Process safety on the road

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In BASF Antwerp, we have initiated different initiatives for reducing the process safety incidents (PSI). All the process safety incidents are categorized in three categories. The incidents around operational integrity are those who are correlated around operator failures. Another group are the PSI's concerning the category of design integrity, these are PSI's correlated around a wrong design. The last group is around mechanical integrity, failures around mechanical equipment and pipelines.

Most of the PSI's are in the group of operational integrity. In total 60% of all PSI's are related around operator failures.

In BASF Antwerp, we have focussed on the reduction of the process safety incidents around operational integrity. Therefore the following reduction initiatives are launched during the last three years:

- Workshops together with operators and management

- The program of Process safety on the road

With the program of Process safety on the road we were questioning, how can you encourage workforce involvement? To be successful, you need to have operators that truly believes that all process safety incidents are preventable. It's got to be in the heads and the hearts of the operators.

This will be the path forward in process safety in the future. Comparing with the long way that occupational safety has travelled with as result a decrease of the number of lost time injuries, this will also be possible for process safety. The goal to be achieved in process safety will be the reduction of the number of PSI's. (incidents like releases of product, fires and explosions), especially those which are due to operator failures.

The same as in occupational safety, as organization you need to change the behaviour of the operators, by creating a process safety culture. A good process safety culture is as operational discipline. You need to reach a level where the workers in your organization are following the procedures, where the operators see that process safety is also a benefit for them. The program 'Process safety on the road' has created a mindset, an awareness for process safety towards the process operators.

The method that BASF process safety experts have used is to talk and to discuss with the process operators about process safety. You always have to remember that operators are 2/3 of the day the plant management. When something happens in the installation, after the normal working hours or during the weekends, the operators have to decide what to do. We used these talks as trainings for the operators. In this way we make the operators more competent, especially in process safety. When you have highly competent people, this will lead to a great process safety performance.

The tool that we have used, is to talk with the operators, go in discussion with the operators in their own comfort zone. We held these discussions, these talks in the control room, where the operators live most of the time.

The program that the process safety experts from BASF have brought in the control room is the following:

- Repeating the definitions of a PSI
- Showing trends
- Discussion around the process safety incident (under the pillar operational integrity) of Formosa Plastics (23 April 2004, Illinois, USA), where human failure was one of the main root causes. Analysing this incident and looking to the different causes for this incident together with the operators, creates also a kind of reflection of the operators from 'Are there similarities with this incident in our own plant?'. This reflection leads to solutions and good practices to avoid these causes in the future.

Process safety on the road

When you look to the title of my presentation « Process safety on the road », everybody will think "which road".
Now, at BASF Antwerp, we have used the road towards the process operators.
The process safety experts in Antwerp have brought process safety to the operators in the different production plants.
What was the reason for this approach? One of the reasons is to reduce the process safety incidents (PSI) especially around operational integrity.
The operators are the people who are running the plant 24 hours each day. With bringing process safety towards the control rooms, we create a kind of workforce involvement for process safety.
Therefore, with this approach, we will make a step forward in process safety.

New insight: Path forward in process safety

Nowadays, the chemical industry is more concerned about process safety than 10 to 20 years ago. During the last decades, the period from 1980-2000, several catastrophic incidents happened around the world. Major incidents like the ones at Flixborough, Piper Alpha, BP Texas City and Bhopal had a great impact on the chemical industry. After each event, a thorough investigation followed, resulting in new regulations and corrective measures. The main issue is that the experience and knowledge derived from those investigation reports, helps preventing new incidents. To a large extent, the improvement of

process safety is the result of an adequate incident analysis and learning from experience. In the analysis of catastrophic incidents, it is important not only to look for immediate causes, but also for the underlying causes. In order to prevent the last incident, you have to look to the immediate causes, but if you want to eliminate other incidents in the future, you need to investigate the underlying causes too. Very important is that operators who are operating your plants also need to have knowledge on the underlying causes of these incidents in order to avoid making the same mistakes as in the past.

The long way occupational safety has travelled with as result a decrease of the number of lost time injuries, will also be possible for process safety. The goal to be achieved in process safety will be the reduction of the number of process safety incidents (like releases of product, fires and explosions). In occupational safety, the decrease of the lost time injuries is achieved with different successive stages in the safety management concept. In the beginning, the mindset especially was to improve the technical safety. That means : try to improve the working conditions first, this resulted in a safer working environment. This improvement has reduced the number of lost time injuries, but after a while the number was stabilized and not decreasing anymore. The next step was the hard-wiring of the safety culture in the mind of the people. This resulted in a management's commitment, where the attitude and the behaviour of management determines the safety climate in an organization. If management is demonstrating a visible safety commitment by joining day-to-day discussions on safety at the workplace, when management is participating in investigations about lost time injuries, they will give a clear signal to the people that safety is one of the core values in the organization. Trends in occupational safety are showing nowadays a decreasing line of lost time injuries during the years.

