



ENERGY NORTHWEST

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U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555-0001

Subject: **COLUMBIA GENERATING STATION, DOCKET NO. 50-397
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION (RAI)
REGARDING LICENSE AMENDMENT REQUEST INVOLVING DIESEL
GENERATOR FUEL OIL STORAGE AND TESTING**

- References:
- 1) Letter GO2-09-114 dated August 17, 2009, SK Gambhir (Energy Northwest) to NRC, "License Amendment Request for Changes to Technical Specifications Relating to Diesel Generator Fuel Oil Storage and Testing," (ADAMS Accession No. ML092380153)
 - 2) Letter dated December 23, 2009, NRC to J. V. Parrish (Energy Northwest), "Request for Additional Information RE: License Amendment Request for Changes to Technical Specifications Relating to Diesel Generator Fuel Oil Storage and Testing (TAC NO. ME2121)," (ADAMS Accession No. ML093500261)

Dear Sir or Madam:

By Reference 1, Energy Northwest requested changes to the Columbia Generating Station (Columbia) Technical Specifications involving Diesel Generator Fuel Oil Storage and Testing. Via Reference 2, the NRC requested additional information related to the Energy Northwest submittal.

The Energy Northwest response to the Reference 2 request for additional information is provided in the attachment to this letter.

The information contained in this response does not impact the original determination of no significant hazards. There are no new commitments contained in this letter.

If you have any questions or require additional information, please contact MC Humphreys at 509 377-4025.

AOD
NRC

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I declare under penalty of perjury that the foregoing is true and correct. Executed on the date of this letter.

Respectfully,



SK Gambhir

Vice President, Technical Services

Attachment: Response to Request for Additional Information

cc: NRC Region IV Administrator
NRC Project Manager
NRC Senior Resident Inspector/988C
RN Sherman – BPA/1399
WA Horin – Winston & Strawn

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Response to Request for Additional Information

Question 1:

On pages 4-5 of 16 of the Enclosure to the licensee's letter dated August 17, 2009, it is stated:

The lube oil level equivalent to a 7 day supply is 330 gallons for Division 1 or 2 DG, and 165 gallons for Division 3 DG.

Please confirm that these 7-day supplies are for lube oil that the emergency DG manufacturer has confirmed is compatible with Ultra-Low-Sulfur Diesel Fuel (ULSD) fuel, and that these quantities are derived from consumption rates applicable to the DG operating with ULSD fuel.

Response:

The diesel vendor, Engine Systems, Inc. (ESI), has confirmed that the lube oil used at Columbia is compatible with ULSD fuel. The diesel vendor has concluded that lube oil consumption should not increase with use of ULSD fuel. Columbia's polling of the industry supports this conclusion in that the plants that have introduced ULSD have not identified any issues related to lube oil consumption. Therefore, assumed consumption rates are expected to remain valid, as well as the 7 day supply quantities derived from them.

Question 2:

On page 8 of 16 of the Enclosure to the licensee's letter dated August 17, 2009, it is stated:

Following the calculation method outlined in Reference 4, utilizing actual consumption rates determined by testing...

Please explain if these consumption rates are determined by testing with ULSD fuel. If not, please explain why these rates are conservative compared to testing with ULSD fuel.

Response:

Testing did not use ULSD fuel. The testing was performed using Low Sulfur Diesel (LSD) and the consumption rates were developed based off the actual energy content of the LSD fuel. Per the industry response via TSTF-08-02 (ADAMS Accession No. ML080670151) to NRC questions on TSTF-501, outside of California the API gravity is expected to remain within the 27 - 39 range used at most plants. An excerpt from TSTF-08-02 states:

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Provided that the diesel fuel delivered to a plant meets the specifications of [ASTM] D975, the property of diesel fuel oil having the most significant effect [on] the plant's fuel oil storage calculations is the energy content (heating value) of the fuel. This can vary from batch-to-batch, since D975 does not place criteria on heating value. However, plant specific calculations include an acceptable range for API Gravity of the fuel, and the fuel is verified to have an API Gravity within this range prior to transfer from the delivery truck into the fuel oil storage tanks. A well-known correlation of API Gravity related to energy content was developed by the National Bureau of Standards ["Thermal Properties of Petroleum Products", US Department of Commerce Miscellaneous Publication No. 97, April 28, 1933], with a 2 degree rise in API Gravity generally corresponding to about a 1% drop in BTUs/gallon. At a minimum, plants calculate their required fuel storage values assuming the most limiting API Gravity, and therefore the most limiting fuel energy content. As long as the fuel oil placed in the storage tank is within the assumed API Gravity range, the calculations of fuel consumption and required stored volume remain valid.

