

Emergency Power Supply Systems (EPSS)

- A Case History-
- New NFPA 99 and 110 Standards-
- Hurricane Sandy-

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Case History

9 Meg Power Plant
Blends in with the environment
Easily serviced during a storm
No available real estate
Can't make any noise.

There was this doctor's driveway....

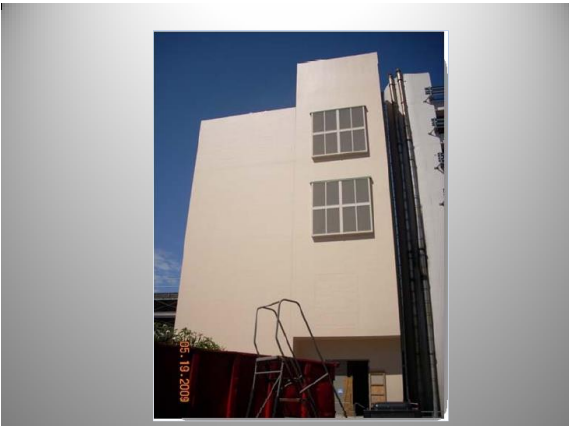




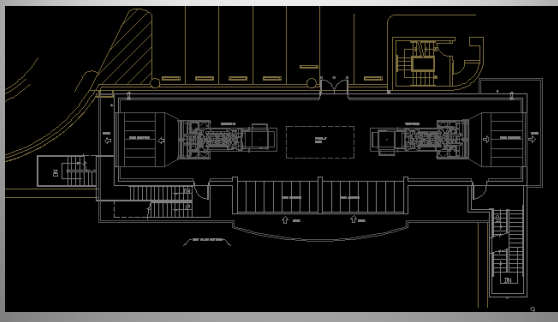






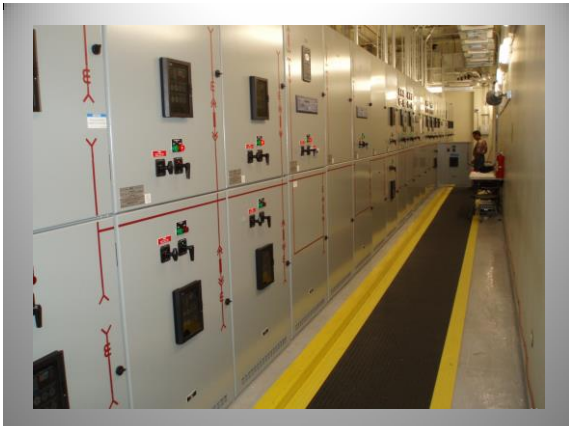


3rd and 4th Floor - Generators



Back To Back Cats





Blended with Environment and No Noise





Joint Commission, CMS and DNV Reporting

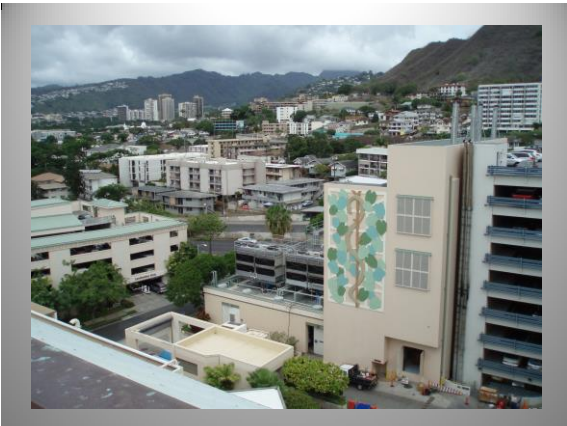
JCAHO Report - Vanderbilt University Medical Center (Gen 1)							
Date And Time		Sunday, September 24, 2006 12:08:13 PM					
Descriptions	Unit	Run Request	CB Closed	Start Of Test	Stage 1 Complete	Stage 2 Complete	Stage 3 Complete
Volts							
AB Volts	0	4161	4158	4163	4163	4163	4163
BC Volts	0	4156	4171	4163	4166	4166	4166
CA Volts	0	4150	4150	4150	4150	4150	4150
Amps							
A Amps	0	0	70	105	105	105	105
B Amps	0	0	88	106	106	106	106
C Amps	0	0	89	105	104	104	104
Frequency	Hz	0.00	60.03	59.98	60.00	60.00	60.00
Generator Output	kW	0	450	750	748	748	749
Air Coolant Temp	deg F	104	104	179	179	179	179
Exhaust Temp #1	deg F	86	86	764	800	800	800
Exhaust Temp #2	deg F	86	86	765	876	876	876
Oil Pressure	PSI	1	1	60	60	60	60
Filtered Oil Pressure	PSI	1	1	6	6	6	6
Engine Speed	RPM	0	0	1799	1798	1801	1801
Percent Engine Load	%	0	0	33	50	50	50
Time		12:08:13 PM	12:08:25 PM	12:39:56 PM	12:52:46 PM	1:12:46 PM	1:12:51 PM
Test Status		INACTIVE	INACTIVE	ACTIVE	ACTIVE	ACTIVE	PASS