A visible safety commitment could be achieved by investigating near misses in occupational health incidents and going in discussion with the people. The famous pyramid, where at the bottom the near misses can be found and at the top a fatality, the same pyramid can be used in process safety. When we investigate these near misses, especially the early warning signs, then the explosions, fires and releases will decrease. With early warning signs I mean the different process upsets happening in your production plant. Each process upset means a deviation from a normal operation mode. These process upsets are early warning signals, something is deviating from the normal working frame. When an operator is confronted with such an early warning signal, he has to write it down in an incident report. But also the process engineer or the day supervisor needs to do checks on a regular base for these process upsets. They also have the responsibility to check if process parameters have certain deviations from their normal values. A few examples of early warning signs are: an activation of an overpressure protecting device (SIL interlock or safety valve), the activation of a high level interlock in a distillation tower, a leakage on a seal barrier of a pump, a sudden temperature rise in a storage tank … With capturing these near misses, you will avoid a fatal incident.

The visible process safety commitment of the management will be that they investigate these incidents together with the operators and go in discussion with the operators in order to avoid these incidents from reoccurring in the future. The same as in occupational safety, as organization you need to change the behaviour of the operators, by creating a process safety culture. Process safety culture is as operational discipline. You need to reach the level in which the workers in your organization are following the procedures, in which operators automatically bring up the near misses, in which the operators see that process safety is also a benefit to them. You can create such a process safety culture when you install a strong workforce involvement.

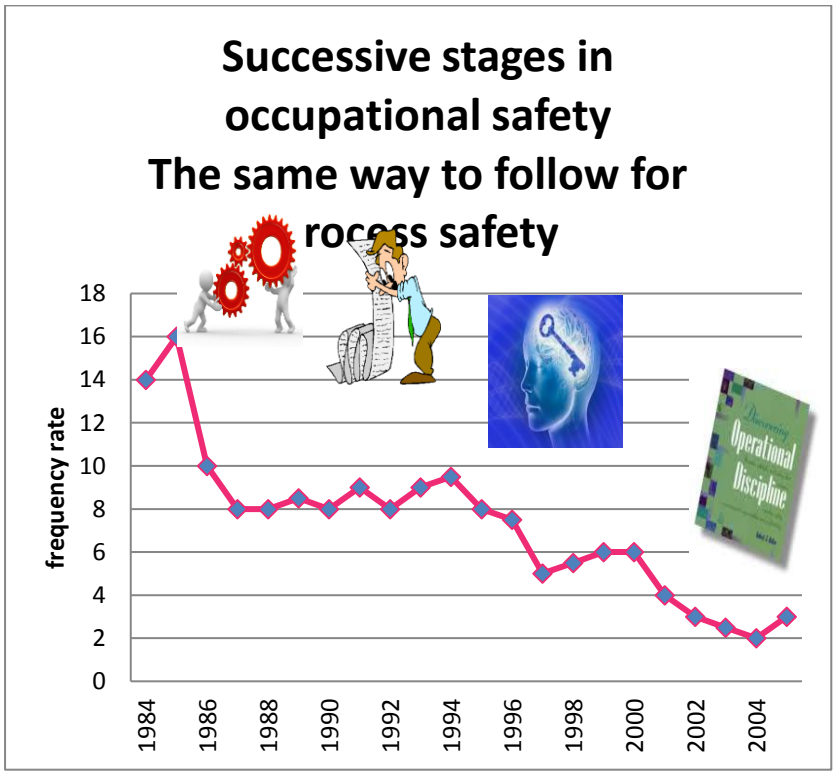

Figure 1: Successive stages in occupational safety

Goal : Reduction of the process safety incidents

We created a reduction program of the process safety incidents together with the operators. In this way we built a framework in which operators are involved The process safety incidents in BASF are categorized into three pillars. These three pillars are PSI's around operational integrity, design integrity and mechanical integrity.

The focus today lies on the reduction of the PSI's especially around operational integrity. This pillar consists of failures of different origin made by operators. These failures could be a lack of communication, a lack of training, not following procedures, human failures or personal performance.