Columbia's analysis assumes the bounding allowed value of energy content for the fuel type to be used, currently specified as an API gravity of 38 for LSD fuel. The limiting value for energy content, i.e. API gravity, of ULSD fuel will be calculated, then utilized to develop the storage volume required when this fuel type is introduced at Columbia to ensure that the 7 day supply of fuel is met.

Question 3:

On page 10 of 16 of the Enclosure to the licensee's letter dated August 17, 2009, it is stated:

Energy Northwest currently allows a range of API [American Petroleum Institute] Gravity values at 60°F [degrees Fahrenheit] of greater than 27 degrees but less than or equal to 38 degrees.

Please explain what may happen if the licensee receives a shipment of fuel oil that has an API Gravity of greater than 38 degrees.

Response:

Every shipment received is tested for API gravity upon arrival. If a shipment of fuel is received that has an unacceptable API gravity, then per plant procedures this fuel is not authorized to enter the protected area. A failed test result will result in the shipment being rejected.

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Question 4:

On page 11 of 16 of the Enclosure to the licensee's letter dated August 17, 2009, it is stated:

The corresponding updated ANSI [American National Standards Institute] standard, ANS [American Nuclear Society]/ANSI-59.51-1997 ["Fuel Oil Systems for Safety-Related Emergency Diesel Generators"], Section 5.51, "Tanks," contains the same requirements while providing more specific details as regards to the tank capacity being sufficient to maintain at least 60 minutes of operation after reaching the low level alarm setpoint (at 110% percent of continuous rated load) based on the minimum quality fuel oil that is acceptable.

In the next paragraph it is stated:

From the above it can be ascertained that the [principal] safety concern with the volume of stored diesel fuel oil in the day tank is that there is an equivalent supply of fuel oil in the day tank is that there is an equivalent supply of fuel [*sic*] to support one hour of operation at 110% of full load.

The staff's view is that the minimum day tank capacity is an amount of fuel oil to support 60 minutes of operation at 100 percent continuous rated load plus a minimum additional margin of 10 percent. Please explain how a supply of fuel to support 1 hour of operation at 110 percent of full load is conservative as compared to the staff's view.

Response:

Columbia concurs with the staff's view that the minimum day tank capacity defined in ANS/ANSI-59.51-1997 is 60 minutes of operation at 100 percent continuous rated load plus a minimum additional margin of 10 percent. Columbia's proposed simplification from "one hour at 100% + 10% margin" to "one hour at 110%" is however conservative to the ANSI-59.51-1997 approach as indicated in the following table.

Diesel #	Consumption Rate at 100% Load (gallons)	100% Load plus 10% margin (gallons)	Consumption Rate at 110% Load (gallons)
DG1	325.8	358.4	372.7
DG2	336.5	370.2	380.3
DG3	200.2	220.2	221.1

The table above contains the demonstrated field results from consumption rate tests at 100% and 110% of rated load. These results indicate that a larger volume of fuel oil is required to meet one hour at 110% of rated load than the volume required to support one hour at 100% of rated load plus an additional 10%. Hence, Columbia's approach to

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require that the day tanks contain enough fuel to meet 110% of rated load is conservative when compared to the requirement specified in ANSI-59.51-1997.

Question 5:

On page 15 of 16 of the Enclosure to the licensee's letter dated August 17, 2009, Reference 6 is listed as ASTM [American Society for Testing and Materials] D975-08, "Standard Specification for Diesel Fuel Oils." Please explain why ASTM D975-08a is not used as the reference.

Response:

ASTM D975-08 was the version of the standard that Columbia had evaluated at the time this portion of the license amendment request was being drafted. There have since been four revisions to the ASTM D975 standard, including three revisions after 08a was released in late 2008. It is Columbia's intent to adhere to the latest applicable standard and ASTM D975-09b is presently being evaluated for use at the site. The version of the standard that Columbia ultimately adopts will be reflected as appropriate in the TS Bases. Future revisions of the ASTM D975 standard will be evaluated as they become available and will be incorporated into the TS Bases as delineated by the TS Bases Control Program.

Question 6:

ASTM D975-08a allows fuel oil to contain up to 5 percent biodiesel. Please explain how your fuel oil calculation will be affected if your fuel oil contains 5 percent biodiesel.

Response:

The purchase contract specifies that diesel fuels containing biodiesel will not be accepted. New shipments of diesel fuel are screened for biodiesel content prior to offloading per plant procedures. Shipments that fail the biodiesel screen are rejected. The fuel oil storage calculation does not accommodate the use of fuel that contains biodiesel.