Camouflaged!



Serviceability





Typical Project Planning Flow Chart

1. Enthusiasm
2. Disillusionment
3. Panic and hysteria
4. Search for the guilty
5. Punishment of the innocent
6. Praise for the nonparticipants.

Un-adopted Standards

Of obvious importance is the total awareness of codes and standards being used by all AHJs and accreditation agencies. Non-compliance can have catastrophic consequences. However, when later editions of the same codes and standards are published and made available to the general public they become accessible to plaintiff's attorneys and often used in legal actions against hospitals. Whether or not these codes/standards have been adopted by the aforementioned entities isn't always germane. (Discoveries in 7 cases following Hurricane Katrina involved questions re standards that had not been "adopted". The same thing is now happening in the wake of Sandy.)

Un-adopted Standards

I think it advisable to discuss these later "un-adopted" standard modifications/editions with counsel, or other C level managers, to ascertain the value/benefit of compliance with these standards in terms of economics, safety and reliability...especially if it does not hinder current operations nor result in non-compliance of currently adopted standards.

EPSS Maintenance and Testing NFPA 110, 2010 ed.

¶1.3: Application "This document applies to new installations of EPSSs, except that the requirements of Chapter 8 [maintenance and testing] shall apply to new and existing systems. Existing systems shall not be required to be modified to conform, except where the authority having jurisdiction determines that nonconformity presents a distinct hazard to life."

Outdoor EPS Installations NFPA 110, 2013 ed.

¶7.2.2.1 The EPS shall be installed in a suitable enclosure located outside the building and capable of resisting the entrance of snow or rain at a maximum wind velocity as required by local building codes.

¶7.2.2.2 EPSS equipment shall be permitted to be installed in the EPS enclosure.

¶7.2.2.3 No other equipment, including architectural appurtenances, except those that serve this space, shall be permitted in the EPS enclosure.

Tank/Fuel Purity NFPA 110, 2013 ed.

¶7.9.1.3 Tanks shall be sized so that the fuel is consumed within the storage life, or provisions shall be made to remediate fuel that is stale or contaminated or to replace stale or contaminated fuel with clean fuel.

Provisions for a Portable NFPA 110, 2013 ed.

¶8.1.2 Consideration shall be given to temporarily providing a portable or alternate source whenever the emergency generator is out of service and the criteria set forth in Section 4.3 cannot be met [10 second requirement].

Fuel Quality Test NFPA 110, 2013 ed.

¶8.3.8 * A fuel quality test shall be performed at least annually using tests approved by appropriate ASTM standards. [D975]

Standby Nameplate Rating NFPA 110, 2013 ed.

¶8.4.2* Diesel generator sets in service shall be exercised at least once monthly, for a minimum of 30 minutes, using one of the following methods:

- (1) Loading that maintains the minimum exhaust gas temperatures as recommended by the manufacturer
- (2) Under operating temperature conditions and at not less than 30 percent of the EPS standby nameplate kW rating

10 Second Requirement NFPA 110, 2013 ed.

¶8.4.6.2 The criteria set forth in Section 4.3 and in Table 4.1(b) shall not be required during the monthly testing of the EPSS. If the criteria are not met during the monthly test, a process shall be provided to annually confirm the capability of the system to comply with Section 4.3.