When you look globally for BASF Antwerp, 60% of all the process safety incidents are due to operational integrity. This is a constant percentage during the years. PSI's mostly appearing during starting up of process units after a shutdown period. One of the typically operator failures are valves being left open after the start-up of a process unit. This could be the result of not following the procedures or a lack of attention.

This is one of the reasons to involve the operators more and more into process safety, trying to avoid these incidents in the future.

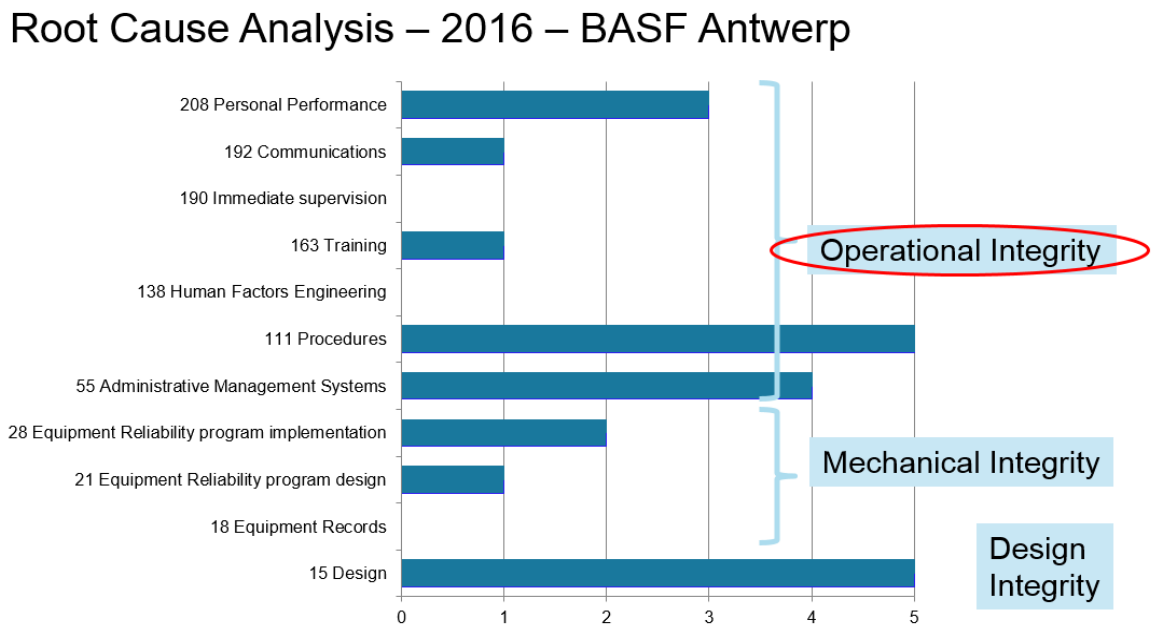

Figure 2: Root cause Analysis-BASF Antwerp

PSI reduction initiatives

To reduce the process safety incidents, different PSI reduction initiatives are initiated in BASF Antwerp.

These initiatives were the following:

a) A reduction program for PSI's around operational integrity:

- Workshops were organized with as topic PSI caused by operator failures. The target group was operations. During this workshop, we started from the classical basic root causes of incidents, illustrated with incidents happened at BASF Antwerp. After the introduction, operators and plant managers developed possible improvements for reducing these PSI's. One of the main issues that came up, was that a lot of good practices are already integrated in different plants. But not all the plants are using these good practices. Therefore, a program is started in order to exchange these good practices between the different plants. A lot of good practices are written down in a good practice catalogue. This catalogue can be used by everyone.
- The program 'Process safety on the road' is another PSI reduction initiative. It creates a mindset for process safety in the heads of the operators.
- Together with operators and plant managers, we are now defining the process safety fundamentals, a list of basic rules for operators around process safety.

b) A reduction program for PSI's around design integrity:

In another workshop around the pillar design integrity, we focussed on PSI's resulted from design failures. The target group was engineering and operations.

The focus was learning from incidents due to design failures. By analysing these incidents, and defining the root causes, the lessons learned are collected and written down in documents, in norms where engineers are working with. On a regular base, the incidents are used as learning material for young engineers, in order to avoid these incidents to reoccur in the future.

c) In the workshop mechanical integrity the focus was on PSI's due to CUI (corrosion under insulation). Here the target group was operations and maintenance people.

The biggest reduction of PSI's could be achieved in the pillar operational integrity, therefore the program of 'Process safety on the road'.

