

Lead Azide Dust Explosion
A Focus on Management of Change (MOC)

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Abstract

Even a simple change or modification to a process can have significant impacts leading to injuries, fatalities, or equipment damage. As managers we must instill the importance of managing change and persist to strive for continuous improvement. As an organization expands and adapts, so must its core safety programs. A recent incident involving management of change was examined where the safety program was not tailored to the plant and led to structural damage. The incident investigation utilized deductive logic along with other common methods to arrive at the root cause. Alongside the incident details are lessons learned and a deeper look into the structure of the management of change program with guidance to successful implementation.

Keywords

Change to Process

Lead Azide

Management of Change

Process Improvement

Remote Operation

Introduction

Austin Star Detonator Company, a subsidiary of Austin Powder Co., is a detonator manufacturing operation with sites in Texas and in Mexico. The shock tube manufacturing and logistical services out of Texas support the blasting cap manufacturing and detonator assembly plants in Mexico.

Founded in 1988 Austin Star Detonator began with its assembly operation of electric detonators and has evolved to a fully self-sufficient company. A significant contribution to achieve this was the commencement of the manufacture of blasting caps for use in detonator assemblies in 2006 at the Detonadores Estrella Mexico site. This process consisted of preparing primary and secondary explosives, formulating and blending delay charges, and pressing into shell cartridges. The intention of the plant was to automate and incorporate remote operations wherever possible. Modern equipment meant higher training and improved organization. It implied a greater effort and more attention to machine integrity. These prerequisites were atypical of what our plant was accustomed to with our familiarity with labor intensive assembly operations of our past. Nevertheless, it was another challenge to be met.

As in any new process a learning curve was expected, and even with the aid of consultants, internal experts, and hazard analyses, there was one safety concept that proved inadequate over time....a defined and well implemented management of change program (MOC). Obviously hurdles had to be overcome. Bumps in the road became “lessons learned”, and as a company we continued to grow, develop, and adapt. Yet eleven years later management

of change, or rather the lack of a well implemented management of change program, was the cause of an incident involving lead azide, a sensitive primary explosive.

Incident Description

On August 12, 2017 at approximately 12:30 in the afternoon a detonation occurred in the washing and drying lead azide bay at the Detonadores Estrella Mexico Plant. The building where this incident occurred is comprised of three individual bays where lead azide and/or PETN is brought in wetted and then washed with alcohol and dried in a heated bowl. Each bay handles 850 grams of explosive powder per batch. The dried powder is then sieved and proportioned into 80 gram cups in the same bay. The process is remotely operated and highly automated. Each bay is equipped with an extractor located at the rear of each bay for fumes produced during operation.

Batches of Lead Azide and PETN were simultaneously in process of washing and drying when an operator working in a neighboring bay heard a detonation. The operator pulled the emergency alarm and immediately evacuated the building. All personnel from both the manufacturing and assembly plants evacuated and met at their corresponding rally points. Investigators arrived on site at 2:00pm cst to assess other possible hazards, the damage incurred, and to secure the explosive materials in process of the affected building.

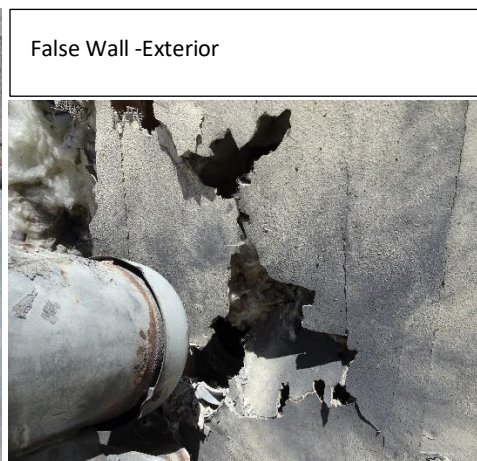


Incident Findings

During the investigation it was discovered that the extractor for the bay had been replaced some time ago with a different type/model without undergoing the management of change process. It is unknown as to when the equipment had been changed since there was no record kept and no one had recalled the event. The replaced model, although similar in function, was not designed for explosive dust environments and over time accumulated Lead Azide powder residues in the motor. Contributing to the incident was the fact the extractors were never included in a preventive maintenance schedule and because the equipment at the rear of the building was not part of an operational checklist, the replaced extractor went unnoticed until the time of the incident.

Impact from Incident

For the reason that the process is operated remotely, no injuries occurred from the incident. There were no health impacts, and no environmental releases. The rear wall of the bay was damaged, which was a weak pressure relief wall as designed. The barricade behind the bay absorbed the explosion and fragments of the extractor. The detonation did not propagate to the in process 850 gr of lead azide. The lead azide was safely removed and disposed. Repair to the bay and to the barricade took two weeks.



Lessons Learned

The incident made us aware that, despite regular cleaning and wash downs, small amounts of lead azide dust was escaping the bay by means of the extractor. The main purpose of the original extractor was to remove fumes from the alcohol washing process. Nonetheless the extractor did contain a filter on the inlet and a completely enclosed motor. It is unclear as to when the extractor was replaced with a different equipment, so it is uncertain over what period of time was needed to accumulate a sufficient amount of the explosive in the motor to result in detonation.

For the reason that the rear of the building was restricted and prevented personnel from accessing the area during operation, the auxiliary equipment on the exterior of the building, such as the extractor system, was overlooked and not included in a preventive maintenance schedule. The same equipment was also overlooked on operational checklists or start up inspections.