10 Second Requirements NFPA 99, 2012 ed.

¶6.4.4.1.1.2 The 10-second criteria shall not apply during the monthly testing of an essential electrical system. If the 10-second criteria is not met during the monthly test, a process shall be provided to annually confirm the capability of the life safety and critical branches to comply with 4.4.3.1. Maintenance shall be performed in accordance with NFPA 110, *Emergency and Standby Power Systems*, Chapter 8.

Annual Load Test – if Needed NFPA 110, 2010 ed.

¶ 8.4.2.3: Diesel-powered EPS installations that do not meet the requirements of 8.4.2 [monthly test] shall be exercised monthly with the available EPSS load, and shall be exercised annually with supplemental loads at not less than 50 percent of the EPS nameplate kW rating for 30 continuous minutes and at not less than 75 percent of the EPS nameplate kW rating for 1 continuous hour for a total test duration of not less than 1.5 hours.

Wet Stacking – Fire Hazard



Insulation Blown Away



Hole

EPSS Operator Education NFPA 110, 2013 ed.

§18.4.8 EPSS components shall be maintained and tested by qualified person(s).

NFPA 20, 9.6.2.2, 2013 Edition

9.6.2.2: The generator shall run and continue to produce rated nameplate power without shutdown or derate for alarms and warnings or failed engine sensors except for shutdown.

9.6.2.3: The generator fuel supply capacity shall be sufficient to provide eight hours of fire pump operation at 100% of the rated pump capacity in addition to the supply required for other demands.

NFPA 20, 9.6.2.2, 2013 Edition

Dan's Note: *NFPA 20, 9.6.2.2 was added in the 2013 edition, so if the AHJ enforces that edition they'll have to comply. The 2014 NEC will probably adopt the changes when that edition comes out and is being enforced. Looks like we'll see a lot more diesel engine driven fire pumps. That make more sense to me anyway than converting electrical generation to drive a motor with all the restrictions on starting voltage drop and now the restrictions on shutdown.*

Hurricane Sandy

Planning for Outside Service Failures

(Most All Problem Issues Were 3rd Party)

Fuel – No Deliveries
 Water Pressure – Absence Of
 Cell Service – No Connection
 Electric Utility Assistance – Lack Of
 EPSS Service Personnel – No Parts

Preparation For LT Outage



From the Roof

Location, Location, Location



Moment of Truth – Loading Dock

Problem - Fuel

Interrupted diesel fuel deliveries because of road conditions and/or no emergency generator at fuel distributor to power pumps for filling tankers.

Possible Solutions - Fuel

- Suggesting fuel distributors invest in an EPSS along with diligent monthly testing according to the standards outlined in NFPA 110 – just like a Type 1 healthcare facility.
- Entering into agreements with multiple distributors.

Possible Solutions - Fuel

- Consider purchasing a 10,000 gallon tanker and leasing to distributor with agreement that tanker be returned to facility filled with fuel before storm. Enter into agreements with local gas stations whereby their diesel fuel could be pumped into facility's tanker during emergencies. Supply filling stations with portable generator to power pumps if power lost to the stations. Leasing of tractor to pull tanker before storm arrives.

Possible Solutions - Fuel

- Topping off main storage tanks.
- Modifying building codes to allow natural gas powered generators for new installations, and to allow retrofitting of bi-fuel apparatus for existing diesel generators. (Once again natural gas was not lost to major hospitals, as was the case during Andrew, Katrina and Irene.)

Possible Solutions - Fuel



Problem – Water Pressure

Interrupted water delivery because of normal power outage at water supply authority. No emergency generator on-site to power pumps.