Workforce involvement is the path forward in process safety

How can you encourage workforce involvement? Because this will be the path forward in process safety in the future.

To be successful you need to have a workforce that truly believes that all incidents are preventable. It's got to be in the heads and hearts of people. We want to create an operator view towards process safety.

To improve process safety, one of the key performance indicators in BASF is the quantity of process safety incidents.

The goal is to reduce the process safety incidents (PSI) by creating a mindset, an awareness for process safety towards the process operators. The manner that we have used is to talk with the process operators about process safety, illustrated via the program 'Process safety on the road'. You can compare it with a kind of impulse talk. You always have to keep in mind that operators are 2/3 of the day the plant management. When something happens in the installation, after the normal working hours or during the weekends, the operators have to decide what to do. We used these talks as trainings for the operators. In this way we make the operators more competent, especially in process safety. When you have highly competent people , this will lead to a great process safety performance.

The tool that we have used, is to talk with the operators, go in discussion with the operators in their own comfort zone. We did these discussions, these talks in the control room, where the operators live most of the time. Very important is that during these discussion sessions, the plant management is also present. The reason is that they can interfere when the topics are specific correlated with the plant itself.

Process Safety on the road: program

The program that the process safety experts from BASF brought in the control room was the following:

- We repeated the definitions of process safety incidents, based on the ICCA rules. Because they have to know what are the parameters for having a process safety incident or not. The investigation of process safety incidents starts with the reporting of these near misses. When the near misses are not reported, then it is not possible to analyse them. Near misses are warning signals, include also in your near misses the different process upsets. In your organization you need to have a blame-free culture. Management needs to promote the reporting of the near misses by the operators. The operators must have the feeling that they will not be punished when they report these near misses. Tell your operators that near misses are free lessons. The organization can learn from these near miss incidents. When the incidents are reported, you can propose improvements, such improvements that the near incidents can't happen anymore.
- We have also shown some trends for the PSI's, in their own field but also worldwide. In this way the operators have an idea about the status of process safety in their plant.
- During the sessions we brought process safety incidents which have happened in the three categories of operational integrity, mechanical integrity and design integrity.
- Most of the incidents are not caused by a lack of knowledge, but by the failure to use the knowledge that is available. How can you improve the knowledge on process safety? One method is by teaching the operators about old incidents. Tell about the incidents that have happened in your plant over the last years, tell them about incidents which have happened in other plants.
- At the end of the session, we exercised a small HAZOP study. During this small study, we defined always different causes of possible hazards. Operators have to look after possible consequences and they can also make proposals for different countermeasures. Two exercises were worked out, an easy one with a pump between a storage tank and a high pressure column and another, more complex one, with a compressor.

Discussion meetings

The main content of the program was telling about the different process safety incidents.

a) *Tell about process safety incidents at BASF Antwerp and worldwide*

During these discussions, connections were made to their own plant. The operators were confronted with situations in their own plant which looked similar to situations in these incidents. By discussing these incidents with the operators, they become more aware of the dangers in the installations. The content of the discussion will be longer remembered and the operators are more committed to the conclusions because it's something that came from them.

Based on a very interesting note from the book 'Learning from accidents' from Trevor Kletz: 'Most writing on safety follows the Greek tradition. It sets down principles and guidelines and urges us to follow them. If we read them, we soon get bored, and soon forget. In contrast, stories, that is, accounts of accidents, can grab our attention, stick in our memories and tell us what we should do to avoid getting into a similar mess. Only a story will convince us that we need to read it.' This philosophy we have used towards our operators, incidents will grab their attention, and will stick in their memories.

Speaking about incidents is telling more than giving theory about it, in this way we can avoid incidents in the future.

b) Telling about incidents and analysing those incidents in group, will also create a view to similarities in their own chemical production units

The question has to be posed : "Why will there be an escalation into these examples and which prevention measures do we have so that this escalation wouldn't happen?"

By doing these sessions in different production plants, there is always a possibility to exchange some good practices and solutions of different plants. The process safety experts, the teachers, can exchange or collect these good practices in the different plants.

Which incidents have been discussed during the sessions?

We divided the incidents in three groups, the first group was the group of incidents concerning operational integrity, where the main cause was an operator failure.

The incidents that we have discussed together with the operators concerning operator failures were the incidents that happened in Formosa Plastics in USA at 23 April 2004 and a same kind of incident that happened in a plant in BASF Antwerp.

