BIG ASS FANS® | EXCEPTIONALLY ENGINEERED

COOLING AIR MOVEMENT, QUIET OPERATION FOR MAXIMUM COMFORT IN INDUSTRIAL FACILITIES

*The implementation of fans is a cost-effective, repeatable way to dramatically improve occupant thermal comfort. However, the use of personal cooling fans has historically been associated with auditory discomfort. Big Ass Fans' **AirEye** product line has been designed to operate at low sound levels in order to ensure that thermally comfortable environments are also sonically suitable. Cumulative fan sound levels should be considered in addition to thermal comfort results for applications with large fan quantities. This white paper summarizes the findings of an in-depth pilot project completed at a 1MM+ square-foot fulfillment center in the Pacific Northwest that was implemented across more than 50 similar facilities nationwide.*

BACKGROUND:

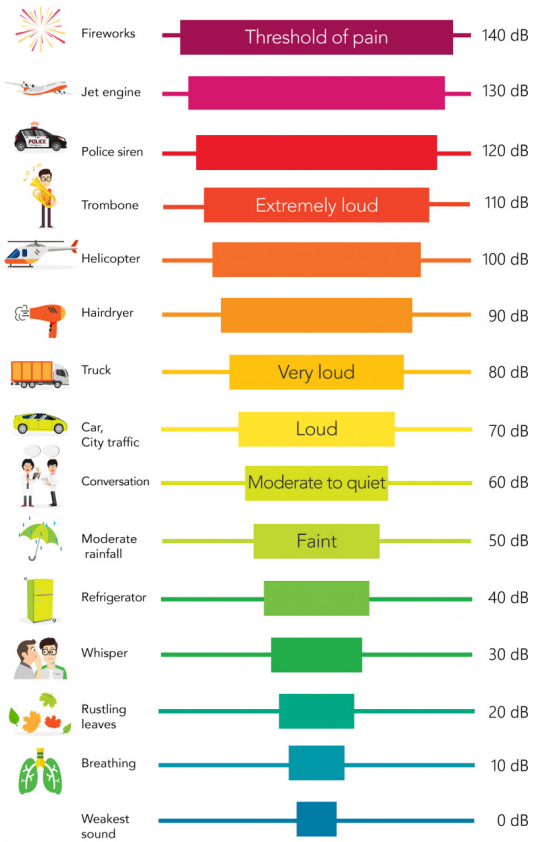
Sortation and fulfillment areas in modern warehouse and distribution facilities can be extremely challenging work environments. As the amount of automated equipment and the number of associates increase to meet today's e-commerce and supply chain needs, it can be difficult to balance the need for fans to provide cooling to workers for **thermal comfort** with OSHA requirements for maximum sound level exposure. Choosing a product that can improve thermal comfort while limiting auditory impact is critical to successful design implementation and execution.

There is often a lot of confusion over measuring sound, the impacts of additive sound sources, and what it all means for the occupants in a given environment. It is important to distinguish the difference between two common but very different terms: sound power and sound pressure.

Sound power is the rate at which acoustical energy is emitted from a source; it is independent of distance from the source and is measured in Watts.

Sound pressure, typically measured in decibels (dB), is the localized deviation in atmospheric pressure associated with a sound wave emitted by a source and is dependent on the distance from that source.

The most commonly used human-corrected weighting for sound pressure levels is the A-weighted scale, noted as dBA. OSHA Standard 1910.95 defines the limit for occupant exposure to sound as 85 dBA averaged over an 8-hour shift. It is also important to contextualize dBA values by comparing sound levels of unfamiliar sources with those we are more familiar with. A visual guide for some common sound sources is shown in the image to the right.



