EHS DESIGN GUIDELINES FOR EMERGENCY GENERATORS

TABLE OF CONTENTS

I. GENERAL

A. BACKGROUND

Emergency generators are required for many of the new building designs based upon the State Building codes that address ventilation for toxic and highly toxic materials, elevators as means of egress, high rise buildings, fire pumps and more. The primary environment, health and safety issues relate to noise and generator air emissions. Most of the generators on the UNC Campus are powered by diesel fuel. Diesel generators emit NOx, hydrocarbons, particulates, CO and SOx. Diesel exhaust is considered a respiratory irritant and a suspect carcinogen. In the near future, tightening of air emission regulations are expected for stationary diesel engines as they are for on-road diesels engines.

B. Generator Location

Sighting the generator must begin in the Building Programming phase. All parties concerned with the generator should provide tentative approval for the "best" location of the generator and stack along with at least 2 alternate locations for the generator, stack or both. Each generator installation must meet the requisite NFPA, electrical and NC building code requirements, the local City noise ordinance (when close to the property boundary) and the manufacturer's specifications.

C. Additional Design Location Requirements

1. The design should accommodate the following additional requirements. If a specification cannot be met, an explanation shall be provided for further evaluation by the EHS Department.
2. The generator exhaust must discharge vertically for maximum dispersion modeling.
3. The rain cap shall fully open without impeding the vertical discharge while the generator is operating.
4. Ensure the exhaust is clear of trees, combustible materials and pedestrian traffic to avoid fires and burn hazards (discharge temperatures are over 1000 degrees F).
5. Control noise exposures in adjacent occupied building spaces below 60 dB averaging for the speech frequencies of 500, 1000, 2000, 4000 and less than 80 dBA .
6. Noise levels 1 meter away from the generator and 1 meter from the ground shall be 82 dBA or less at all locations around the generator as installed.
7. Locate generator in area that is not subject to flooding.
8. In confined areas, provide for direct reading exposure monitoring for generator operators (NOx, CO, O2).
9. Provide for spill catchments for diesel tank storage filling operations.(overfills, drips etc.)
10. Position the exhaust point above roof level and away from air intakes.
11. Provide an above ground fuel tanks with integral secondary containment
12. Provide for sufficient equipment spatial clearances for maintenance and repair personnel to access all sides of the generator in confined buildings or vaults.
13. Exposure monitoring equipment may be required for generator maintenance personnel working on the generator in confined areas.
14. Plan for fueling accessibility and spill control during fueling
15. Guard the exhaust stack to prevent burns or fire hazards

D. Emissions Modeling

Based upon the "best" location, the architects/engineers will provide the EHS Office with the key information requested in the attached emergency generator form. The EHS Office will provide this detailed information on the generator to an Environmental Engineering consulting firm in order to mathematically model both environmental emissions and personnel exposures around the generator. The Environmental Engineers will evaluate the emissions against;

1. EPA standards for Ambient Air Quality

a) Proximity of receptors
b) Passersby
c) Open windows
d) Building air intakes
e) Confined spaces

2. Recommended Personnel Exposure Limits

a) < 1ppm NO2 in 15 min. (NIOSH STEL) {assume NO2 is 34% of total NOx from RWDI- Science Complex Study '02}
b) <0.02 mg/M3 respirable, Elemental Carbon (EC) (ACGIH Notice of Intended Changes) {assume 40% of total particulate matter is EC from www.dieselnet.com/standards/us/ohs.html}
c) 4000:1 dilution or greater from the generator stack discharge- typically reduces the nuisance odors to nondetect levels for 50% of the population (from RWDI)

E. Approval

When the modeling is completed, a confirmation letter from EHS Department will be provided to the UNC Design Coordinator if all of the criteria are met. If the generator emissions exceed allowable limits, the deficiencies will be noted. Correcting the deficiencies could involve relocating the generator and/or providing additional engineering controls. If the generator or exhaust point is relocated, the emissions must be remodeled. If engineering controls are selected, the anticipated reductions in generated pollutants can be applied directly to the modeled emissions.

