PROCESS SAFETY: EXPLOSION PROTECTION EQUIPMENT

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Abstract

Nowadays the Manufacturing Industry still growing, much of them are creating new facilities and others just making improvements in their existing facilities. But something that all of them need to take in consideration is their safety, especially if there is combustible dust in their process like in this occasion. This time as others, the customer is adding equipment into their process to protect their equipment in the plant. The safety Equipment to be implemented will not change anything in the customer process but will protect the silos and other components in the process as well of possible explosion because of the combustible dust. The DMAIC methodology was used to make possible a better understanding of the process. The safety equipment installed in the transfer pipelines will not interfere with the travel velocity of the product but will help to protect the line and avoid propagation and secondary explosions.

Introduction

This project is focused in the implementation of safety equipment in order to protect the silos, vacuum receiver, the cyclone and other components of the process from damage of a possible explosion by overpressure or ignition source in the system. We are installing explosion protection equipment which consists in flameless vents attached to the silo, and panels located in the receiver and cyclone. Also, explosion isolation equipment is installed in the shipping lines to protect from propagation.

Objectives

- Understanding the product that the customer will be working with in the plant and if it will be mixed at some point of their process.
- Evaluate the design and the position of machinery to be installed in the production line.
- Design taking in consideration safety equipment to be installed.
- Install the safety equipment.
- Start up (test) of the process, certify it as good to be operated.
- Motivate other companies to protect their facilities because is a requisite by law and in order to protect their facilities and much more important human lives. Also, we are trying to keep implementing the Safety Culture.

Methodology

In order to accomplish the objective already established in this Design Project, the DMAIC strategy will be held to develop this project following the five steps that make it up, each one with different strategies: Define, Measure, Analyze, Improve and Control. The strategies are focused in improving quality of the process, reducing waste, increasing efficiency, among others.

Results and Discussion
Define Phase

The goal of this project is to prevent major damage to the equipment by reducing the chances of rise in pressure by detecting it on time and shutting down the system and in case of an explosion, be able to vent it through the flameless vent equipment and at the same time seal the transfer line pipes with the explosion protection valves to avoid propagation and second explosions.

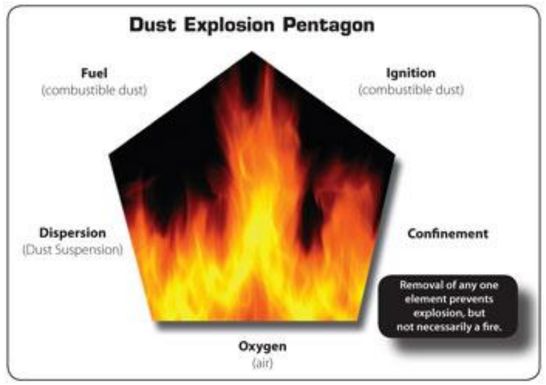

Figure 1: Dust Explosion Pentagon

Measure Phase

A 'VOC' table is generally conducted at the start of any product, or process in order to have a better understanding of what the client's wants and needs to obtain a more detailed product and its specifications. Customer is looking to complete their job in a time manner because of their product demand, but at the same time accuracy and quality must be present in the development. The most important drivers within the process of the Commissioning and Service Report are time, accuracy and quality, in which a critical to quality (CTQ) was define for each. CTQs are the main key measurable characteristics of a product or process whose performance standards and specifications limits must be met in order to satisfy the customer.

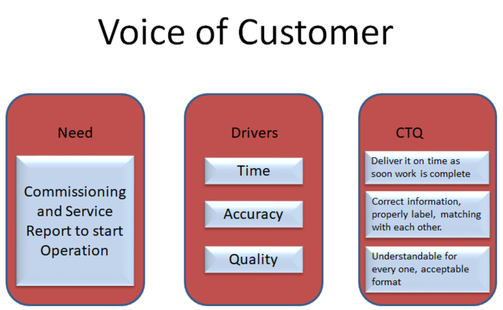

Figure 2: Voice of Customer

Measure Phase (cont.)

