*Jill’s “Ye Liste of Nine”… this document may or may not follow the Liste*

*3.         Change permitting requirements for emergency generators and small natural gas or oil-fired equipment*

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| No. | Comment | Answer |
| Clarify and update air quality rules | | |
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| Change permitting requirements for emergency generators and small natural gas or oil-fired equipment | | |
| 27 | AOI:  Source Category Table (OAR 340-216-8010)  The Department’s proposed list of source categories that require an ACDP, OAR 340-216-8010, repeats two problems noted in the comments above.  First, source category number 87 on Part B of the list would apply to certain emergency generators and firewater pumps, i.e., those with “emissions, in aggregate, [] greater than 10 tons for any regulated pollutant based on 100 hours of operation or some other hours of operation specified in a permit.” Comparing emergency unit emissions to an artificially high 100 hours of operation threshold could needlessly subject many sources with inconsequential actual emissions from these units to permitting requirements. AOI thus requests that the Department change the permitting threshold for this source category such that permits would only be required for “emergency generators and firewater pumps, the actual emissions from which over a calendar year, in aggregate, are greater than 10 tons for any regulated pollutant.” Second, source category number 89 on Part B of the list would apply to any portable sources the Department determines present “an air quality concern,” “significant malodorous emissions,” or actual emissions over specified levels. The Department lacks jurisdiction to regulate portable, mobile or nonroad sources unless they are or are part of a stationary source. Accordingly, we request that the Department either delete proposed source category 89entirely or revise it to make clear that it only applies to portable sources that are or are part of a stationary source. | See gfd’s response to comments at the end of this document, starting on page 12. Note the use of footnotes. Don’t know if footnotes are compatible with the way the final RTC will be formatted.  George |
| 28 | PGE:  PGE does not support changes in the definition of emergency generators and pumps in OAR 430-0200-0020(23)(uu) to include emergency engines or pumps greater than 500 hp or with aggregate emissions greater than de minimis thresholds. The regulatory burden will be disproportionally large given the insignificant emissions of such units. | See 29 |
| 29 | Associated Oregon Industries, Oregon Association of Clean Water Agencies, The Western States Petroleum Association (WSPA)  (3):  DEQ proposed revisions to the categorically insignificant activity category for emergency generators and pumps are overly broad and overreaching. DEQs proposal would make the definition of categorically insignificant emergency generators much too narrow, and impose new costs and administrative burdens on myriad sources with emergency generators the emissions from which are clearly insignificant. To fix this, AOI asks the Department to make the following two edits to its proposed definition of the emergency generator categorically insignificant activity category:  First, the Department should eliminate part (B) of the proposed definition. The mere fact that a source has an emergency unit rated at 500 horsepower or greater does not reflect the source’s actual emissions from that unit, or other of its emergency generators.  Second, the Department should revise part (A) of the proposed definition to clarify that the assessment of a source’s aggregate emergency generator emissions should be made by reference to actual emissions from those units over the calendar year. In particular, we request that part (A) be revised to state: “The actual aggregate emissions from stationary emergency generators and pumps over a calendar year are greater than the de minimis level for any regulated pollutant.”  The vast majority of sources lack any incentive to actually operate their emergency generators for any longer than is necessary. For the overwhelming majority of sources, estimating emergency generator emissions by reference to the 100 total readiness testing hours of operation allowed by applicable NSPS or NESHAP requirements would grossly exaggerate emissions from those units. Such sources (and DEQ) would bear new costs and regulatory burdens (e.g., construction approvals, permit modifications, emission factor development) disproportionate to the insignificant emissions from those units. To avoid these unintended consequences, DEQ should define categorically insignificant emergency generators by reference to the actual emissions from those units.  Insignificant emission units – small natural gas and oil fired units could require permitting that is currently exempt from permitting. It is important to note that many wastewater treatment plants are REQUIRED by the DEQ water quality permitting program to install and maintain backup generator sources of power.  DEQ should not impose the more restrictive definitions of Categorically Insignificant Activities (OAR 340-200-0020) and corresponding additions to the list of categories requiring an ACDP (OAR 340-216-8010), because they appear to have little or no benefit but increase permitting burdens |  |