F. Additional Design Consideration

1. While not mandatory, these concepts will aid in future reconfigurations of emergency power infrastructure supplied to the campus buildings.
2. Design building electrical distribution to provide automatic load shedding to isolate critical emergency equipment and allow for potential sharing of emergency power units. It is far cheaper to install this equipment when the building is built than performing a retrofit.
3. Combine buildings to share larger generators which are located further from the buildings. Emission controls for the redesigned, larger diesel engines are actively under development and more readily available for purchase.
4. Identify generators that will run with a variety of fuels including ultra low sulfur diesel (<5 PPM sulfur), biodiesel and diesel/water mixtures
5. Potential emission control technologies include water injection, timing adjustments, catalytic conversion, particulate traps etc. If the additional cost is within budget, consider purchasing control technology in confined areas where emissions are marginally acceptable. Modeling is a relatively crude tool and provides only a rough estimate of exposures.
6. Ensure that the new diesel engines to be purchase are adaptable to the emerging control technologies that may be required with new regulations.
7. At a minimum, specifications for new generators should comply with EPA off-road diesel engine Tier I-III standards.

G. Comments for Designers on Selecting New Generators (8/13/03):

1. UNC-Chapel Hill will be included in the RTP non-attainment area for the air pollutant ozone. Since diesel engines emit significant quantities of NOx that contributes to ozone production, they may be more closely regulated. Also, EPA has been regulating off-road diesel engines since 1996. In May 2003, EPA began rule making for the Tier 4 emission reductions required for off-road engines.
2. In most states, including NC, the regulations have been applied primarily to mobile sources. However, in California, they have adopted the EPA standards for stationary sources in 2003.
3. Because emergency generators have a long service life, it is prudent for the University to prepare for future regulations of emergency/standby generators by procuring the latest engine technology. Careful genset specification and purchasing will reduce air pollution now and will enable the addition of less costly emission controls in the future.

H. Desirable emission features for new generators are as follows:

1. The generator should meet at least the most stringent of the applicable EPA Tier 1-3 off-road diesel engine standards without the use of end of pipe exhaust treatment when burning #2 fuel oil. The phase-in schedule for the applicable EPA Tiered emission standards is based upon the engine power output and the calendar date. (Engines which meet EPA's voluntary "Blue Sky Series" requirements will operate even cleaner but may not be available for purchase at this time.)
2. Generator specifications should require that the engine would meet the corresponding emission Tier requirements in the year it is purchased. The manufacturers should be consulted to determine when their lower emitting engines would be available. Delaying a purchase by a few months to buy the next generation of generator could significantly reduce emissions. See www.dieselnet.com/standards/us/offroad.html for details on EPA's emission standards reduction schedule including the Tier 4 proposal. Some manufacturers may try to reduce their emissions sooner than required for the benefit of the buyer. Special consideration should be given to the cleanest burning engines.
3. Emissions modeling will be based upon the generator specifications. Generators must not be substituted by the contractor after bidding without detailed review by EHS.
4. The generator engine must be capable of running on the full spectrum of diesel fuels from heating oil (diesel fuel #2), low sulfur, ultra-low sulfur, and no sulfur fuel to biodiesel.
5. Sufficient space should be provided around the generator for emissions equipment upgrades should they be required in the future.

II. EMERGENCY GENERATOR DATA SHEET

The following information should be included to expedite the processing of the application for a Certification of Approval. If more than one emergency generator is being applied for, please fill out one of these data sheets for each emergency generator or include the information contained below in a summary table.

A. Please provide a brief description of the intended use of the emergency generator.
B. Where will the generator be located? (e.g., indoors, outdoors in enclosure)
C. Identify the fuel being used (e.g., diesel oil, natural gas, etc.)
D. What is the unit rated for? (in kW)
E. Provide exhaust emission data and exhaust building/enclosure, then the exhaust flow rate (actual m3/s) and temperature (Celsius degrees) are required.
F. Provide the stack exit diameter (in metres)
G. Provide the stack height above the roof (in metres).
H. H. Provide the stack height above grade (in metres).
I. I. If the generator is located indoors, please provide the following:

1. Building dimensions (including dimensions of all buildings within 5L of the generator (5L is 5 times the lesser of the height or projected width of the buildings).
2. Building elevation(s)
3. Location of the exhaust stack
4. Location of the property line

J. If the generator is located outdoors in an enclosure, please provide the following:

1. Enclosure dimensions (length, width, height)
2. If the enclosure is within 5 metres of any other structures, include the dimensions of that structure as well
3. Location of exhaust stack
4. location of property line

K. Provide the distance from the ventilation openings for combustion air intake/exhaust or the combustion exhaust stack (whichever is closer) to the nearest residential property line (if the residences are located on-site, then provide the distance to the nearest residential receptor).
L. If there are any sensitive receptors (e.g., hospital, school, nursing home, day care center) within 500 metres of the exhaust stack, please provide details of their location
M. Provide exhaust emission information, if available. Include equipment data sheet, if available
N. Is the required fuel readily available on campus?
O. Provide the maximum sulfur content of fuel to be burned

(END OF SECTION)