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design PLUS

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Professional Engineering Services
For Mission Critical Industries

designPLUS

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The ***FEA*** designPLUS Newsletter will now be distributed based on the method you chose in our recent questionnaire. We were very pleased with the high response rate and would like to thank everyone who participated. We also received many excellent suggestions for future articles.

If you elected to continue receiving the Newsletter by mail, you have been sent a three ring binder with all previous newsletters and an Index. You will now receive future newsletters quarterly with an updated Index.

If you elected to receive the Newsletter by email, you have been notified by email that the newsletter is available at the ***FEA*** web site. For your convenience, the email provided a link to the ***FEA*** web site "Newsletter" section where you can view or print any newsletter. The Index is also on the web site.

If you would like to change the method of receipt, please feel free to call Linda Sand at 860-677-2285 or email her at lsand@feace.com with your request. Also, if you know of someone who may benefit by receiving the designPLUS Newsletter, please let Linda know.

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CHOOSING A MISSION CRITICAL DESIGN FIRM

by Leo P. Soucy, Jr., P.E. - FEA

During the past few months ***FEA*** has been involved in several mission critical projects, which required substantial upgrade of the infrastructure to meet the Owner's business objective.

In one project, the plan was to upgrade an old data center based on a report provided by a major computer equipment supplier. ***FEA*** was engaged to implement the recommendations. In reviewing the recommendations, we pointed out to the Owner that the proposed upgrades would not provide N+N reliability nor accommodate dual power cord technologies. ***FEA*** provided a management presentation outlining our findings, which resulted in placing the project on hold while the original recommendations were reviewed. Based on the extent of the recommended revisions it was also decided to look at the construction of a new data center that would incorporate 21st century mission critical design concepts. ***FEA*** provided a preliminary design with probable construction costs for the new facility to assist upper management in making an informed decision. The project review delayed the hardening of the existing data center but little work had been implemented on the original marginal recommendations so there wasn't much of a cost impact.

In another project, ***FEA*** was to extend base building services to serve a new mission critical facility. In reviewing the base building services it was determined that they would not provide 7x24 redundant services. A major study was conducted which reviewed all critical systems and it was decided to substantially upgrade the existing infrastructure resulting in a large increase to the project budget.

A mission critical facility is a very expensive project. In order to avoid the problems previously discussed it makes sense to carefully choose a consultant on the basis of their ability to do the job, and not exclusively on price.

In order for the Owner to evaluate a consultant's experience, you should request a list of previous mission critical projects they have completed and talk with the Owner's of these projects including a tour of the facilities. You should also find out if the firm belongs to any associations devoted to mission critical design. Another excellent approach is to talk with the salesmen and vendors of mission critical equipment - chillers, air conditioning, uninterruptible power supplies, generators and switchgear - asking if this consultant is knowledgeable in 7x24xForever mission critical design concepts, or if they can recommend consultants that are.

Designing numerous mission critical facilities is one of the best ways to develop mission critical design experience. The design concepts necessary for mission critical systems are often not obvious until implementation and start-up in the field. Experience is the best teacher. Any firm that performs comprehensive integration testing of mission critical systems in addition to the basic design will have gained extensive field expertise in system reliability and equipment inter-relationships. A consultant engaged in mission critical design should provide extensive testing services including on-site review, factory witness testing of critical equipment and extensive integration testing of the various systems.

Along with distributing the Newsletter electronically, we have updated our web site. We encourage you to visit it at www..feace.com and provide any comments you may have.

PLANNING CRITICAL SUPPORT SYSTEMS FOR DATA CENTERS

*by William H. Flaherty , P.E. - **FEA***

When Information Technology (IT) planners decide they need a particular amount of raised floor space to accommodate their equipment, serious thought must be given to providing space for critical support systems such as UPS, back-up generation and cooling. Mechanical and electrical rooms must be sized in proportion to the load requirements (watts per square foot) and reliability level (N+0, N+1, N+2, N+N, etc.) of the data center to be supported. Additional space must be considered for locating cooling towers (if required), fuel storage and water storage. In addition to equipment spaces to handle critical loads, space for support of non-critical loads such as office area HVAC and lighting must be planned.

Often, at the preliminary design stage of a project, it is necessary to develop quick square foot estimates of the space necessary to house the mission critical utility support equipment. ***FEA*** has developed estimating models to assist Owners in determining the overall building size. Unfortunately, if this is not adequately addressed in the preliminary stages of a project, the building size and associated budget may be grossly inadequate.

FEA has designed many data centers and is presenting the following scenario, which covers a typical case. It should be noted that substantial additional square footage must be provided beyond that which is needed for the IT equipment.

