



Fire Station Electrical Improvements
Assessment of Existing Emergency/Standby Power Systems
City of Aurora

Project #14-130-873

April 15, 2014
Final Report



Fire Station No. 3



Fire Station No. 4



Fire Station No. 5



Fire Station No. 7



Fire Station No. 9



Fire Station No. 10



Executive Summary

Kluber Architects + Engineers was engaged by the City of Aurora to perform an assessment of the existing electrical services at six (6) Aurora Fire Stations. The purpose of this assessment is to assist the City of Aurora with its capital planning efforts. This assessment provides an initial recommendation to increase the reliability of the availability of electrical power at each of these facilities.

The fire stations addressed in this assessment include:

- Station 3: 600 West Indian Trail
- Station 4: 800 Michels Avenue
- Station 5: 730 Hill Avenue
- Station 7: 824 Kenilworth Avenue
- Station 9: 2339 Diehl Road
- Station 10: 2390 W. Illinois Avenue

Kluber recommends installing a permanent diesel generator at each of these facilities and discontinue the use of portable and limited use generators currently used at each of the stations.

The initial budget of total project costs for each of these recommendations includes:

<u>Station</u>	<u>Initial Construction Cost Budget</u>
Station 3	\$137,764
Station 4	\$107,081
Station 5	\$124,554
Station 7	\$0
Station 9	\$113,572
Station 10	\$124,554

Total initial budget of total project cost for all fire station improvements is \$607,523.



Functional Needs Assessment

Each fire station contains a satisfactory emergency power system necessary for the normal occupation and use of these facilities.

A functional need for increased reliability to the electrical system, however, is evident with regards to the role the fire stations serve during disaster recovery.

Fire Stations are an essential component to public safety within our communities and have been deemed critical facilities for disaster recovery. Electrical power is vital to recovery and post-disaster operations.

Kane County Illinois is subject to natural hazards that threaten life and health and have caused extensive property damage. Floods struck the County in 1993, 1996 and 2007, blizzards in 1999 and 2000 and tornadoes in 1990, 1991 and 1993¹.

Recent disaster recovery efforts have shown that facilities with functional alternate sources of power were better equipped to continue operations after the storms than those that were left completely without power. At critical facilities where emergency power was not available or generators failed as a result of inundation, mechanical, electrical, and communications systems became partially or completely unusable².

Based upon these industry needs, the National Electrical Code (NFPA 70) introduced new code requirements for critical operations power systems in its 2008 edition.

¹ Data provided by Natural Hazards Mitigation Plan, Kane County, Illinois originally published September 2003, Updated August 2009.

² Data provided by 2013 Illinois Natural Hazard Mitigation Plan published October 2013.

Selection Criterion

Kluber recommends utilizing an alternate power source that has on-site fuel storage capabilities for use during disaster recovery periods. Public utilities, available resources and transportation may be hampered or disrupted during these events. Diesel engines are well suited for this application due to their efficient fuel usage and demonstrated reliability and were selected as the alternate power system of choice.

The deployment of diesel fuel should also be addressed. The quantity of fuel storage on site affects both the cost of maintenance of this fuel supply as well as the level of safety required in the handling of large quantities of fuel. The burning of diesel fuel is regulated by emissions standards and care must be exercised in the selection of this equipment. An on-site fuel supply that is independent of utility supply for 72 hours is required.

Fire stations are inherently functional by design and few electrical loads exist that are unrelated to fire department operational functions. The cost of segregating necessary versus unnecessary loads outweighs the cost associated with including these loads within this system. The costs of construction as well as the disruption of the facilities during construction are greatly reduced by limiting the construction activities to the main electrical service area. The marginal increase in generation capacity is not significant in the size of this alternate power source. Kluber recommends that this system be classified as optional stand-by system to allow the greatest flexibility.

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Fire Station Electrical Improvements – Reliability Assessment



Summary of Existing Electrical Service Characteristics

The table hereafter summarizes the electrical service voltages and ampacities for each fire station.

Station	Voltage	Phase	Ampacity	Connection
3	120/208	3 phase	400	Wye
4	120/240	3 phase	200	Delta
5	120/208	3 phase	400	Wye
7	120/240	1 phase	200	Center Tap
9	120/208	3 phase	400	Wye
10	120/208	3 phase	225	Wye

Summary of Existing Load Profile (kVA)

The table hereafter summarizes the various loads connected at each of the fire stations. Plug loads and interior lighting loads were based upon square footage allowances.

Station	HVAC	Interior Lighting	Exterior Lighting	Plug Load	Doors	Exhaust Systems	Other	Total
3	36.1	5.7	1.3	7.6	1.4	5.6	.6	52.8
4	21.4	5.0	1.5	6.7	1.4	5.6		40.7
5	17.2	7.8	2.2	10.4	1.3	5.6		46.7
7	Not reviewed							
9	24.5	7.8	1.9	10.4	1.3	5.6		53.5
10	20.1	7.8	1.9	10.4	1.3	5.6		45.3
Total	1119.3	34.1	8.8	45.5	6.7	28.0	.6	239.0

Summary of Recommended Generator Sizes

The table hereafter summarizes the recommended generator sizes for each of the fire station sites. Kluber utilized Electric Power SpecSizer Version 2.9.0.

Station	Generator Size (kVA)
3	156
4	100
5	156
7	No Recommendation
9	125
10	156



Station 3

Address: 600 West Indian Trail, Aurora Illinois 60506

Description: Station 3 serves as the battalion headquarters for the west side as well as the fueling depot for the west side.

