

PALOMAR ENERGY PROJECT (01-AFC-24)
CEC STAFF DATA REQUEST NUMBER 5

Technical Area: Air Quality

Response Date: April 8, 2002

REQUEST:

Please describe how the emission levels for commissioning (AFC p. 5.2-19) adequately characterize the anticipated emissions. The discussion should explain what data was used to develop the proposed emission rates.

RESPONSE:

The emission levels during plant commissioning were calculated by considering the types of tests that would be conducted, gas turbine loads during the tests, and operability of the SCR and CO systems during the tests. Using this information combined with estimated part load emissions information for the gas turbines as obtained from the gas turbine manufacturer and estimated SCR and CO catalyst control efficiency curves as obtained from SCR and CO catalyst vendors, as applicable, emissions for each test were estimated. Since the gas turbine combustors will not have been tuned prior to the start of commissioning, a factor was applied to the calculated emissions to account for additional gas turbine emissions above those predicted by the gas turbine manufacturer for normal tuned part-load operation. Since it is not possible to precisely predict the emissions of the gas turbines prior to tuning, and the load conditions required to facilitate tuning of the combustors, the emissions indicated in the table are estimated only. During commissioning, the gas turbines will normally be run intermittently and initially, one turbine at a time.

Full Speed-No Load Test (No SCR in Operations)

These tests involve starting the gas turbines, ramping them up to design operating specs, and then holding them at that point while not generating electrical power output. This allows testing of the gas turbine ignition system, test of the synchronizing system for the electric generator, and tests of the turbine overspeed safety system. During this test the heat input into the gas turbine will be approximately 25% of the maximum heat input rating. The test is expected to last approximately 5 days.

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Steam Blows (No SCR in Operation)

During this period the gas turbines and heat recovery steam generators are operated to generate low pressure steam. This steam is released through vents at the ends of each of the branches in the steam piping in order to heat up the piping and create a high velocity motive force to dislodge and remove dirt, mill scale, oil, and other debris from the inside of the piping and the inside of the boiler components. These contaminants must be removed prior to admission of steam into the steam turbine to prevent damage to the steam turbine. The gas turbines will be operated at a load of 7.5% to 20% during this period, with a heat input of 35% to 40% of maximum heat input rating. The steam blows are expected to last approximately 5 to 10 days.

Part Load Tests (No SCR in Operation)

These tests allow the gas turbine combustors to be tuned to minimize emissions, while also testing the heat recovery steam generator and steam turbine. During these tests the gas turbine will be started and ramped up to various load points from 7.5% to 100% in 5 MW intervals. The gas turbines will operate with a heat input of 25% to 100% of maximum heat input rating. The part load tests are expected to last approximately 6 days.

Full Load Tests (No SCR in Operation)

These tests will include further tests of the steam turbine, heat recovery steam generator and associated equipment. During these tests, the gas turbines will be started and ramped up to 100% output with 100% of its maximum heat input rating. These tests are expected to last approximately 4 days.

Full Load Tests (SCR Tuning)

These tests will include tuning of the ammonia injection system to minimize stack exhaust NO_x. During these tests, the gas turbines will be started and ramped up to 100% output with 100% of its maximum heat input rating. These tests are expected to last approximately 5 days.

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Full and Peak Load Tests (SCR Operational)

These tests will include additional testing of the gas turbines, steam turbine, heat recovery steam generator and associated plant equipment. The duct burner system will also be tested to verify system operation at its full design capacity. During these tests the gas turbine will be started and ramped up to 100% output with 100% of its maximum heat input rating. The duct burners will also be started and ramped to 100% of their maximum heat input rating. The SCR and CO catalyst systems are expected to be fully operational during these tests. These tests are expected to last approximately 15 days.

Worst Case Emissions

The emissions given in the AFC Table 5.2-7 actually represent the average emission rates over the commissioning period. As discussed above, it is not possible to precisely predict the emissions of the gas turbines prior to tuning and to predict all the load conditions and hold points for the gas turbines during commissioning of the facility. Due to manufacturing tolerances of the gas turbines and other equipment and variances in plant design and manufacturer's equipment, each plant will operate a little differently until the plant can be fully tuned to attain stable and optimal operation. The gas turbines may need to be held at different load points in different plants to facilitate the tuning. Therefore, determining the maximum hourly emissions rates during commissioning is difficult. The maximum hourly emission rates for various loads could be as high as 450 lb/hour of NO_x and 2000 lb/hour of CO for a fully tuned combustor. The plant is not expected to be operated at these high emissions rates for sustained periods. However, operation at these high emission rates is possible and may be needed to allow tuning problems to be identified and corrected. Steps will be taken to minimize these, one-time, short-term emissions.