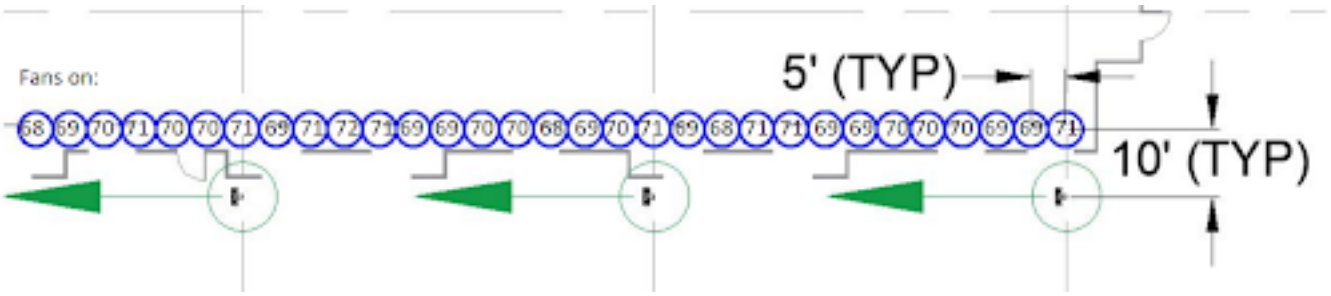
PROJECT SCOPE:

The primary concerns for the pilot facility were areas where equipment and associate density were the highest. Specifically, the upper levels of a mezzanine where associates pick and stow purchased or newly stocked items. Due to the high density of obstructions/occupants and the low ceiling heights in these mezzanine areas, overhead fans were not a viable option for employee cooling. Directional fans were seen as the most practical alternative, but noise was of significant concern due to the dBA levels created by traditional barrel fans used throughout much of the industry.

BAF's proposed solution provided an AirEye fan at an interval of approximately every three workstations. As a validation test, BAF conducted noise level studies in the designated testing area both before and after the test fans were installed. The results from these studies were compared against theoretical values obtained from published fan sound pressure levels for further validation. These test measures allowed for quantitative analysis (from OSHA Standard 1910.95) that ensured the fans were not exceeding the recommended 85 dBA average shift exposure level in the occupied area.

KEY DATA AND OUTCOMES:

Once fan installation was completed, sound pressure levels were taken at intervals along the occupied portion of the test area to benchmark dBA in the work environment with fans turned off. To evaluate the impact of fans on associates, sound pressure levels were taken during the same shift in the same location for comparison with fans turned on and spinning at 100% of max RPM. The measurements for each location can be seen below (inside blue circles).



Upon test completion, average sound pressure levels for each condition were calculated based on collected data and compared, with less than a 2 dBA increase in average sound pressure level across the testing area. These findings were consistent with theoretical sound calculations based on manufacturer-provided sound data.

Sound Pressure Level Comparison			
Experimental AirEye Fans OFF (dBA)	Experimental AirEye Fans ON (dBA)	Theoretical AirEye Fans ON (dBA)	Experimental Sound Pressure Difference (dBA)
68	69.8	69.8	1.8

Despite the addition of the fans, sound levels in the work areas were still well below OSHA and customer-specified standards of 85 dBA (averaged) for an 8-hour shift. This is a testament to the efficiency and design of the AirEye when compared to other products in its field. For comparison, utilizing a directional fan that produces 80dBA would lead to an estimated sound pressure increase of more than 10 dBA in this testing environment (less than 2.0 dBA increase with AirEye fans). The minimal auditory impact of the AirEye, combined with its performance, makes it a superior option for warehouse spaces where noise levels often stay at the upper limit of what is acceptable.

FURTHER ACTIONS:

Occupants, and stakeholders across all levels of the customer's corporate organization, were so pleased with the solution at the pilot facility that the project was used as the basis of design for more than 50 other locations nationwide. BAF partnered with internal and external contractors to develop easy-to-follow design standards for similar facilities. The development of these standards dramatically reduced the amount of design time spent on subsequent BAF projects; maximizing return on investment for each site while making the rapid network-wide implementation of a solution a reality.