B.03.09 NOISE AND VIBRATIONS

Sources

Sources of noise and vibration from the proposed development will include;

- Gas turbines;
- Steam turbines;
- Generators;
- Cooling water pumps.
- FSU

Mitigation

The gas turbine core engine has external insulation for personnel protection to both reduce the temperature on exposed surfaces, and to minimise noise levels within the enclosure. Heat and acoustic lagging is applied from compressor stage 3 at the cold end and continuously over the hot section and the exhaust diffuser to reduce temperature and noise. The steam turbine and generators will also be enclosed in metal acoustical enclosures designed for outdoor service. Cooling water pumps, and all associated equipment will be located inside a dedicated pump house building to reduce noise effects.

The noise generated by the operation of the proposed development, under all operating conditions and site climatic conditions, shall comply with EU Directive 2002/49/EC and the Maltese Directive LN 193/2004 in order to comply with the limits imposed by the environmental and personnel safety regulations.

As part of the development, the following guarantees for sound emissions have been provided by the contractor;

Near Field

The surface sound pressure level shall not exceed 85 dB(A) during normal operation of the proposed development measured at 1m distance from any equipment or enclosure. Measurements will be undertaken in accordance to IS0 11204 "*Acoustics- Noise emitted by machinery and equipment- measurement of emission sound pressure levels at workstation and at other specified positions- Method requiring environmental correction*". Noise measurement points will be evenly distributed, at 1m from the equipment and 1.5m above ground level (agl), from which a surface sound pressure level shall be calculated. This will include correction for baseline background noise and reflections and this corrected value will be compared with guaranteed sound pressure levels.

Both ambient background noise and noise at full load will be measured. If the difference between background noise and the Power Plant in operation at full load is between 6-15 dB(A), corrections will be undertaken in accordance with ISO 11204. If the difference is less than 6 dB(A), but the measured noise level at full load is less than the contract level, the sound guarantee will be considered as satisfactory. No measurements can be taken if the background noise is more than the contract level and the sound guarantee will be considered as satisfactory.

Far Field

The equivalent sound pressure level shall not exceed 65 dB(A) during normal operation measured at 100m distance from the proposed development site boundary. The measurement points will be placed in accordance with policy ANSI B 133.8 "*Gas turbine installation sound emissions*".

Both ambient background noise and the sound level for the operational power plant at full load will be measured. Typical measurement times for each point will be between 5-10 minutes and measurement points will not be located at sea level. L_{eq} (A) measurement will be used. If the measurements are disturbed by non-stationary noise, like passing vehicles, L_{90} will be used. The L_{90} refers to when the sound pressure level is exceeded 90 percent of the time during the measurement period. The Lgo represent the steady-state sound pressure level at the measurement location. The wind speed will preferably be less than 6 m/s during the measurement and the weather conditions must be approximately the same during the measurement periods. Wind speed and direction, relative humidity and air temperature will be documented through the measurement period. If necessary, corrections for baseline background sound will be undertaken.

Measurements cannot be performed if the difference between the equipment at full load and background noise (ambient noise) is less than 3 dB. If this is the case, one of the following alternatives can be used for evaluating environmental noise:

1. Sound pressure measurements will be carried out closer to the Power Plant where the difference between the equipment at full load and background noise is greater than 3 dB(A). The procedure will follow ISO 8297.

2. Sound power levels will be measured for all dominating sound sources (except the stacks) belonging to the installation. The procedure will follow ISO 10494 - Gas turbines and gas turbine sets. Measurement of emitted airborne noise - Engineering/survey method will be used. The noise should then be predicted using ISO 9613-2 "*Acoustics Attenuation of sound during propagation outdoors, Part 2: General method of calculation*".

Office and Control Rooms
The sound pressure level contribution from equipment should not exceed 45 dB(A) in the main control room during normal operation measured in accordance with ISO 11204.

Conditions for sound guarantee
The sound guarantee is valid for Combined Cycle operation. The guarantee value is valid under the following conditions:

- Correction for background sound and reflections shall be made;
- The object under test is operated in continuous duty at full load, during normal operating conditions;
- All measurement readings will be made with slow response filter; and

Guarantee exclusions
Following operation modes are excluded from the sound guarantee:

- Blow down of the boiler;
- By-pass stack operation;
- By-pass operation of the steam turbine;
- Start-up and shut-down of the Power Plant;
- Operation below minimum load, i.e. 70% GT load;
- Safety valve blow;
- Construction and installation;
- Commissioning, including steam blow cleaning; and
- Other abnormal operation conditions:

- Blowing of rupture discs;
- Fast drainage of the feed water tank;
- Free blowing of steam from boiler to atmosphere;
- Power Plant trips.

FSU Noise constraints

The FSU will be built and maintained with NK Rules and to IMO Regulations. New equipment will be certified to BV Rules and IMO regulations and maintained with BV Rules and to IMO regulations. The specific standard for noise emissions shall be 2002/49/EC as well as all requirements of the EIA. Final noise survey will be carried out once the FSU is operational to confirm that it meets the above criteria.

Noise Sensitive Locations

The figure below identifies the two nearest noise-sensitive positions (NSPs), PM1 & PM2, which were identified during the EIS for the following reasons;

- Most exposed façades;
- Nearest and most exposed NSPs/receptors;
- There are at least five family groups that live in proximity to the area boundary (within 200 meters); and
- The measurement locations are also good to validate the noise model with regards to actual noise coming off the site i.e. to ensure that the various sound powers of the surfaces/items and propagation are within 3dB of each other signifying no major errors in the model.

Noise Measurement Surveys

Ambient background noise level measurements were taken at various locations across the existing DPS as well as the NSPs above. Full details of the findings of this assessment are presented in the EIS. Noise monitoring regime in line with BS4142 will be set up as part of the operational procedures and will be included as part of the environmental management plan. . Noise monitoring that has taken place during the construction phase of the project shall be used as a basis of this monitoring.

Combined noise monitoring will be carried out in conjunction with the other operators on the Delimara site. Enemalta will take the lead in this and have engaged with Acousti-CAL Consultancy to produce the noise monitoring method statement which is currently being discussed and reviewed by all parties.