Question 7:

Please confirm that the volumes shown in Attachment 3 to the Enclosure of the licensee's letter dated August 17, 2009, Table B 3.8.3-1, "Minimum Required DG Fuel Oil Supply," include an unusable volume for vortex prevention and for water and sediment at the tank bottoms.

Response:

The volumes in Table B 3.8.3-1 are based on the usable amount of fuel that must be present in the tanks, and not on the total fuel present in the tanks. The measurement of the usable fuel takes into account that un-useable fuel exists at the bottom of the tank. The tables relating usable fuel to elevation of fuel in the storage tank exist in plant

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procedures. The values specified in Table B 3.8.3-1 are reflective of calculations that determine how much usable fuel is available taking into account fuel tank internal geometry and fuel pump suction limitations (physical location and vortexing).

Question 8:

Section 5.4 of ANSI/ANS-59.51-1997 states that the usable fuel oil storage requirements calculation shall include an explicit allowance for fuel consumption required by periodic testing. Please discuss how this allowance is incorporated into your 7-day fuel oil quantities.

Response:

The current licensing basis for Columbia does not include an explicit volume allowance for fuel consumption associated with periodic testing. The current TS fuel oil volume requirement was established via Amendment 136, approved by the NRC on April 25, 1995, based on the storage requirement supporting seven days of operation at full electrical design rating. A review of the related license amendment submittal, dated April 1, 1993, and our current submittal (Reference 1), indicates that no exception to the ANSI/ANS-59.51-1976 calculation methodology was identified.

What constitutes "periodic testing" is not defined in ANSI/ANS-59.51. It should be noted that both versions of ANSI/ANS-59.51, 1976 and 1997, specify that an allowance for fuel consumption required by periodic testing shall be included in the calculation for 7-day storage. Columbia has committed to comply with Regulatory Guide 1.137 which endorses ANSI/ANS-59.51-1976. At Columbia, there are two periodic surveillance requirements for diesel generators that could impact fuel oil storage volumes.

Surveillance Requirement (SR) 3.8.1.3, performed on a 31 day frequency interval, requires the diesel generator system to be operated for 60 minutes at or near rated power. SR 3.8.1.14, which is performed on a 24-month frequency, requires an extended run time of the diesel generator for 24 hours. Columbia's surveillance procedures that satisfy SR 3.8.1.3 ensure that the 7-day fuel oil storage requirement is verified immediately upon completion of the surveillance test. The 24 hour surveillance procedure requires that fuel oil volume be closely monitored and fuel added to the storage tank to ensure that the 7-day storage requirement is maintained during this surveillance test.

As delineated on page 10 of the enclosure to the submittal (Reference 1), Columbia's interpretation of the regulatory requirements is that a 7 day supply of diesel fuel oil is required to be maintained on site for each diesel generator. Columbia's fuel oil storage calculation meets this regulatory requirement.

Columbia acknowledges that not including an explicit allowance for fuel consumption required by periodic testing in the calculation for 7-day storage requirements is an exception to the storage calculation criteria specified in ANSI/ANS-59.51-1976. It is

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Columbia's position that confirmation of the 7-day supply of fuel during or immediately after periodic testing, as described above, constitutes an acceptable alternative approach to that specified in ANSI/ANS-59.51-1976.

Question 9:

Provide a summary of the analyses that shows how the proposed fuel oil volumes in Table B 3.8.3-1 were determined.

Response:

The analysis is based on test results for each diesel generator. The analysis took the results of the tests, which included the API gravity of the fuel in the day tank, the fuel temperature, generator kW output and fuel usage in approximately 15 minute intervals, and the laboratory test results on the heat of combustion of the fuel in the day tank. The API gravity test was used for a gross analysis to determine operability immediately after the test, while the lab tested heat of combustion was used for the final, refined analysis. The uncertainty of each input was included in the analysis. Two tests were performed on each diesel generator; a run at 100% rated load and a run at 110% rated load.

Based on this test data, the analysis determined the total required heat of combustion for the required function (100% rated load for seven days or 110% rated load for one hour). Since API is based on 60°F, the amount of actual fuel volume used was adjusted to take into account the difference between test fuel temperature and ANSI standard temperature, to obtain the amount of 60°F fuel that would have been consumed, which was then converted into its total heat of combustion per hour at rated conditions. At this point, the total heat of combustion required to support one hour at 100% and 110% rated load, including uncertainties, has been determined.

The analysis then assumed that we would be using the limiting API fuel and used ASTM D4868-88 methodology to determine the heat of combustion per gallon, using the maximum values for water, ash and sulfur content to conservatively yield the lowest heat of combustion.