The second group was a process safety incident concerning mechanical integrity, where we had an implosion of a vessel due to under-pressure caused by a mechanical failure.

And the last group was an incident due to a design failure, a vapor cloud explosion due to thermal fatigue in the beginning of 2015.

The framework which has been used towards the operators, will now be illustrated by the Formosa Plastics incident. This process safety incident happened at 23 April 2004 in Illinois. In total there were 5 fatalities and 3 injuries.

First was given a description of the incident, what has happened in Formosa Plastics?

At 23 April 2004 a vapor cloud explosion occurred in the plant due to the wrong draining of a full reactor filled with VCM (vinyl chlorine monomer).

Normally in each of the reactors, the polymerization happened from a vinyl chlorine monomer towards PVC (polymer). The reaction takes place under pressure and temperature conditions.

When the polymerization ended, the tank/batch is transferred to a storage tank, afterwards the reactor was cleaned with fresh process water.

There were two operators, one at an upper level, who rinsed the reactor and another operator at the floor level, who opened the drain when the reactor was cleaned.

The floor level operator went downwards and took the wrong reactor, instead of opening reactor A, he drained reactor B. This was a typical slip or lapse of attention. He came down the stairs and instead of going to the right, he went to the left and was standing in front of the wrong reactor. At that moment, an interlock was activated on the drain valve. Due to the high pressure/temperature still in the reactor the drain valve couldn't be opened. But the operator had the possibility to bypass the interlock. With small flexible hoses he could put air on the motor of the valve, and the drain valve opened.

The result was the draining of a complete full reactor with a flammable liquid. A vapor cloud explosion occurred resulting in 5 fatalities.

During our sessions in the control-room, and after giving the description of the incident, the different basic root causes of this incident are explained. The question asked to the operators was: « Can such incidents also arise in our own environment? » or « Do we see the same similarities in our own chemical plant? »

This question created discussions amongst the operators. They looked after similarities in their own plant and also mentioned the different safeguards they have for preventing such incidents. Having such discussions, is also a leaning tool. This learning is the clue that we want to achieve in these discussions, trying to get process safety in the heads and the hearts of the operators.

At the end, good practices or solutions were given. These best practices could be collected by the process safety experts and used in other plants.

Now I will zoom in at the different basic root causes of this incident and highlight the different proposals of possible solutions to avoid this incident in the future and also show some good practices.

Human error as one of the basic root causes

Zooming into the different basic root causes of this incident, one of the main causes was 'Human error', categorized as personal performance. The operator made the following mistake : he opened the drain of the wrong reactor.

In discussion with the operators, we have seen that such incidents are not so rare. We see the same similarities.

During the sessions in the control room, by explaining the different basic root causes of the incident, each process safety expert also illustrated some basic root causes from his own experiences.

I have experienced similar incidents around human error a few times. In my previous plant, the cyclohexane oxidation plant, I remember that a mechanic had nearly opened a filter which was still in operation.

In the morning he had received the work permit from production for opening the A-filter, which was still in operation and not cleaned. The B-filter, which was standing behind the A-filter, was cleaned, and normally the mechanic had to receive a work permit for the B-filter.

The mistake was made due to an operator failure during the night. Each time when you have rinsed a filter with water, you need to change a label on the top of the filter, from 'Filter in operation' to 'Filter not in operation'.

At that moment, the filter where the mechanic wanted to work on, the A-filter, had the label 'Not in operation', but in reality the filter was in operation. During the cleaning activities in the night, an operator hadn't changed the label, and so the mistake of the operator in the morning was made, a typical slippery or lapse of attention.

But the mechanic, which is the last safety barrier most of the time, at that moment, made use of his senses. At that moment the filter was still warm because the filter was still in operation. In this case the last safety barrier had worked, because the mechanic had used his STOP reflex. He went back to the control room and he said "there is something not normal on the filter", because he was still warm. In the control room, the operators immediately saw their mistake, the mechanic was standing in front of the wrong filter. He was very lucky because he used his STOP reflex.

Figure 3: Filter combination

I can tell a similar story around human error with pumps. In a plant you mostly have the combination of A/B pumps. When you are standing in front of the pumps, the A-pump is at the left and the B-pump stands at the right. When at a certain place in your plant this combination is changed from A/B to B/A, you could guarantee that there will be a moment that this will go wrong.

This design is error prone and there will be a moment a mechanic will start to work on the B pump instead of the A pump.

In the same plant that I mentioned before, we had a pump combination as you can see on the picture. A mechanic received a work permit for working on the pump P110. But due to a lapse of attention of the mechanic, he started to work on the wrong pump.