Project Business Objective:

Develop the space planning requirements for a data center that will have 40,000 sq. ft. of raised floor for IT equipment. The following are to be the technical design parameters for the utility support systems:

1. The load will be 50 watts/sq. ft.
2. UPS system to be N+N redundant.
3. Mechanical and electrical generator systems to be N+1 redundant.
4. Cooling air will be distributed under the raised floor.
5. Down flow computer room air conditioning (CRAC) units will be used to provide N+25% redun dant cooling for the IT equip ment.
6. PDU's will be located on the raised floor.
7. The distribution to the raised floor will be 480 Volt.
8. UPS system to have wet cell batteries stacked two high on their racks in dedicated battery rooms.
9. Generators will be located inside the building envelope with sound abatement silencers on the inlet and outlet cooling air openings.
10. Building envelope comfort heating and cooling are not considered as part of this estimate and would depend on how much office space, if any, would be part of the data center.

After determining the space requirements to handle UPS, STS, switch gear, chillers, generators and other facility equipment to support 50 watts/ sq. ft., the following would be the recommended square footage to be considered:

Mechanical	1,900	square feet
Electrical	13,000	square feet
Total	14,900	square feet

Based on the original 40,000 square feet of raised floor, an approximate 40% increase in additional building space will be required for facilities support. Also, approximately 5,000 square feet should be allocated to PDUs, STSs and A/C units on the raised floor. Office space requirements and their support equipment would also increase the total square footage.

The above scenario serves to illustrate that planning for new Information Technology requirements must also consider the interrelationships between 7 x 24 facilities requirements as well as provisions for the actual processing equipment space. The 40% additional space required is for this specific design criteria taking into account the raised floor area, load density, redundancy requirements and is not a general "rule of thumb" to be applied across any project. A consulting engineering firm experienced in this type of planning and design should be brought on board at the earliest stages of the process to insure that there is sufficient space to house the mission critical utility infra-structure.

EMERGENCY GENERATOR AIR PERMITTING CONSIDERATIONS

Most emergency generators are powered by reciprocating engines that use distillate oils. Due to the operating characteristics of such engines, emergency generators have the potential to emit significant amounts of air pollution, especially nitrogen oxides (NOx). For example, the potential NOx emissions from a typical 2,000 kW generator powered by a diesel engine may be as high as 280 tons per year. The NOx emissions from such a generator restricted to 500 hours of operation per year are approximately 16 tons.

Emergency generators are considered stationary sources of air pollution and may require air pollution permits before they are installed and/or operated. If air pollution permits are necessary, several months may be required to prepare the applications and obtain the permits. There are two general types of air pollution permits; permits for specific pieces of equipment and permits for the premise or facility that includes the equipment. There are circumstances that could require both kinds of permits for the installation of emergency generators.

The applicability of air pollution regulations to emergency generators is usually a function of the potential emissions of the generator and the total potential emissions of all the air pollution emitting equipment at the facility where the generator is to be located. Certain areas of the country, where the National Ambient Air Quality Standard for ozone is exceeded, have more restrictive regulations for NOx emission sources, since NOx is known to contribute to the formation of ozone in the lower atmosphere. Such regulations may complicate the permitting of emergency generators.

Fortunately, many states have simplified air permitting mechanisms or exemptions from permitting for small emergency generators and emergency generators located at facilities without many other sources of air pollution. However, there is no way to determine what the possible permitting options are without carefully reviewing the specific situation. Furthermore, even if a permit is not required, there still may be fuel restrictions, exhaust stack requirements, record keeping, monitoring, and reporting requirements that need to be considered before the equipment is purchased and installed.

Before the planning for any project involving emergency generators is finalized, it is in the owner/operator's best interest to perform an evaluation of how the local air pollution regulations apply to the proposed project. A professional, who has air pollution permitting and air compliance experience, should perform the analysis. If internal resources for such an analysis are not available, an outside expert should be employed.

FEA *would like to thank Raymond F. Yarmac of SCI-TECH, Inc. for furnishing the information for this article.*

Interesting Facts

FEA has a capacity increase project for a corporate data center, which has experienced a 200% load increase in 2 ½ years. This company is at the leading edge of e-commerce and Internet customer interaction.

Another client is seeing double-digit load growth in only 18 months, which will require providing added UPS and chiller capacity.

These are two examples of large load increases that have occurred since the introduction of CMOS technology. Up until now, we have mainly seen the load decrease or remain fixed.

NFPA 110 was recently revised to require that all emergency generator fuel be consumed within the storage life, be replaced periodically or have a fuel polishing system installed

Policy

designPLUS Newsletter is published to keep the readers current with the latest trends in mission critical systems.

Correspondence

FEA welcomes any letters, articles, reports and comments for publication. Please mail, fax or email written material to:

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