This process has calculations that need to be performed in order to found a suitable solution for the customer equipment application. We are using a software designed to work with this type of applications in order to come up with a venting area, then work with sizes of the flameless vents to be use. The software is already loaded with graphs that represent the different shapes of the silos, cyclones; filter receivers, etc., of the equipment that we will be working with and the space to put in the characteristics or values of it to be calculated. In this project are three different systems interconnected and all of them needs to be protected. Follow, are the representation of the three systems with values obtained after run the software, specifically the vent area for each one.

Analyze Phase

After work is done, the goal in the analyze phase is to identify the possible root causes of the delay or defective report which is develop for commissioning purpose as well as generation process. The Pareto chart can be used as a guide to identify major problems in the process. In the Pareto chart below we are using a scale of 10 jobs to run it and it can be observed that the top offender was missing data with a frequency of 9 times representing a 40.9% of all the total defects. Also, the chart is helping us to detect the areas where we need to improve in order to turn in the reports complete and without errors which make us work extra. Creating a check list to go through helps us make sure we touch the critical points before delivering the report.

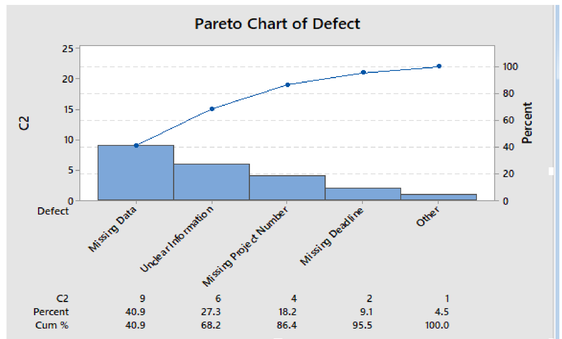

Figure 4: Pareto Chart of Defects

Improve Phase

In order to identify all possible solutions, a study was held of where to look to avoid defects. Between the responsible of the reports was a meeting where criteria were made out of different categories to be evaluated in order to come up with a solution. The following are the principal solutions selected to correct the errors found in the reports. Also, the principal objective of the project was achieved; we protected the customer system by 99.99%. Normally we assure to our customer that their equipment or facilities were our systems are installed are protected a 100% and one the reasons that I have decide to left out the 0.01% is because sometimes there is a failure in the plant that can affect the area where our equipment are installed like power loss or air supply loss. This does not mean that they will be unprotected but definitely it can affect the functionality if this is going for a long period or continuously.

Control Phase

As we know, Control phase is the last step of the DMAIC model, with the purpose of making sure that changes implemented during the improvement phase are well documented and sustained. We can achieve that goal by standardize the process and creating different tools to help us improve. To help making the transition smoother, a complementary training of how to use the tools to achieve a good job was part of the process to teach the current and future personal in the United State location but also, in Europe and Asia locations. As a company oriented to the safety and that provide equipment to make a process more safety we have bring to the attention the documentation aspect, which is very important in order to identify opportunities for constant improvement making possible the measuring of the success and the validation of new processes. Also, in the industrial environment, documents are part of the day to day for all the activities in order to keep track of everything and for legal purpose.

Conclusions

As a recognized company and experts in the dust explosion protection industry, we receive many inquiries from different industries as Food, Pharmaceutical, Recycling, etc., asking for solutions to protect their facilities and equipment of any major incident. In this occasion we worked to found a solution for our customer which is in the Food industry. After performing a positive DHA (Dust Hazard Analysis) we found out that the product (soy beans) the customer is processing acquire its explosive characteristics in one of the phases and that the place where it is going to be contained needs to be protected. After implementing the DMAIC methodology we were able to meet the objectives established at the very beginning of the research. Also, according to our calculations we determine that the silos (container) were the product will be processed can have an explosion overpressure impact of 8.7 Bar which is 126.18 PSI and according to the DHA the product specification constant (Kst) can reach a maximum of 117 m·bar/s. In order to avoid some damage to the structure because of not enough vent area to vent all the pressure, we also calculate it and obtained 1.30 m^2 per vent equipment. An internal calculation gives us a total amount of 16 Explosion Flameless vent equipment that needs to be installed in order to protect the silos, as well 1 panel for the Receiver and 1 cylindrical panel for the Cyclone. Part of this project was develop a start-up and deliver a Service Reports of all the information about the system and recommendation for maintenance and gives training about it to make sure everybody understand how to handle the equipment in different situations. The project was successful and report was delivering on time.

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