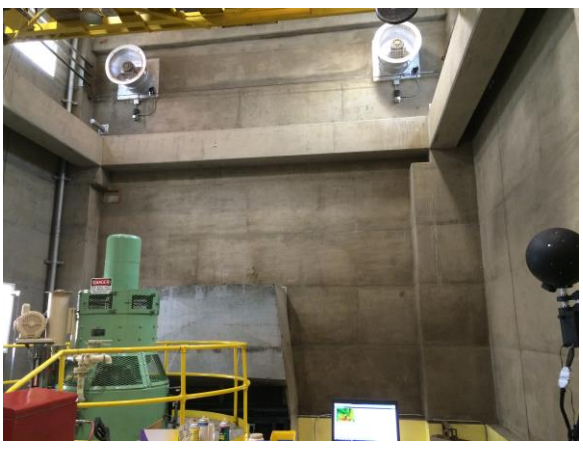
Case History: Noise Reduction in Hydropower Plants

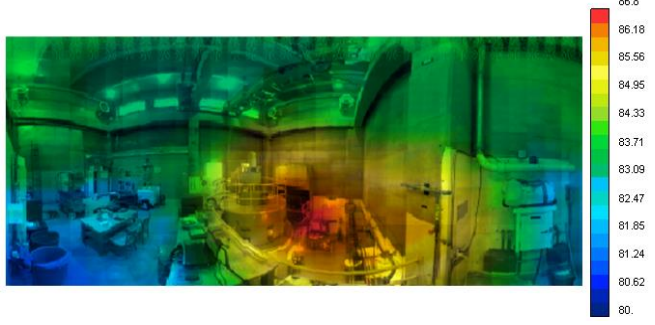
Noise Control Engineering (NCE) has been the prime contractor for the U.S. Department of the Interior, Bureau of Reclamation (Reclamation) on a research program to reduce noise in their hydropower plants throughout the country. To date, NCE has conducted surveys for 35 plant and have developed and implemented noise mitigation plans for 20 of these plants including Grand Coulee Dam Powerplant and Hoover Dam Powerplant. This case history will highlight the Heart Mountain Hydropower Plant located in Cody, Wyoming because of unique solutions that were developed during the research and development of effective noise controls and also the very successful noise mitigation results.

Initial Noise Survey

Heart Mountain Powerplant consists of a single 5 MW generator. During the initial survey, noise measurements throughout the main floor were extremely high, ranging from 95 dBA to as high as 97 dBA. There were a number of noise sources which included the turbine cooling fans, the generator cooling slots as well as the overhead building exhaust fans. The plant walls, as is typical, consisted of hard concrete surfaces which exacerbated the situation because of the high reverberation effects. The picture at the left shows the inside of the plant. On the far wall in front of the generator, the three turbine cooling fans are located inside the sheet metal duct. The hard concrete surfaces are apparent as well as the building exhaust fans shown up high, just under the yellow crane. The generator also has cooling slots (not visible). Because of the high levels and high reverberation, it was difficult to rank the sources, which is necessary for an effective noise control plan.



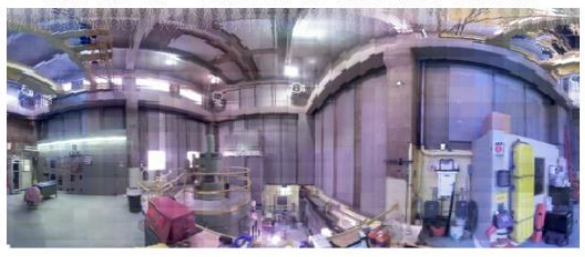
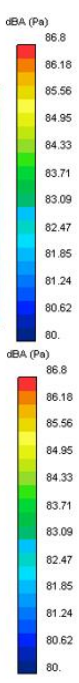
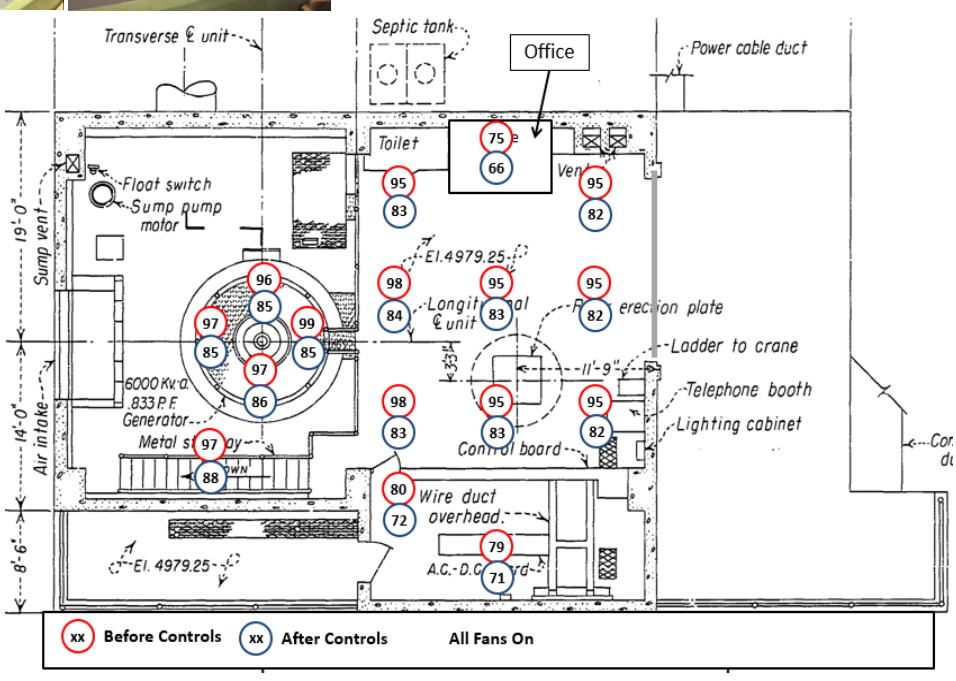
Because of this difficulty, the acoustic array was employed as a measurement tool. The measurements from the array allow the identification of acoustic "hot spots" and enables the ranking of noise sources. Acoustic array results clearly showed that the turbine cooling fans were the highest noise source. When these fans were turned off, it was determined that the generator cooling slots were the next highest source. This information was used to prioritize noise mitigation treatments.



Noise Control Implementation

Noise being generated by the turbine cooling fans was primarily from the high volume of air flow, but motor noise was also a factor. The initial design of the powerplant had air intake to the fans coming from outside of the plant. However, because of a number of factors, including continual clogging of air filters, it was decided years ago to close off the outside intake and draw air from inside the plant. This created a high air flow situation and hence high noise levels. To mitigate the noise, the front opening of the ductwork which housed the cooling fans was closed off and the top of the duct was opened for the intake. A silencer was installed on this intake and acoustic blankets were installed around the front of the duct to mitigate both the motor noise and noise coming through the ductwork due to the high airflow inside. In addition to this, acoustic absorption panels were installed on the walls and overhead of the plant.

Finally, custom silencers were designed to install in front of the 28 cooling slots that exist around the generator. The result after all controls were installed was dramatic. Noise levels throughout the plant were reduced 15 dB with the range in the main plant area being 11 to 15 dB. All areas of the plant are now below the target levels of 85 dBA.

All Fans On – Gen Load 4.8 MW-Before Controls

All Fans On – Gen Load 4.8 MW-After Controls