Possible Solution - Water

- Suggest water authority invest in an EPSS and test according to NFPA 110 standards – just like a Type 1 healthcare facility. Require annual testing of EPSS and pumps under full load for 4 continuous hours.
- If water authority cannot afford a generator suggest the installation of a connection cabinet for use with portable generator.
- RWJ loaned one of their Non-Essential Generators to city of New Brunswick. (See Article)



Problem – Cell Service

Failure of cell phone service resulting in inability to communicate with contractors and service personnel outside the facility. Twenty four hours after the power outage all communication with outside service personnel was lost. The reason cell service failed was because the cell tower generators, which power transmission gear and HVAC, ran out of fuel. The diesel belly tanks, or day tanks, normally found at tower sites only contain maybe 24-36 hours of fuel when running at full load. (The loads on the generators will increase with escalated phone usage resulting in higher operating temperatures and increased load on the HVAC.)

Solutions – Cell Service

- Encourage your cell service company to invest in larger tanks (96 hour minimum burn time) as part of the facility's contract for cell services.
- Require vendor to test EPSS according to the standards outlined in NFPA 110 – just like a Type 1 healthcare facility.
- Discuss the possibilities of using natural gas or bi-fueled generators.

Problem - Electric Utility Connections

Although plans had been made to connect trailer mounted generators to “non-essential” boards in order to provide 100% backup for the facility in case of long term outages, electric utility personnel were unable to travel so as to make connections inside vaults.

This required connections to transformers and other utility owned, and secured, equipment.



Solutions – Electrical Utility Connections

- If utility employees are unable to access the site hospital electricians and/or electrical contractors familiar with the hospital's distribution system should be trained to cut locks, dress in appropriate PPE (NFPA 70E demands it), cut locks and make connections.
- Training to be led by utility supervisors
- One-lines updated and placed in vaults
- Sequence of operations posted in vaults

Do It Yourself – Cutting Locks

Being Careful - PPE

Solutions – Electrical Utility Connections

- New CEP
- Larger Generators and Switchgear
- Adding Another Feed

Problem - EPSS Parts and Service

- EPSS contractors were unable to reach facilities to perform repairs.
- Inaccessibility of parts to make repairs

No Dealer – No Parts



Solution – EPSS Parts

Hospital staff should be trained to perform services at least at the level of what would be completed during an annual generator service. We suggest in-service programs where at least one staff member assists with normal annual servicing, and the inspection of switchgear.

Solution – EPSS Parts

Stock OEM manuals, tools and hi-mortality parts as per NFPA 110, which states:

- 8.2.2 For Level 1 systems, instruction manuals shall be kept in a secure, convenient location, one set near the equipment, and the other set in a separate location.
- 8.2.3 Special tools and testing devices necessary for routine maintenance shall be available for use when needed.
- 8.2.4 Replacement for parts identified by experience as high mortality items shall be maintained in a secure location(s) on the premises.
- 8.2.4.1 Consideration shall be given to stocking spare parts as recommended by the manufacturer.

Risk Analysis

Note: A risk analysis and evaluation of ALL components of the EPSS should be made by experienced individuals (those who have supervised the landing of multiple wires and the turning of several wrenches) and then tested under worst case scenarios. An EPSS consists of 8 major sub-systems and 175+ components, all of which can fail because of non-compliant code provisions or “best practice” protocols

N+1, or No

In regard to "N+1" systems ANY single point of failure can erase redundancy. For example, consider 4 paralleled generators utilizing a single cooling tower, or maybe 5 paralleled generators being fueled from a single day tank with only a single pump. An assessment must be made to determine whether you truly have an N+1 EPSS...or maybe just an N+1 with an asterisk(*)).

2 x 4 Intrusion

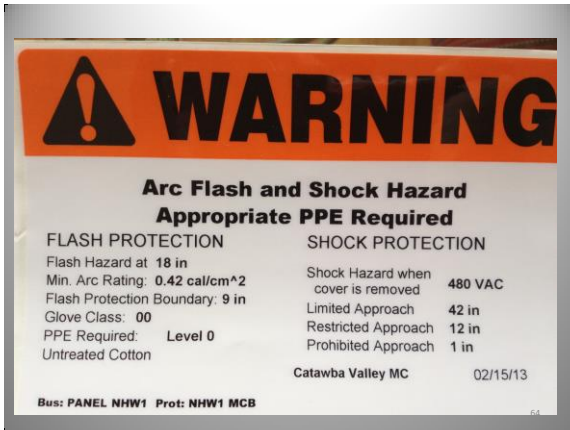
Don't put EPSS stuff on the outside which includes the roof.