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| 42 | Associated Oregon Industries:  DEQ should not change the current definition of “categorically insignificant activity,” which includes “[n]atural gas and propane burning equipment rated at less than or equal to 2.0 million Btu/hr.” OAR 340-200-0020(20)(d). Emissions from such equipment are insignificant, it would be inappropriately costly (to sources and of the Department’s limited resources) to subject this equipment to the full extent of regulation under the state’s air quality rules.  DEQ proposes to limit the small natural gas and propane burning equipment qualifying as a categorically insignificant activity. This would dramatically reduce the universe of small natural gas and propane burning equipment qualifying as categorically insignificant. Under the proposed language, 2.0 million Btu/hour natural-gas fired hot water heaters used for heating a dozen of buildings will no longer qualify as categorically insignificant only because the facility also operating a single natural-gas fired 40 million Btu/hour boiler for industrial processes. DEQ’s proposed language will subject (for the first time) a vast array of equipment with truly trivial emissions to regulation, with all attending costs and administrative burdens, but without any proportionate benefit to human health or the environment. Most problematic, every one of those 2.0 million Btu/hour water heaters will now require a notice of construction (NOC). Such a requirement would be administratively impossible for sources to implement. The installation and modification of minor heating equipment (whether natural gas or propane-fired) typically occurs as routine maintenance activity completed without sufficient advance planning or documentation to enable preparation of a NOC. It would be an imprudent use of the state’s limited resources to require the Department to review a NOC for every hot water heater (and similar device) installed in every stationary source statewide. DEQ should either retract its revisions to this proposed categorically insignificant activity category or revise OAR 340-210-0205(2) to add a new subsection (f) which states:  “(2) OAR 340-210-0205 through 340-210-0250 do not apply to the following sources:”  \* \* \*  “(f) Natural gas or propane burning equipment with a heat input less than or equal to 2.0 million Btu/hour.” | read this  needs to be combined with ACWA comment |
| 43 | Associated Oregon Industries:  AOI requests that DEQ reconsider its approach to regulating emissions from distillate oil, kerosene or gasoline fuel-burning equipment rated at less than or equal to 0.4 million Btu/hour. DEQ should either remove its proposed revisions to this categorically insignificant activity category or, at the very least, revise OAR 340-210-0205(2) to make clear that construction approval is not required for insignificant distillate oil, kerosene or gasoline fuel-burning equipment. Otherwise, the proposed regulations will have real impacts on regulated sources. For example, the fact that a source had even a single oil-fired unit rated at greater than 0.4 million Btu/hour would mean that none of the de minimis oil-fired comfort heaters (rated well below 0.4 million Btu/hour) that source may also operate would qualify as categorically insignificant. That same source would need to obtain construction approvals before installing or modifying any of its oil-fired combustion devices, irrespective of those units’ emissions. These changes impose even more costs and administrative burdens on sources without any discernible benefit to human health or the environment.  To that end, the Department could add a new subsection (g) which states:  “(2) OAR 340-210-0205 through 340-210-0250 do not apply to the following sources:”  \* \* \*  “(g) Distillate oil, kerosene, or gasoline fuel burning equipment rated at less than or equal to 0.4 million Btu/hour.” | read this,  needs to be combined with ACWA comment |
