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Reducing Sound Levels of Granulator at ORBIS Corporation

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Problem Statement

ORBIS Corporation, owned by Menasha Corporation, is a manufacturer of reusable plastic bulk containers, hand-held containers, pallets, dunnage and packaging. One of ORBIS' main goals is to create a sustainable way to improve product flow throughout a supply chain. The ORBIS Corporation, a subsidiary of Menasha Corporation, has more than 35 world-wide locations to improve supply chains in many industries. Some of ORBIS' customers are companies in the food, beverage, automotive, general manufacturing and pharmaceutical industries. In 2007, ORBIS acquired a major manufacturer of bulk containers, making it North America's leader in reusable plastic packaging (ORBIS, 2017). ORBIS uses injection molding for their plastic products (Boffeli et al., 2017). The Monticello plant alone has 140 employees, the stakeholders, and produces over 30 million pounds of plastic annually (Wortman, 2017). ORBIS is wants to do whatever it can to reduce the risk to its employees.

ORBIS uses a granulator for one of its processes to grind down scrap product to reuse. When an operator runs the granulator, it generates a high decibel level of approximately 114 dB, at the location of the operator. The sound level at the nearest workstation, which is 40 ft. away, is at 91 dB. These levels are significantly higher than OSHA's standards. The human pain threshold is 120 dB, so this problem could lead to hearing loss, rapid employee turnover, workman's compensation, and fines from OSHA. ORBIS wants to reduce them to make the work environment safer and more comfortable for employees, and to meet OSHA's standards.

Machines in factories are typically loud, and other companies want to keep the sound levels low just like ORBIS does. We expect that our proposed solution would be applicable to similar situations, especially if it is being applied to a granulator. There are many manufacturers of products, such as sound blankets, that are meant to reduce sound levels in factories, so there are many other companies that have a similar problem that our solution could be applied to.

Disciplines

Bioresource and Agricultural Engineering | Industrial Technology

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TSM 416 Technology Capstone Project

Reducing Sound Levels of Granulator at ORBIS Corporation

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1 PROBLEM STATEMENT

ORBIS Corporation, owned by Menasha Corporation, is a manufacturer of reusable plastic bulk containers, hand-held containers, pallets, dunnage and packaging. One of ORBIS' main goals is to create a sustainable way to improve product flow throughout a supply chain. The ORBIS Corporation, a subsidiary of Menasha Corporation, has more than 35 world-wide locations to improve supply chains in many industries. Some of ORBIS' customers are companies in the food, beverage, automotive, general manufacturing and pharmaceutical industries. In 2007, ORBIS acquired a major manufacturer of bulk containers, making it North America's leader in reusable plastic packaging (ORBIS, 2017). ORBIS uses injection molding for their plastic products (Boffeli et al., 2017). The Monticello plant alone has 140 employees, the stakeholders, and produces over 30 million pounds of plastic annually (Wortman, 2017). ORBIS is wants to do whatever it can to reduce the risk to its employees.

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of the operator. The sound level at the nearest workstation, which is 40 ft. away, is at 91 dB. These levels are significantly higher than OSHA's standards. The human pain threshold is 120 dB, so this problem could lead to hearing loss, rapid employee turnover, workman's compensation, and fines from OSHA. ORBIS wants to reduce them to make the work environment safer and more comfortable for employees, and to meet OSHA's standards.

Machines in factories are typically loud, and other companies want to keep the sound levels low just like ORBIS does. We expect that our proposed solution would be applicable to similar situations, especially if it is being applied to a granulator. There are many manufacturers of products, such as sound blankets, that are meant to reduce sound levels in factories, so there are many other companies that have a similar problem that our solution could be applied to.

