022	0.029	0.022	0.025
	C4	5136	37.64	0.022	0.029	0.022	0.025
Total Concentration [µg/m³]				**0.291**	**0.182**	**0.369**	**0.139**

Wind Direction Adjustment Data

Emission Source	ID	Receptor Location Dilution Factor			
		Air Intake R5	Entrances	Terrace/Courtyard R8	Windows
Emergency Generators	A1- A6	-	-	-	-
Boilers	B1 - B2	36.71%	-	39.09%	-
Cooling Towers	C1 -C4	-	-	-	-

Adjusted FPM Concentrations

Emission Source	ID	Operating Hours Per Year	In-Stack Concentration [µg/m³]	Concentration at Receptor [µg/m³]			
				Air Intakes (R5)	Entrances	Terrace/Courtyard (R8)	Windows
Emergency Generators	A1	52	16465.10	0.005	0.003	0.003	0.002
	A2	52	16465.10	0.005	0.003	0.003	0.002
	A3	52	16465.10	0.005	0.003	0.003	0.002
	A4	52	16465.10	0.005	0.003	0.003	0.002
	A5	52	16465.10	0.005	0.003	0.003	0.002
	A6	52	16465.10	0.005	0.003	0.003	0.002
Boilers	B1	8760	1297.48	0.050	0.076	0.073	0.057
	B2	8760	997.72	0.038	0.059	0.056	0.044
Cooling Towers	C1	5136	37.64	0.022	0.029	0.022	0.025
	C2	5136	37.64	0.022	0.029	0.022	0.025
	C3	5136	37.64	0.022	0.029	0.022	0.025
	C4	5136	37.64	0.022	0.029	0.022	0.025
Total Concentration [µg/m³]				**0.139**	**0.182**	**0.169**	**0.139**

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