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| 73 | PGE, BCPW (2):  The proposed changes to Categorically insignificant Units appear to add an unnecessary complexity to the air-permitting program. The proposed changes will require significant accounting efforts for insignificant emission sources. Complete inventory of very small emission units will be a continues process that will cause many repeated modification to the air permits to account for every new unit listed. The fees for continues routine permit modifications can quickly accumulate to considerable sums. If DEQ insists on regulation those small units, it should at least design a process to accommodate those routine modifications easily and cheaply. Quantifying the emissions from those many small sources will also be extremely difficult, as emissions data on those units is scarce and testing so many units is not feasible. | combine this with other comments on CIA |
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| 82 | The Collins Companies, OFIC (2):  OFIC objects to the Department’s proposed revisions to the categorically insignificant activity category of natural gas and propane equipment less than or equal to 2.0 MMBtu per hour. The Department has proposed language that would prohibit a facility from being able to manage any of its natural gas fired units as categorically insignificant if any single gas-fired piece of equipment anywhere on site is rated at more than 2.0 MMBtu per hour. As a result of this proposed language, a forest products company with a 30 MMBtu per hour natural gas fired boiler would be required to treat a tiny gas-fired comfort heater as a fully regulated emissions source while a 650 MMBtu per hour coal-fired power plant would not. There is no sound policy underlying such a distinction.  In addition, the proposed rule language would require that a source inventory every single gas-fired appliance on site (including water heaters, comfort heaters, cook stoves, decorative fireplaces) in order to determine whether their emissions could conceivably exceed 1 ton per year of any pollutant. This alone is an enormous administrative task regardless of the outcome. If the collective plant-wide emissions could conceivably exceed 1 ton per year, then all of these devices, right down to the smallest hot water heater, would have to be fully permitted and the installation of a new hot water heater would require DEQ’s full permitting review. There is no reasonable policy purpose underlying this proposed rule change.  Oregon’s existing categorically insignificant activity is already substantially more stringent than what is defined as insignificant in Washington. For a source in Washington, any combustion source firing natural gas, butane, propane or LPG is considered insignificant if it is rated at less than 5 MMBtu per hour. No assessment is required under Washington law of how many of these units are on site. Washington’s listing of these units as categorically insignificant was upheld by the Ninth Circuit and so clearly there is a legitimate legal basis for these higher insignificance thresholds. | Combine with other CIA comments |
| 83 | The Collins Companies, OFIC (2):  Collins similarly objects to DEQ’s proposed revisions to the categorically insignificant activity category of distillate, kerosene and gasoline-fired equipment less than or equal to 0.4 MMBtu per hour. DEQ has proposed language that would prohibit a facility from being able to manage any of its distillate, kerosene or gasoline-fired units as categorically insignificant if any single piece of liquid fuel-fired equipment anywhere on the mill site is rated at more than 0.4 MMBtu per hour. As with the gas-fired units, there is no sound policy underlying such a distinction.  In addition, the proposed rule language would require that we would have to inventory every single distillate, kerosene and gasoline-fired device on site--no matter how small--in order to determine whether their emissions, in aggregate, could conceivably exceed 1 ton per year of any pollutant. This alone is an enormous administrative task regardless of the outcome. If the aggregate emissions could conceivably exceed 1 ton per year, then all of those devices, right down to the comfort heaters in our maintenance shops, would have to be fully permitted and the installation or modification of a heater would require DEQ’s full permitting review. There is no reasonable policy purpose served by this proposed rule change. DEQ has had this categorically insignificant activity unchanged in its rules for 22 years and we do not see any new development that justifies its revision. The burden placed on us and DEQ are not justified by any material environmental benefit that DEQ failed to identify 22 years ago when it adopted this provision.  Existing categorically insignificant activity is already substantially more limited than what is defined as insignificant in Washington. For a source in Washington, any combustion source firing kerosene or distillate is considered insignificant if it is rated at less than 1 MMBtu per hour and this increases to 5 MMBtu per hour for space heaters and hot water heaters. Washington’s listing of these units as categorically insignificant was upheld by the Ninth Circuit and so clearly there is a legitimate legal basis for these higher insignificance thresholds. | Combine with other CIA comments |