2 GOAL STATEMENT

The current state of the environment near the granulator is much louder than it should be. The noise being produced by the granulator is outputting a dangerous level of sound for the employees' ears. On our site tour, in which we gathered decibel readings with a sound meter, we determined that most of the sound produced by the granulator is being released from a gap between the granulator chute and the wall separating it from the operator's station, and from the pipes that the pellets travel through to a storage bin. We believe that the root causes of the high sound levels are due to vibration of the granulator and deflection of the sound. Another cause for the high decibel readings is due to a pneumatic system blow-off valve that is missing a muffler.

Our goal is to reduce the decibel levels at the location of the operator at the nearest workstation, which is roughly 30 feet from the granulator. We got a reading of approximately 91 dB at the operator's location while the granulator is running. ORBIS would like that to be reduced to 80 dB, which is upwards of a 13% reduction. Fortunately, when the granulator isn't running, that operator is only experiencing 82 dB. It is very likely that hearing damage will be caused in a time exposure of 12 hours at 82 dB, and thus, a hearing conservation program should be established. By doing this project, we will be lowering the risk of hearing damage among the employees, particularly the operator at the nearest workstation. This will improve the work environment, making a difference in how well the operators perform during work. It's been proven that if an employee is comfortable in his or her place of work, he or she will perform better.

Our main objective is to implement sound abatement systems near the granulator to reduce the decibel levels being released from it. To meet ORBIS' specified criteria, we will need to reduce the decibels that reach the operator at the nearest workstation from 91 dB to 80 dB while the granulator is running. Our only constraint is that we are unable to completely block off the granulator area from the rest of the plant.

After our project is completed, ORBIS should maintain, if applicable, the sound abatement method implemented. This way the problem will not return after an amount of time due to wear from use of the method. ORBIS could also try to implement the same, or similar, methods throughout the rest of the plant or other ORBIS plants across the country to reduce noise.

3 PROJECT PLAN/OUTLINE

A. Methods/Approach

a. Reference Materials

i. OSHA Technical Manual on noise and sound Chapter III: Section 5

b. Data Collection

i. Data is defined as the decibel level at a certain location in relation to the grinder. Data for this project has been obtained using a decibel meter by the team on the floor during an operation. Other dimensions and standard sound abatement techniques were considered. Data was also collected by small scale testing of noise abatement techniques.

c. Skills

i. A skill that we learned throughout the course of this team development is project planning.

ii. With one of our teammates studying the safety surrounding industry, his competency in such an area is useful to remaining within OSHA regulations.

d. Solutions

i. A combination of noise abatement procedures was developed through testing on a small scale, which will be followed by implementation and testing by the team on the floor. For our small-scale tests, we set up a soft test that would allow us to compare different sound blankets effectiveness.

ii. The success of our solutions can be measured by the reduction of sound at the target workstation below 85 decibels.

iii. Evaluation of sound abatement solutions were ranked upon their usefulness in reducing sound in a modeled environment. After ranking the usefulness, we created a decision matrix that was weighted by our group and our client.

iv. The evaluation ranking scale was based upon the performance and effectiveness of each noise abatement tactic and was wagered against the cost effectiveness. The options were heavily weighed against the client's input. The decision matrix helped us come to the decision of implementing both a sound blanket wall and the sound reducing foam.

v. The success of the project will be determined upon the ability to reduce the noise level below 85 decibels at the desired operator.

vi. Due to the client's direct input with the potential solutions, the client's expectations will be directly evaluated.

e. Organization

i. To best maintain open lines of communication and understanding between the client and the team, the team has maintained a bi-weekly check-in. By utilizing the group report outline, we were able to effectively break up our work and keep every member accountable.

ii. Major milestones for this project include but were not limited to the identification of sound type and location, as well as, the installation and testing of noise abatement materials.

iii. Due to circumstances outside of our control, including long lead times of the product we ordered, we had to move our date of installation and testing back a few weeks. Besides this, we have not had any other set-backs.