What happened? The pumps in this particular plant were arranged in the following way, on one side you could see the pumps P109-120-130-140 on the right of the gangway, on the left side of the gangway there was pump P110 located. The mechanic thought at that moment, I see here pump P109, the next pump will be P110. Again he was saved by his senses, because when he came at pump P120, the pump was running and made a lot of noise. Due to the noise, he immediately went back to the control room and there he immediately saw his mistake.

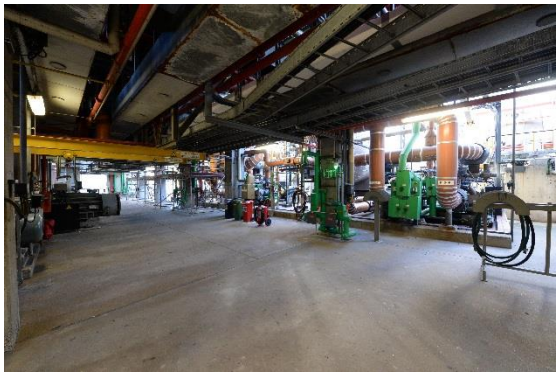

Figure 4: Pump combination (left pump is P110, right P109-120)

One of the underlying basic causes in the Formosa Plastics incident was the bad design of the reactor panel. The mistake the operator made, was a typical slippery or lapse of attention. The bottom operator had poor information about the process conditions in the reactor. Also the bypassing of the interlock was too easy.

In discussion with our operators : "Again, do you see such similarities?" When they see such situations, they have to mention it to their management. Because there is a general rule : « when a situation is error prone, change your design ». Change your design to remove opportunities for human error.

In some cases this could be easily done by using colours or putting these extra process conditions visible for the bottom operator on his working place.

A good practice would be that the operations team has discussions with the operators about situations where a human error could be made on a regular base. Therefore, invite the operators also during model reviews of new projects. Afterwards they will have to manage these new installation parts. From the start of the new project, they can already deliver input to these new concepts. In this way, you can avoid bad designs!

Another root cause of this incident was not following the procedures. Not following the procedures, is not fulfilling operational excellence.

In the Formosa incident, the operator could easily open the locked drain valve, but he was not following the procedure, normally he needed to ask the approval of a superior. This was the four eyes principle, which has been bypassed.

Sometimes we are seeing the same similarities in our own plants. Mostly the procedures are written down by the management, but the question is : "Will these procedures be followed up by the operators in the same way as they are written down?"

When an operator follows the procedures, at the end, you will achieve operational excellence, and this will result in a process safety excellence. You need a symbiosis between the management and the operators. It must go in both directions. The procedure must be lived by both parties. When there are changes, the operators have the obligation to mention this at the management, but also in the opposite direction, when there is a change in the procedure from the management, it has to be discussed with the operators.

Following up that procedures will be executed as they are written down, has to be checked. As manager, make an observation of the execution of the procedure in the field. In this way you can check whether the procedure is executed as it is written down.

Inadequate management system as root cause

Another basic root cause of the Formosa incident was an inadequate management system. It's very important to execute a good HAZOP around the different process units.

In this case, the phase between normal operation and changing to the phase «cleaning of the reactor » had to be defined as a very high risk. The likelihood was also very high, because cleaning of the reactors was happening on a regular base.

For such high risks, we mostly define a countermeasure from a high quality. That means that the administrative protection mode of an interlock with a bypass, only controlled by a written procedure, was too poor for such a raw risk.

A possible solution could be a key system. With this key system, you will always have the four eyes principle.

You can only open the drain valve with a key that you can get as operator in the control room, given by a supervisor. Both people have to agree to open the drain valve at that moment, in this way the four eyes principle is present.

A good practice for executing a high quality HAZOP is to have a good team around the table, invite operators during these HAZOP sessions. You will create a mix of practical experience, given by the operators and experience in process safety given by the process safety expert.

HAZOP's are also a very good learning tool for operators, they get a deeper knowledge of the safe guards in your different process units. In this way you create a win-win situation.

Train your operators on a regular basis on the different safety guards in the plant. In this way they know which are the critical interlocks and what the background is behind it. In this way, you involve the operators in process safety.

Another inadequate management system in the Formosa incident was not learning from similar incidents. In the case of Formosa Plastics, the same incident happened before, once in Baton Rouge in 2003 and another in Delaware in 2005, both in the USA.