**RTC on CIA, small fuel burning and emergency RICE**

DEQ proposed revisions to how four categorically insignificant activities are defined because it has been found that emissions or potential to emit from those activities are significant at some sources, i.e. equal to or more than the de minimis emission rate for a regulated pollutant, which was the criteria in determining the original list of categorically insignificant activities. DEQ has also proposed other rule changes to ensure that including formerly categorically insignificant activities in a permit will not trigger new regulatory requirements, other than the requirement to include them in a source’s permit and account for their emissions.

DEQ proposed changes to the list of categorically insignificant activities to exclude activities whose emissions would exceed the de minimis level and to account for their emissions for the purpose of properly administering the air permitting program. Revising these categories will result in some equipment no longer being considered categorically insignificant.DEQ believes commenters raised good points regarding the proposed changes. DEQ re-examined the proposed changes to all four categorically insignificant activities and has revised each of them as explained below.

Categories (c) and (d)

The current rules read as follows:

(c) Distillate oil, kerosene, and gasoline fuel burning equipment rated at less than or equal to 0.4 million Btu/hr;

(d) Natural gas and propane burning equipment rated at less than or equal to 2.0 million Btu/hr;

DEQ believes that categories (c) and (d) cover generally similar types of equipment, with the primary difference being the type of fuel used. Under the final rules, DEQ has therefore combined them into a single category. DEQ also recognizes that a source may have a number of such devices, some of which may be too small to justify the effort to track them and include them in a permit. On the other hand, DEQ is aware of sources where the aggregated emissions from these devices exceed the de minimis level. For this category, DEQ has tried to find a balance between these conflicting considerations, and therefore will allow sources to split these devices into two groups. One group would still be considered categorically insignificant, provided certain conditions are met. The other group would not be considered categorically insignificant and must be included in the source’s permit. DEQ has calculated a default aggregate heat input rating of 5.0 million Btu per hour for the categorically insignificant equipment, knowing that equipment less than this heat input rating will have emissions less than de minimis levels. As an alternative, sources may identify which devices are categorically insignificant based on site specific expected usage.

DEQ determined the default aggregate heat input rating of 5.0 million Btu per hour by converting emission factors from AP-42 for external combustion devices rated less than 100 million Btu per hour for distillate fuel oil and natural gas to a pound per million Btu basis and compared. The higher of the two factors was then used to calculate a maximum heat input rating based on a 33 1/3 percent capacity factor (that is, assuming the maximum firing rate for 1/3 of a year or 2,920 hours).

Distillate fuel oil (ultra-low sulfur diesel is assumed)

20 lb/kgal × 1 kgal/1000 gal × 1 gal/140,000 Btu × 1,000,000 Btu/MMBtu = 0.14 lb/MMBtu

Natural gas

100 lb/MMcf × 1 MMcf/1,000,000 cubic feet × 1 cubic feet/1025 Btu × 1,000,000 Btu/MMBtu = 0.10 lb/MMBtu

The maximum heat input rating that would result in emissions of 1 ton of NOx, which has the highest emission factor of the criteria pollutants, was then calculated, based on an annual capacity factor of 33 1/3 percent.

X MMBtu/hr × 0.14 lb/MMBtu × 2920 hr/yr × 1 ton/2000 lb = 1 ton per year

Solving for X gives the default aggregate heat input rating:

X = 4.9 MMBtu/hr (rounded up to 5.0)

In reviewing categories (c) and (d), DEQ also noted that category (c) includes the phrase “fuel burning equipment”, but category (d) does not include this phrase. The phrase “fuel burning equipment” has a particular meaning in DEQ’s rules which is too restrictive for the type of equipment that DEQ intends to address in these categories. The equipment that DEQ intends to address includes water heaters and space heaters, or more generally, equipment that uses either direct or indirect heat transfer. DEQ has therefore removed the phrase “fuel burning equipment” and replaced it with “equipment utilizing direct or indirect heat transfer”.

The final proposed revision for categories (c) and (d) are as follows:

(c) Distillate oil, kerosene, gasoline, natural gas or propane burning equipment, or a subgroup of such equipment identified by the source, that meet the criteria in paragraphs (A) and (B).

(A) The categorically insignificant equipment or subgroup must meet one of the following criteria:

(i) the aggregate maximum heat input rating of the equipment or subgroup may not exceed 5.0 million Btu/hr; or

(ii) the aggregate emissions of the equipment or subgroup may not exceed the de minimis level for any regulated pollutant, based on the expected maximum annual operation of the equipment.

(B) The categorically insignificant equipment or subgroup may not include the following:

(i) individual distillate oil, kerosene or gasoline burning equipment with a heat input rating greater than 0.4 million Btu/hr; or

(ii) individual natural gas or propane burning equipment with a heat input rating greater than 2.0 million Btu/hour;

(d) (reserved)

Category (uu)

In recent years reciprocating internal combustion engines (RICE) used to power emergency generators and pumps have become more of a concern to DEQ for the following reasons:

* EPA promulgated two New Source Performance Standards (NSPS), 40 CFR Part 60, Subparts IIII and JJJJ, and a National Emission Standard for Hazardous Air Pollutants (NESHAP), 40 CFR Part 63, Subpart ZZZZ, for reciprocating internal combustion engines;
* The construction of data centers equipped with a large backup generator capacity powered by emergency engines; and
* Finding that at least one existing source is also equipped with a large backup generator capacity powered by emergency engines.

Prior to this rulemaking, all emergency generators and pumps were classified as “categorically insignificant activities” and have generally not been addressed in permits. In this rulemaking, DEQ proposed to exclude emergency engines from being categorically insignificant if their aggregate emissions, based on 100 hours per year of operation, exceed the de minimis rate. Commenters indicated that sources have no incentive to operate emergency engines more than necessary, and upon review, DEQ agrees. DEQ also believes this category can be simplified, as explained below.