B. Results/Deliverables

a. The main deliverables for this project are: testing and validating the sound level baseline and reduction below 85db, permanently installing a sound abatement system, and preventing any interference of the machine's safety measures.
b. The products our team will propose the implementation of the Acoustical Solutions ABBC-13 Audioseal Combination sound blanket (Acoustical Solutions, 2018) and Acoustical Solutions Alphamax Anechoic wedge foam (Acoustical Solutions, 2018).
c. If the milestones are not able to be completed as planned by the assigned group member, all team members will lend their assistance to that portion of a project.
d. Our project has not been implemented due to the long lead times of the product we ordered but will be implemented as soon as the product arrives. The estimated time of arrival is 4/19/2018. The results will be tested the following week once everything is installed.
e. Depending on the post-implementation results, we would recommend having a larger scale sound reduction system. We recommend this since without the granulator running, the sound within the facility is still close to the OSHA limit for sound decibels.

C. Timeline

a. The testing and validation of the sound level baseline and reduction below 85db stands to be completed by the week of 04/30/2018.
b. The permanent installation of a sound abatement system stands to be completed by the week of 04/30/2018.

4 BROADER OPPORTUNITY STATEMENT

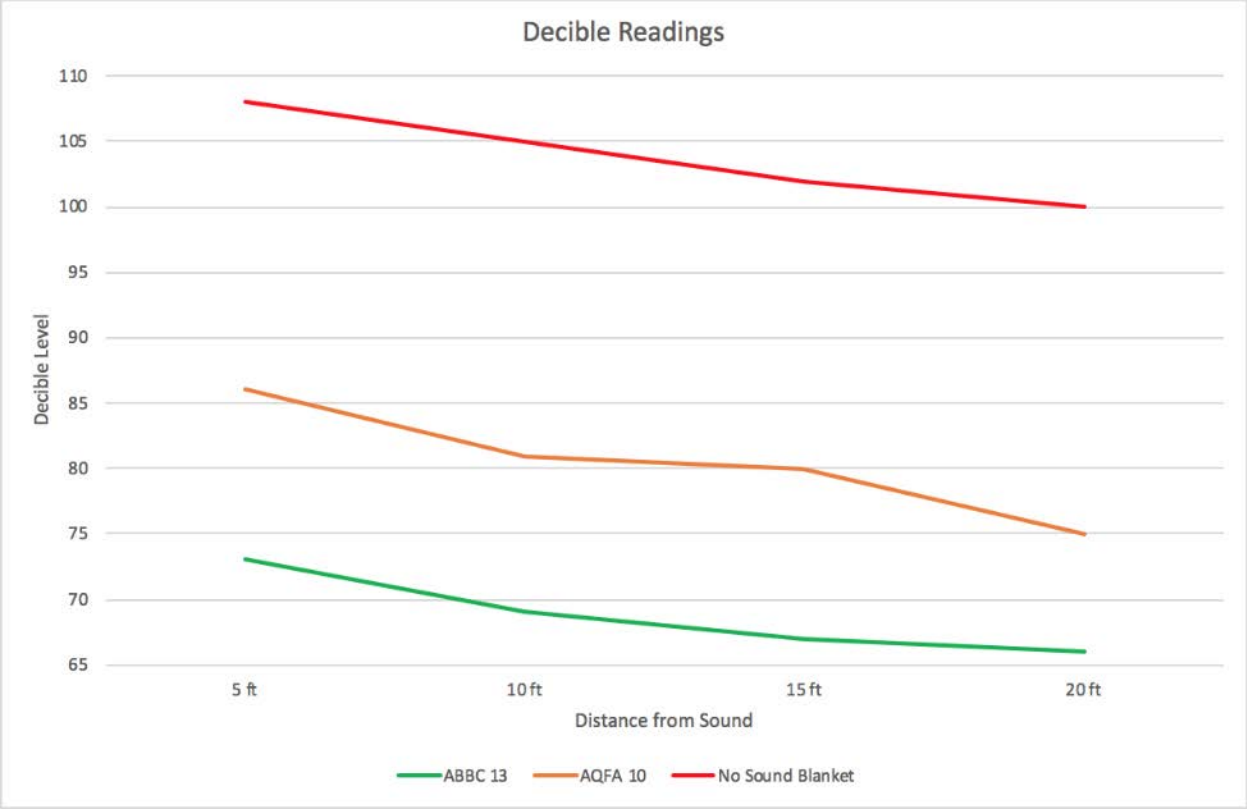
There are environments that employees work in that can be uncomfortable to the human body. If these employees operate in these for long durations, long-term effects could occur. Hearing injuries can be difficult to detect, the effects could occur years after exposure. In this project, there are high sound levels originating from a plastic granulator. When the granulator is operating it produces 114 decibels. Which is like be between a car horn and a thunderclap. The workplace environment for all employees will be greatly impacted by this implementation. The sound blankets will enable employees to be protected from the harm of high sound levels. This will also enable employees to enjoy their everyday job in a comfortable environment. Hearing protection for employees is not an isolated event. Manufacturing and construction industries face the same issues. Other manufacturing facilities could implement blanket walls around high sound level areas. They could also install sound absorbent materials throughout facilities to capture reverberating sounds. In the construction industry, projects can last years if large enough. This can support the use of sectioned areas with portable sound blanket walls to protect employees close to the source of the loud sounds. The benefit of this solution can benefit many industries in preventing OSHA penalties and workers compensation costs. Workers compensation for a hearing loss in both ears can cost a company 80% of spendable income up to 175 weeks (Trier, 2005). Overall, this solution can benefit not only Orbis Corporation but many others in manufacturing and construction.