When you don't analyse an incident properly, it will repeat, and can have, in some cases, a much bigger impact.

Most of the incidents have the same basic root causes, the art is to recognize them, why will it happen in this plant and not in another plant?

Those who cannot remember the past, are condemned to repeat it, was a famous note from Trevor Kletz.

Therefore, it's very important for the operators, when they have a process upset in their shift, that they communicate it to the management and write it down in an incident report. An incident could end in this shift without consequences, but can become a nightmare for another shift.

In BASF Antwerp, all these incidents are collected in an incident database, this is a big source of information. This source is available for a big group of people, engineering, assets, operations and maintenance people. For near misses we are looking for potential outcomes and implement countermeasures to prevent these near misses.

A few good practices around learning of incidents are the following:

- Make an incident flash of each incident, each PSI. This incident flash is like a one pager. Discuss these one-pagers of the different incidents in your plant or site with the operators on a regular base. They can learn about it, they can see if some basic root causes can also impact their plant.

The information of these process safety incidents in these one pagers can be used as a learning tool. The format of these incident flashes is always the same. Each incident flash will give the course of the events, the causes and the corrective actions.

- Another best practice around learning from incidents would be to have strong involvement of operators in incident investigation meetings.

Even in the vision 20/20 of the CCPS it was already mentioned: "The ability to rapidly share lessons learned and use those lessons to lead procedural or mechanical change across plants, is the key to improve process safety performance".

Another example of Operational Integrity

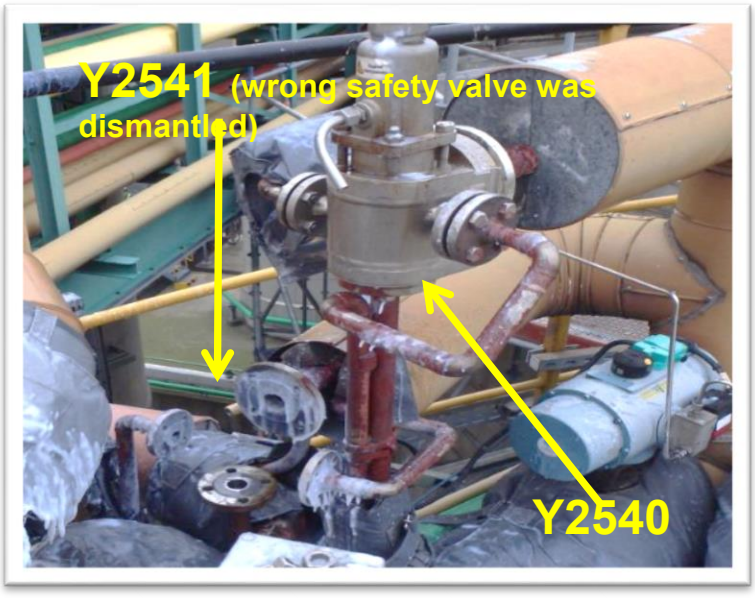

Figure 5: Leakage of sticky product

Another example of an incident that we have discussed with the operators on operational integrity is the following incident that happened in a production plant of BASF Antwerp. It is typically an example of an operator error. There was a leakage on a flange of a safety valve. During a control tour the leaking flange was discovered, it was a leakage to the environment. The name of the safety valve was Y2541. The operator went to the control room and told the upset to the supervisor. The supervisor of operations and maintenance prepared the permit to disassemble the safety valve which was leaking. But a

mistake was made, the work permit was written for the dismantling of the safety valve Y2540 (this safety valve was directly located in the neighbourhood of safety valve Y2541). The rinsing activities and the preparation was done for the dismantling of the safety valve Y2540.

But this was not the safety valve which was leaking. After the preparation, the operator went outside together with a mechanic. The operator pointed the wrong safety valve. Instead of safety valve Y2540, he pointed out Y2541. The permit was prepared for Y2540, the operator went outside with the permit for Y2540, but he pointed out the safety valve Y2541, which was not prepared to disassembly. The operator made a mistake, a typical slippery or lapse of attention .

The mechanic dismantled the safety valve Y2541, because there was the real leakage. But the safety valve was not rinsed and was still in operation. During the dismantling, there was not directly a problem, but during the time the safety valve was built off, the pump was started again and there was a release of hot (+/-100 degrees Celsius) product in the environment. The mechanic has had big luck, because otherwise he had severe burning wounds due to the hot sticky product.

Which lessons could we learn for operators in this incident?