Emergency engines are usually diesel engines, and NOx is the pollutant emitted that will exceed the de minimis level first, assuming the use of ultra-low sulfur diesel fuel. The de minimis emission level for NOx is 1 ton per year. DEQ believes there are sources that have enough emergency engine capacity to emit more than 1 ton per year from maintenance and readiness testing operation of their emergency engines. Therefore, DEQ believes it is appropriate to revise the category of emergency generators and fire pumps in the definition of categorically insignificant activities to exclude emergency engines if they exceed a specified threshold.

DEQ originally proposed to change this category to read as follows:

Stationary emergency generators and pumps used only during loss of primary equipment or utility service due to circumstances beyond the reasonable control of the owner or operator, or to address a power emergency; unless one or both of the following conditions is met, then all of this equipment is no longer categorically insignificant:

(A) The aggregate emissions from stationary emergency generators and pumps are greater than the de minimis level for any regulated pollutant based on the readiness and testing hours of operation allowed by NSPS or NESHAP requirements or some other hours of operation specified in a permit; or

(B) Any individual stationary emergency generator or pump is rated at 500 horsepower or more.

In (A), the readiness and testing hours of operation allowed by NSPS or NESHAP requirements is 100 hours per year. Commenters pointed out that sources have no incentive to actually operate emergency engines for this number of hours, and DEQ agrees. The proposed language would allow a source to specify a different number of hours per year in a permit, but this would obviously require revising a permit to specify the number of hours. Upon reconsideration, DEQ believes that the proposed change would create an additional workload for affected sources as well as for DEQ with little or no environmental benefit.

Instead, DEQ believes it is possible to establish a conservative default aggregate engine horsepower level at which emissions can reliably be assumed to not exceed the de minimis level. DEQ believes that this default level will allow emergency generators and pumps at the majority of sources to still be considered categorically insignificant without requiring emissions calculations or permit revisions to specify the number of operating hours used for the emissions calculations. If the aggregate engine horsepower exceeds the threshold, then all of the engines at the source are not categorically insignificant.

DEQ conservatively estimated the default maximum aggregate horsepower as explained below.

* DEQ used the uncontrolled diesel engine NOx emission factor of 0.024 lb/hp-hr from AP-42, Table 3.4-1, and
* DEQ used 28 hours per year of operation for testing and maintenance, determined as follows:
* Two information sources[[1]](#footnote-1) indicate that emergency generators should be tested for 30 minutes per month. Another source[[2]](#footnote-2) indicated that the 30 minutes does not include warm-up and cool-down time; DEQ has therefore assumed a minimum of 1 hour of operation per month. In addition, this source indicates that certain emergency generators, such as those at hospitals, must perform an annual load test that lasts for a minimum of two hours. DEQ assumes this also does not include warm-up and cool-down and therefore assumes a total of 3 hours of operation. One hour of operation for 11 months plus three hours in one month gives a total minimum operating time of 14 hours per year. To be conservative, DEQ has doubled this value to 28 hours per year.

Based on the above, the default maximum horsepower rating is:

1 ton/yr × 2000 lb/ton / (0.024 lb/hp-hr × 28 hr/yr) = 2,976 hp (rounded to 3,000 hp).

The final proposed revision for category (uu) reads as follows:

(uu) Stationary emergency generators and pumps used only during loss of primary equipment or utility service due to circumstances beyond the reasonable control of the owner or operator, or to address a power emergency, provided that the aggregate horsepower rating of all stationary emergency generators and pumps is not more than 3,000 horsepower. If the aggregate horsepower rating of all stationary emergency generators and pumps is more than 3,000 horsepower, then no emergency generators and pumps at the source may be considered categorically insignificant;

Need to add something for category bbb, get from Max

\*\*\*\*\*\*\*\*\*\*\*\*\* Jill, below is for division 216, new permitting category

Proposed new permitting category in division 216 for emergency generators

DEQ has recently required data centers to obtain permits. These data centers are equipped with a large backup generator capacity powered by emergency engines. DEQ required permits under current permit category 85 in division 216, Table 1, Part B, which reads:

All Other Sources not listed herein that would have actual emissions, if the source were to operate uncontrolled, of 5 or more tons a year of PM10 if located in a PM10 non-attainment or maintenance area, or 10 or more tons of any single criteria pollutant in any part of the state. DEQ required these facilities to estimate their emissions based on the 100 hours of readiness and testing operation allowed by the NSPS and NESHAP requirements.