Significant Findings:

The utility service equipment is located on a dedicated overhead utility pole located on the south perimeter of the south parking lot.

The service lateral conductors extend underground to the metering equipment and main distribution panel located within the center of the building adjacent to the apparatus bay area.

Load Profile:

Description	Load (kVA)
HVAC	36.1
Lighting	5.7
Exterior Lighting	1.3
Plug Load	7.6
Doors (Intermittent)	1.4
Fuel Dispensing (Intermittent)	.6
Vehicle Exhaust (Intermittent)	6.3
Total Running kVA/kW	52.8/45.1
Total Starting kVA/kW	225.6/110.2

Generator Size: 125kW/156kVA

Recommendation: Provide a new 156 kVA diesel generator along the south perimeter of the parking lot. Modify the main electrical service at its current location. Replacement of the electrical panels is also recommended at this location within the next 5 to 10 years due to age of equipment.



Station 4

Address: 800 Michels Avenue, Aurora, Illinois 60505

Description: Station 4 serves as the main training facility.

Significant Findings:

The service lateral conductors extend to the utility overhead pole a significant distance from the building.

The main distribution panel board and metering equipment are located within the interior of the building adjacent to the apparatus bay.

A 6000 watt portable generator with a permanently mounted 6 circuit manual transfer switch/panel is located within the electrical room.

Load Profile:

Description	Load (kVA)
HVAC	21.4
Lighting	5.0
Exterior Lighting	1.5
Plug Load	6.7
Doors (Intermittent)	1.4
Vehicle Exhaust (Intermittent)	5.6
Total Running kVA/kW	40.7/35.3
Total Starting kVA/kW	1498.4/74.1

Generator Size: 80kW/100kVA

Recommendation: Provide a new 100 kVA diesel generator along the west property line and modify the main electrical service at its current location. Replacement of the electrical panels is also recommended at this location within the next 5 to 10 years.



Station 5

Address: 730 Hill Avenue, Aurora, Illinois 60505

Description: Station 5 serves as Battalion headquarters for the east side of Aurora.

Significant Findings:

The building is serviced from a dedicated pad-mount transformer located adjacent to the building with service equipment located at the north exterior wall.

A 6000 watt portable generator with a permanently mounted 6 circuit manual transfer switch/panel is located within the electrical room.

A 43 kVA natural gas spark-ignited generator is located near the main service.

Load Profile:

Description	Load (kVA)
HVAC	17.2
Lighting	7.8
Exterior Lighting	2.2
Plug Load	10.4
Doors (Intermittent)	1.3
Vehicle Exhaust (Intermittent)	5.6
Total Running kVA/kW	46.7/34.5
Total Starting kVA/kW	175.4/111.1

Generator Size: 125kW/156kVA

Recommendation: Provide a new 156 kVA diesel generator located along north perimeter of the building adjacent to the main electrical service. Provide new service distribution at the building exterior at the north building wall.



Station 7

Address: 824 Kenilworth Avenue, Aurora, Illinois 60506

Significant Findings:

The service lateral conductors extend to a utility overhead pole a significant distance from the building.

At the Owners request, analysis of Station 7 was not included in this assessment.



Station 9

Address: 2339 Diehl Road, Aurora, Illinois 60505

Description: Station 9 houses the communications room.

Significant Findings:

The building is serviced from a dedicated pad-mount transformer located adjacent to the building with service equipment located at the south exterior wall.

A 6000 watt portable generator with a permanently mounted 6 circuit manual transfer switch/panel is located within the electrical room.

A 43 kVA natural gas spark-ignited generator is located near the main service.

Load Profile:

Description	Load (kVA)
HVAC	24.5
Lighting	7.8
Exterior Lighting	1.9
Plug Load	10.4
Doors (Intermittent)	1.3
Vehicle Exhaust (Intermittent)	5.6
Total Running kVA/kW	53.5/39.1
Total Starting kVA/kW	165.1/101.5

Generator Size: 100 kW/125kVA

Recommendation: Provide a new 125 kVA diesel generator located along north perimeter of the building adjacent to the main electrical service. Provide new service distribution at the building exterior at the north building wall.



Station 10

Address: 2390 West Illinois Avenue, Aurora, Illinois 60506

Description: Station 10 is typical prototype plan.

Significant Findings:

The building is serviced from a dedicated pad-mount transformer located adjacent to the building with service equipment located at the south exterior wall.

A 5000 watt portable generator is available. This fire station has experienced several recent electrical outages due to unreliable utility service.

Load Profile:

Description	Load (kVA)
HVAC	20.1
Lighting	7.8
Exterior Lighting	1.9
Plug Load	10.4
Doors (Intermittent)	1.3
Vehicle Exhaust (Intermittent)	5.6
Total Running kVA/kW	45.3/36.5
Total Starting kVA/kW	158.6/89.2

Generator Size: 125 kW/156kVA

Recommendation: Provide a new 156kVA diesel generator located along south perimeter of the building adjacent to the main electrical service. Modify existing main distribution equipment within the main electrical room.



Appendix A

Peak Demand

The utility electrical bills were reviewed over the past two years to determine the peak electrical demand experienced at each site. The peak electrical demands are a scheduled hereafter.

<u>Station</u>	<u>Date</u>	<u>Peak Demand</u>
Station 3	8/19/2013	33.03
Station 4	6/17/2013	18.46
Station 5	7/23/2012	28.2
Station 7	7/10/2012	16.77
Station 9	7/12/2012	29.07
Station 10	8/31/2012	32.96