For the one hour analysis: The required heat of combustion for one hour at 110% rated load was divided by the heat of combustion for the limiting API fuel to determine the total required volume of fuel. This fuel volume is based on a fuel temperature of 60°F since the API heat of combustion is based on 60°F. Since the day tank fuel temperature will frequently be higher than 60°F, the volume is converted assuming a bounding value of 150°F.

For seven day analysis: The total heat of combustion per hour at 100% rated load was multiplied by seven days, then divided by the heat of combustion of one gallon at the limiting API to determine the total required volume of fuel. This fuel volume is for 60°F fuel since the API heat of combustion is based on 60°F fuel.

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The fuel required to support seven day operation is stored in two different tanks. Therefore, in order to determine how much fuel has to be stored in the storage tank, the amount of fuel available in the day tank above and beyond that which is required to support one hour at 110% rated load is determined. First, the volume required for the day tank is corrected based on 60°F. Then the amount of fuel at 60°F determined above, required to support one hour at 110%, is subtracted from the low level alarm setpoint value of 1400 gallons. The remaining fuel available in the day tank is then subtracted from the amount of 60°F fuel required to support seven day operation. This provides the amount of 60°F fuel required to be in the storage tank. The storage tank volume calculation is then corrected upward based on an assumed bounding temperature of 76°F.

Question 10:

The licensee is proposing to change the word "tank" to "subsystem" in TS Surveillance Requirement 3.8.3.1. According to the definition in ANSI N195-1976, "Fuel Oil Systems for Standby Diesel-Generators," the term "tank" includes day tank and storage tank. The licensee stated on page 3 of 16 of the Enclosure to its letter dated August 17, 2009, that Technical Specification Task Force (TSTF)-501, Revision 0, "Relocate Stored Fuel Oil and Lube Oil Values to Licensee Control," only addressed the diesel storage tank volume whereas the CGS design utilizes both diesel storage tank as well as the excess volume available in the day tank. The NRC staff found that TSTF-501 also used the term "tank" for day tank and storage tank as addressed in the TSTF-501 Bases. The staff requests the licensee to provide justification for deviating from the standard term "tank" as used in ANSI N195-1976 and TSTF-501 and confirm that this change would not result in a non-conservative fuel oil storage volume.

Response:

ANSI N195-1976 states that where the word "tank" is used without modifiers, the term includes day, integral, and supply tanks. TSTF-501, and the related TS and SR requirements, use the modifier "storage." Per the ANSI N195-1976 definition, since a modifier is used, the storage tank is but a single, specific tank. From a practical standpoint, using the term "storage tank" or just "tank" to describe a "series of tanks" was confusing to the Operations staff that reviewed this proposed change. Since Columbia credits the combined volumes of fuel available in the storage and day tanks to meet the seven day (and one hour at 110%) requirement, a term was selected that is representative of more than one tank, i.e. "subsystem." ANSI N195-1976 defines a fuel oil subsystem as, "The subset of the fuel oil system which consists of equipment which supplies oil to a single diesel-generator unit." The term "subsystem" was selected to be consistent with ANSI N195-1976 as well as to accurately reflect the Columbia design and licensing basis. The proposed deviation is only to change the terminology from the current TS and TSTF-501 term of "storage tank" to "storage subsystem" and does not impact the requirements for meeting fuel oil storage volume.

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ANSI N195-1976 uses the terms "on-site oil storage" and "fuel oil storage capacity", and does not use the term "fuel oil storage tank" in sections 5.2 and 5.4. ANSI N195-1976 does not specifically require that the seven day fuel storage exist within a single tank.

Columbia's proposed deviation from the TSTF-501 with the use of "fuel oil storage subsystem" in lieu of "storage tank" does not change the storage requirements nor lend itself to allowing a non-conservative fuel storage volume. Replacing the term "storage tank" with the generic term of "tank" as allowed by the ANSI definitions was not pursued because of the potential confusion to the Operations staff, i.e. "tank" would have to be defined to include both the storage and day tank. Replacing the term "storage tank" with "storage tank[s]" was not pursued because Columbia's equipment part number includes the word "storage" and is a singular tank.

The deviation from the standard terminology is requested based on the Columbia design utilizing two separate tanks to provide the requisite storage volume.

References

1. Letter GO2-09-114 dated August 17, 2009, SK Gambhir (Energy Northwest) to NRC, "License Amendment Request for Changes to Technical Specifications Relating to Diesel Generator Fuel Oil Storage and Testing," (ADAMS Accession No. ML092380153)
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