- Delivering of the permit on the place itself: this was not completely fulfilled (because the operator has still pointed on the wrong safety valve)
- Stop reflex was not really used. When there is a chance that you are pointing out the wrong safety valve (or filter or pump or …) you have to stop and contact your shift leader again. When you deliver a permit to a mechanic, you need to be sure that the mechanic will start to work on the right equipment. Otherwise the consequences could be really disastrous. The operator must be 100% sure otherwise he has to use the stop reflex.
- This is not only an operator failure, you could also say, this is may be also a design failure, because installing such safety valves very close to each other creates mistakes (‘an error prone design’). The safety valves were not very good labelled on the place itself. The reason to put these safety valves very close to each other was due to solidification purposes. Both the products solidify very easily, and therefore it’s easier to keep the safety valves warm by insulation when there are located close to each other.
- Another lesson of this incident is to have a good communication because the initial failure started with the preparation being done for the wrong safety valve. The leaking safety valve was Y2541 and the preparation was done on Y2540.

Now this is really an incident that could happen in each production plant. We have discussed this with the operators in different control rooms. In every plant they recognized these situations. In this way we create a sensibility to look for such situations also in their plants. Again we were encouraging the process operators to tell about these examples, in this way we are improving the process safety mindset of the process operators.

PSI reduction initiative ‘Process Safety on the road’: Results

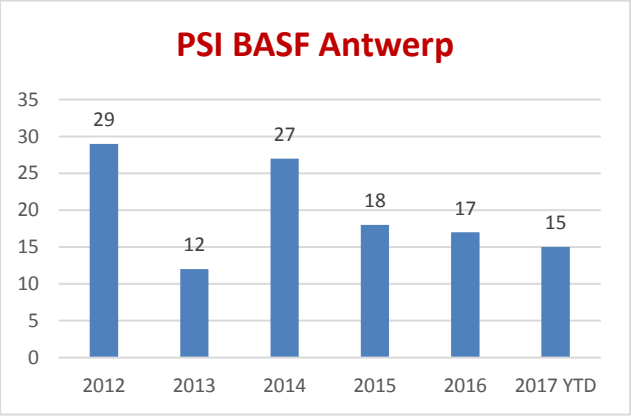

Figure 6: PSI BASF Antwerp

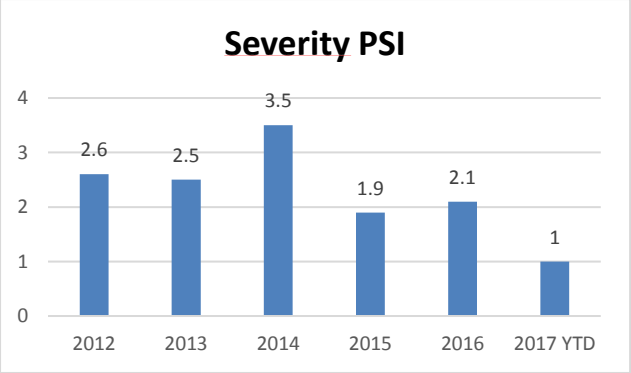

Figure 7: Severity PSI

What were the results of the 'Process safety on the road' program?

During our 'Process safety on the road' program, we have reached about one thousand process operators. This was done in a total of 87 sessions in the control room, each session took about 2 to 3 hours. All the people of process safety (6 experts in total) were the teachers. With this 'Process safety on the road' program we have created an awareness training for all process operators with an intensive interactive discussion around process safety incidents.

Due to the different PSI reduction initiatives, we are in a decreasing trend concerning process safety incidents. The different workshops around operational integrity , design integrity and mechanical integrity, but surely also the program of 'Process safety on the road' have created this result.

Not only the PSI's are decreasing, but also the severity of the different incidents.

Conclusion: Process safety on the road

The main goal of the program 'Process safety on the road' was:

To create an involvement of all the operators in process safety, creating a mindset, an awareness for process safety in the heads and the hearts of the process operators ! With this mindset, we shall decrease the process safety incidents around operational integrity.

The tool we have used is a kind of impulse talk in the control room. We did it for each plant and this in total for 4 shifts. We brought incidents based on the pillars of operational integrity, design integrity and mechanical integrity. We brought and distributed good practices in the different plants of BASF Antwerp.

The content of our impulse talks were mainly discussions about incidents, because with incidents, you directly grab the attention of the operators.

Reference

-CSB, Chemical safety Board, Formosa Plastics Vinyl Chloride explosion, 04/23/2004, Illiopolis

-'Learning from incidents', Trevor Kletz