The Department of Home Security

We're pretty sure you have the wrong house,
but hey; come on in and let's talk about it.



Medical Cost of AF Survivor

The average medical cost of arc flash survivor is \$1.5M. Obviously this is not a small consideration. Lost work time is also a major factor, as this can total 6 to 8 months of lost work even for the fortunate victims who have relatively minor injury. Often, such a devastating injury ends a worker's career. Noted during the webinar: "many times they don't return to their previous career path. They'll take a job as a clerk, or as a planner or something else. They're not back on the floor with their tool belt." Finally, there is also the aspect of lawsuits that may follow such an accident. The average cost of litigation and settlement costs in an arc flash case is \$5 to 10 million.

Resetting a Breaker

Resetting a breaker can invalidate the arc flash incident energy and category level. Breaker's feeding motor loads are the most "violated" breakers because of "nuisance" trips being treated by dialing the breaker instantaneous setting up.

ASSE 6000 PROFESSIONAL QUALIFICATIONS STANDARD FOR MEDICAL GAS SYSTEMS PERSONNEL



PRESENTED BY:
DAN CHISHOLM JR.
MEDICAL GAS CERTIFICATIONS, INC.

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ASSE 6000

About ASSE and the Standard

- ASSE – American Society of Sanitary Engineering
- The Series 6000 Standard was initially published in 1997
- ASSE 6000 - Professional Qualifications Standard for Medical Gas Systems Personnel
- ASSE does not certify to this Standard and does not provide training

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CERTIFICATION PROGRAMS

ASSE 6000 Series

- 6005 - Medical Gas Systems Generalists - Provides general knowledge of medical gas and vacuum systems.
- 6010 - Medical Gas Systems Installers - Applies to any individual who installs medical gas and vacuum systems.
- 6020 - Medical Gas Systems Inspectors - Applies to any individual who inspects the installation of medical gas and vacuum distribution systems.
- 6040 - Medical Gas Systems Maintenance Personnel - Applies to any individual who maintains medical gas and vacuum systems.

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ONLINE CERTIFICATION

Medical Gas Certifications, Inc.
www.MedGasCerts.com

- **No Time Constraints** - You have 365 days to complete once you begin. Each of the ASSE 6000 courses are self-paced. Schedule your training for when time permits.
- **Available 24x7** - All you need is a computer with internet connection. The ASSE 6005, 6020 and 6040 are completely web based.
- **Technical Questions Answered** - If you need clarification during the course simply submit your question.

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TESTING

100 Questions – 2 Hours

- **Option 1** – Online examination through MGC web site.
- **Option 2** – NITC (National Inspection Testing Certification)
 - Third-party provider of certification services to the Piping Industry
 - 200 ACT Testing Center Locations in US

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HOW-IT-WORKS



Register Online



Take your course and exam



Receive Certificate and Wallet Card

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Re-Certification

All of the ASSE 6000 certificate programs are good for three (3) years. During that three-year period continuing education credits must be obtained for re-certification.

NFPA 99, 2012 Edition

Persons maintaining medical gas systems shall be qualified to perform these operations. Appropriate qualification can be demonstrated through credentialing to the requirements of ASSE 6040, Professional Qualification Standard for Medical Gas Maintenance Personnel. For more information see NFPA 99 5.1.14.2.2.5, 2012 Edition.

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WEB SITE

Medical Gas Certifications, Inc.

www.MedGasCerts.com



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Diesel EPS Combined Monthly, Load Bank and Triennial Test

Percentage of Standby Nameplate	EPS #:	101	Standby kW Nameplate Rating:				1750
100%	Load for Load Bank Test & Last 1 Hour for EPS Loaded < 30%						
95	Base kW Load for Monthly and Triennial Test						
90							
85							
80							
75	www.epssgroup.net						
70							
65							
60							
55							
50	875	1312.5					1312.5
45							
40							
35							
30	525	525	525			525	
25							
20							
Time (mins)	0-30	30-60	60-90	90-120	120-150	150-180	180-210 210-240