5 PROJECT SCOPE

The scope of this project is only to reduce sound levels in a nearby workstation caused by the granulator, not throughout the entire plant. We are also not aiming to reduce the sound levels enough that the operator of the granulator doesn't need to wear hearing protection. Initially, we thought that our goal was to reduce the sound levels 10%. When we met with our client contact at ORBIS, he clarified what improvement he would like to see. He would like the sound level at the location of the operator at the nearest workstation to be at 80 dB. To avoid disturbing ORBIS' process of operating the granulator, we are unable to close off the operator's location more than it is. We did notice that there was a pneumatic system near the operator that had a loud blow-off valve without a muffler on it. This obviously adds to the high sound levels at the location of the nearby operator, and a work order has been filed to fix this issue.

6 GRAPHICAL ABSTRACT

Figure 1. Decibel readings of the 7 MAR 2018 soft test comparing AQFA-10 to ABBC-13 sound blankets.



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8 APPENDIXES

Brand	Blanket Model	NRC	Price per sheet	Sheet size
Acoustical Solutions	ABBC-13	0.85	$455	4.5' x 8'
Acoustical Solutions	AQFA-10	0.85	$214	4' x 8'
Acoustic Sonic	Quilted Fiberglass	0.80 - 1.05	$420	4' x 8' x 2"
Acoustical Surfaces	N/A	0.85	N/A	4'/4.5' x 25' x 2"

Figure 2. Sound blanket comparison matrix.

Brand	NRC	Price per panel	Area per panel
Acoustical Solutions	1.33	$209	1' x 1' x 8"
Acoustic Sonic	0.71	N/A	2" tall
Acoustical Surfaces	1.05	$655.92	2' x 2' x 4"
Soundproof Cow	0.65	$109.98	4' x 8' x 1"

Figure 3. Acoustical foam comparison matrix.

	15%	20%	25%	40%	100%
Option	**Cost**	**Usability**	**Ease of Installation**	**Sound Reduction**	**Score**
Sound blanket hanging wall	3	3	5	5	**4.3**
Sound blanket enclosure	1	1	1	5	**2.6**
Wedge foam in top of shute	3	3	5	3	**3.5**
Insulating interior wall	3	3	1	1	**1.7**
Vibration isolators	3	3	1	1	**1.7**

Figure 4. Overall solution comparison matrix.