The building construction in respect to the pressure relief wall and barricade surrounding the building performed as designed. The weak wall immediately collapsed and prevented pressure from the detonation from propagating to the explosives in process. Pressure was exerted out of the bay toward the barricade. Data from the investigation did however suggest that a blast curtain or shield constructed of recycled rubber be installed between the auxiliary equipment and the barricade to reduce damage by absorbing fragmentations from potential future occurrences.

Recognizably the lasting impression of the incident was the need to review the management of change program already in place. The incident demonstrated the importance of following the program. Retraining personnel at all levels was a start. The program called for group decision making and it is designed to identify potential hazards and address them appropriately. Carried out effectively management of change instills in people the significance of what may seem to be a minor change to a process. History has shown us exactly that. There are many incidents around the world where management of change failed and resulted in severe or catastrophic events.

So if a program was in place, and it was understood how it should work, then why did it fail?

Somewhere in our plant resided a document with the title “Management of Change” but it had no purpose and served no benefit. The incident had brought it out from the back of the file cabinet to the top of the meeting table. How many other changes had been made without approval? How many have the potential to result in injury or equipment loss?

Defining the Program and Stream Line It

If your programs are a hundred pages long and have multiple forms that need to be filled out by the line personnel, then it is guaranteed that no one will use it. A beneficial program must be streamlined and customized to your operation. In any business in any industry you must adapt to survive. Safety programs, on the contrary, often do not adapt alongside of growth or change. As in our case with the recent expansion of the blasting cap plant at our Mexico site left our safety program ineffective to this new process.

Knowledge of your in-plant resources should determine the complexity of your program. Our plant ran 24/7 with three hundred people. After the incident our MOC paperwork was reduced to a one page form and another for approvals. It is notable to implement a simple program rather than writing a novel-like docket that requires hours of paperwork and meetings. In any business environment management wants volume, as well as quality, and would not support a program that withdraws resources from that. In the end management of change should not put its focus on generating mounds of paperwork but rather on a simplified program involving group decision making. Define the structure and what stages of decision making will be expected.

Our management of change program was revised in order to define two types of change. Process Improvements and Change Process. In the case of an improvement, the process is only enhanced but there is no effect to the process itself. This type of change is more common and should be streamlined in order to execute it in a reasonable timeframe. Change process involves detailed studies and supporting documentation. This type of change, for obvious reasons, would entail several group discussions over the development of the project.

Effective Training

How do you conduct training? Do you read through the program word for word and put the group to sleep? It is easy to distribute the program material and collect signatures on an attendance sheet, but it takes effort to make a training “stick”. An effective training should be measured by how much of the material was absorbed by the group. Using examples of incidents or near misses from the actual process or off-site incidents related to the process grabs their attention and leaves behind images of what could be. This has worked for us because the people can gain knowledge from a photo or short video of the materials they handle on a day-to-day basis.

Consider splitting the training into two sessions. Rather than repeating the same training over and over, cover a part of it and build on it next time. Provoke discussion or group exercise. This technique has worked in our establishment especially well with regulatory compliance trainings. Meetings are split into two, sometimes three, days lasting no

more than thirty to forty-five minutes each day. At the start of each session a review is performed and the training is built upon it.

Safety training of particular subject matter can also be incorporated into other trainings that relate to one another. It is known that it takes several elements to come together to make a comprehensive and all-inclusive plant safety program. An example would be a mechanical integrity program that incorporates management of change. This is an opportunity to illustrate the dependency of other programs or departments to work in unison to achieve greater results.

Selection of Group

Group decision making is at the heart of management of change as well as hazard studies, and risk analyses. To this point the group must be comprised of the right people. Given that people from different departments with different backgrounds view ideas from unique viewpoints it is understandable to utilize a diverse group for the approval process. Horizontal collaboration within the organization will streamline communication and create effective sharing of information.

Planning

Plan the change. A realistic timeframe should be set to evolve an idea of change through execution. Move to fast and issues are often overlooked. Take too long and you lose interest and collaboration. Clearly the timeframe is dependent on the criticality of the change. This is where a well-defined management of change program becomes beneficial to a practical situation. What type of change are we dealing with? Is it an improvement or a change to the process? In either case scheduling the review meetings over the development of the change and communicating to those involved a little organization and planning that goes a long way.

Culture Change

People accept change differently. In our organization we introduced new safety, health and environmental guidelines that profoundly changed how we operate. There is always resistance, however being persistent and involving all levels of management is key. Ultimately buying into change is the most difficult challenge.

Ownership is one means of sharing the responsibilities that provides involvement at different levels. I have found that rather than demanding a change you let them own it and they will nurture it with greater care. Roles and responsibilities are assigned vertically and horizontally within the organization. In turn, they partake in the change rather than resist it. Encourage those that accept their roles willingly and celebrate success.

Provide feedback to all affected personnel. In this way you build trust and demonstrate the effects the change has had on the organization. Often times it is the labor workers who initiate the ideas, so keeping the communication open preserves their involvement and attitude toward change.

As a final point management of change should not be regarded as forms that need to be filled out. It is group decision making throughout the stages of a change. Whether an improvement or a process change, we as managers, must instill the importance of the change and bestow ownership at all levels with the organization. Success will be more likely if the programs we implement are well defined and communication is maintained throughout. As the organization grows and adapts in order to sustain itself as an ongoing concern, so must our safety programs. Efforts should be spent on communication and customizing programs to work for type of organization or process it is intended for. The “buy in” of change will be achieved with persistent positive attitude from management. The attitude and culture of an organization starts from the top. Strive for improvement, be persistent, keep looking forward, and others will follow.

Acknowledgments

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