DEQ was also motivated by the fact that the engines at these facilities were subject to the RICE NSPS and NESHAP requirements, and reasoned that such significant groupings of emergency engines should have permits and be subject to DEQ inspection to insure compliance with the NSPS and NESHAP requirements.

Upon reconsideration of this proposed permitting category, DEQ took into consideration the comment on the proposed change to category (uu) in categorically insignificant activities that owners and operators of emergency engines have no reason to operate the engines for the full 100 hours per year specified in the NSPSs and NESHAP. However, DEQ also took into consideration that the real environmental concern over data centers and other sources with large backup generating capacity is their short term emissions. During an actual power outage, many or all of the emergency engines at these sources will be operated, resulting in short term emissions equivalent to the short term emissions of much larger sources. Although DEQ does not regulate the emergency operation of these engines, one of DEQ’s goals is to ensure that emissions are minimized during emergency operation by proper maintenance of the engines.

As discussed above in the section on categorically insignificant activities, DEQ believes it is possible to establish a simple aggregate horsepower threshold level for this permitting category, rather than requiring all potentially affected sources to calculate their emissions or obtain a permit for the purpose of being able to specify some number of readiness and testing hours other than 100 hour per year.

The approach used to calculate a threshold horsepower level for permitting is similar to the approach used to calculate a threshold horsepower level for categorically insignificant activities.

DEQ conservatively estimated the default maximum aggregate horsepower as explained below.

* DEQ used the uncontrolled diesel engine NOx emission factor of 0.024 lb/hp-hr from AP-42, Table 3.4-1, and
* DEQ used 28 hours per year of operation for testing and maintenance, determined as described in the preceding section on categorically insignificant activities.

Based on the above, the permitting threshold based on the aggregate horsepower rating of the source is:

10 ton/yr x 2000 lb/ton / (0.024 lb/hp-hr x 28 hr/yr) = 29,762 hp (rounded to 30,000).

DEQ notes that several data centers have already been issued permits. The data center with the least emergency generating capacity has an aggregate rating of 22,500 kilowatts. Assuming 85 percent efficiency converting engine power to electricity, this is equivalent to approximately 35,500[[3]](#footnote-3) horsepower. Therefore the data centers already permitted will be required to have a permit under the proposed permitting threshold as well.

The final proposed revision to division 216, Table 1, Part B, category 87(a) is:

87 Stationary internal combustion engines only if the aggregate horsepower rating of all emergency generators and firewater pumps is 30,000 horsepower or more; or

Note, final language on b, c and d is from Jerry

(b) For any individual non-emergency or non-fire pump engine, the engine is subject to 40 CFR part 63, subpart ZZZZ and is rated at 500 horsepower or more, excluding two stroke lean burn engines, engines burning exclusively landfill or digester gas, and four stroke engines located in remote areas; or

(c) For any individual non-emergency engine, the engine is subject to 40 CFR part 60, subpart IIII and:

(A) The engine has a displacement of 30 liters or more per cylinder; or

(B) The engine has a displacement of less than 30 liters per cylinder and is rated at 500 horsepower or more; or

(d) For any individual non-emergency engine, the engine is subject to 40 CFR part 60, subpart JJJJ and is rated at 500 horsepower or more,

1. Maintaining Emergency and Standby Engine-Generator Sets

   Hartford Steam BoilerOne State Street P.O. Box 5024 Hartford, CT 06102-5024 Tel: (800) 472-1866 www.hsb.com June 2014

   Power topic #7004 | Technical information from Cummins Power Generation

   Maintenance is one key to diesel generator set reliability > White paper By Timothy A. Loehlein, Project Manager [↑](#footnote-ref-1)
2. INSPECTION AND TESTING OF EMERGENCY GENERATORS, available at: http://www.health.state.mn.us/divs/fpc/Gensets2.pdf [↑](#footnote-ref-2)
3. 22,500 kW/(0.7457 kW/hp x 0.85) = 35,498 hp [↑](#footnote-ref-3)