Noise from sandblasting / Personnel noise exposure

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Abstract: Three different aspects that influence the noise exposure have been evaluated: a: Noise from the nozzle and the blasting object, b: Noise generated by the air supply in the masks/helmets and c: Sound attenuation of the masks and helmets. Normal noise levels outside the protective gear are between 110 and 120 dBA while sandblasting. The noise level inside the mask and the inner hood will vary from 95 - 105 dBA from the sandblasting. The noise generated by the air supply can be as high 90 - 100 dBA inside the inner hood. Thus the total average noise exposure for the personnel (without earplugs) is 97 - 107 dBA with today's most common equipment in Norway. UHP-water blasting, an alternative technique, can also reach levels up to 110 - 120 dBA, depending on the blasting object and the acoustic environment. Normal working gear give less protection to the ear than the sandblasting gear. Both the sandblasting and the UHP waterblasting may create loss of hearing to the workers and all possibilities of noise reduction must be considered. The workers should be closely checked by use of audiometry. There is a great need for new development of blasting equipment and noise reducing working gear.

GENERAL

One important aspect of the working environment is the noise level that people are exposed to at their work place, both offshore and onshore. Offshore work in the Norwegian sector are governed by "Regulations relating to systematic follow-up of the working environment in the petroleum activities", by NPD, i.e. the Norwegian Petroleum Directorate. According to these regulations no employees should be subjected to a daily noise exposure which during the a workshift exceeds a 12-hour equivalent sound level of 83 dBA or and impulsive sound level above 130 dBC (Peak).
There is a general lack of knowledge related to the noise exposure of blasting personnel. The vendors give very little information about their equipment. A better understanding of the subject is therefore required.

MEASUREMENTS AND CONFIDENCE LEVEL

Most of the measurements have been performed as dual channel measurements of noise levels, in order to calculate the sound power level or the insertion loss of the working gear.
Type of nozzle and sand , sand consumption, blasting distance, object shape, working gear etc. influence the noise level. Thus this projects main goal has been to establish an overall understanding of the noise levels and how they vary with the various factors. We have chosen to perform great number of measurements with a single change for each situation, rather than to investigate the confidence level of a limited number of factors. The presented levels should give a representative view of the situation for evaluation of possible hearing risks and the need of noise reducing actions, even if the uncertainty for single measurements can be up to 3 - 5 dBA.

SANDBLASTING NOZZLES, SAND CONSUMPTION ETC.

Both Standard Venturi and the and the Wide throat nozzles have a venturi shaped bore. The Double Venturi has in addition a set of holes around the middle of the nozzle. These holes let in air that form a jacket surrounding the blast jet, thus reducing the air speed difference between the jet stream and the surrounding air.

The sound power level from the double venturi is typically 5 dBA lower than the other nozzles. The noise levels varies however a lot with the sand consumption. With a small amount of sand used, the sound power levels are up to about 120 - 125 dBA. With a large amount of sand the sound power levels are around 110 - 115 dBA.

With a high sand consumption the noise contribution from the nozzle and the object is about equal. Corners create more noise than plates. With a small sand consumption the level is dominated by noise from the nozzle. The sound levels varies less than 1 - 2 dBA within the actual distances between the nozzle and the object.
The type of sand used may influence the noise level considerably. The levels varied from 112 to 122 dBA with grit as the most noisy. Garnet was less noise than expected, probably due to its high weight.

NOISE FROM THE AIR SUPPLY

The noise level from the air supply is measured by using a Head and Torso simulator from Brüel & Kjær that was dresses with various working gears. This Head and Torso simulator has the shape of a human head and upper body. It is equipped with a 1/2 " microphone in each ear. The noise level was measured directly by using a two channel real-time analyser connected to "the ears".

The test was performed with a working pressure of 8 bar at the air supply. This is the same pressure that is used for sandblasting. Measurements were performed with various masks and helmets and with and without different inner hoods of cotton. The air flow was adjusted by the local control valve on the various masks and helmets.

The noise levels from the air supply inside the masks is very dependant on the design of the air supply. Measured levels are in a range from 85 to 107 dBA. The inner hoods reduces the noise exposure at the ears from 3 - 10 dBA.

Normally (at site in Norway) the same pressure is used for the air supply and the sandblasting. By reducing the pressure to the air supply, the noise level generated in the mask and the local reduction valve can be considerably lowered. A reduction from 8 to 3.5 bars lower the noise level by about 15 - 20 dBA for one of the valves and helmets.

SOUND ATTENUATION OF MASKS AND HELMETS

The sound attenuation of various masks and helmets are measured by using the same Head and Torso simulator from Brüel & Kjær. The noise level at each of the "ears" was measured while sending Pink noise through a loudspeaker. The noise level measured in the room without any protection or cover over the ears was used as the reference level. The insertion loss in dBA was calculated with typical sound blasting spectrum as reference.

The sound attenuation for the various masks and helmets is from 10 to 14 dBA without inner hoods and 12 to 17 dBA with inner hood. The sound attenuation for the masks are slightly better than for the helmets. This is particularly noticeable at the 1000 Hz octave band where the insertion loss is 10 -12 dB better for the masks compared with the helmet with the lowest attenuation for helmets. The main reason for the lower attenuation for the helmets is probably noise let through the cape. For all helmets the cape fabric is much thinner and lighter than the fabric of the masks.

For both masks and helmets the attenuation is improved when using a inner hood, generally 2 - 3 dBA. The increase is however higher than this at the 4000 and 8000 Hz octave bands. At 4000 Hz the improvement is 12 - 15 dBA. The difference at 8000 Hz is even bigger.

UHP WATER BLASTING

The tests were performed at a pressure of 2000 bar. The noise form UHP (Ultra High Pressure) water blasting in our test was higher than the noise from sandblasting. The sound power levels vary from 115 - 135 dBA. Expect for blasting a plate, the measurements do not indicate any significant difference in the noise emission between the two guns tested.

Since the helmets used for UHP water blasting do not cover the ears, the noise levels without ear protection are the levels at the position of the workers head - thus a very good ear protection is required.

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