# GETTING THE MOST OUT OF PROCESS SAFETY INCIDENT REPORTING

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## ABSTRACT

Over the past few years Orica has focused on gaining as much insight as possible out of our process safety event reporting. We have implemented an event classification system, defining events as events as weak signals, safe operating window excursions or near miss fatalities. The data, once collated, is analysed using PowerBI, which provides an easy way to slice and dice the data such that we can deep dive by site, by process, by product group etc, allowing us to target our efforts on the most frequently occurring events to prevent future serious process safety events from occurring. By tracking the data over time, we can see where the proposed improvements have been successful and where they have not, allowing further fine tuning of our approach to prevent process safety events in our plants.

## INTRODUCTION

It is rare that a catastrophic process safety event occurs without prior warning signs related to human behaviour, equipment reliability, procedural failures, process system failures, management system failures or organisational factors. If we can detect and rectify the many apparently minor process safety issues we see in our plants, this decreases the probability of a catastrophic event occurring in the future.

For each process, there is a point or small range of conditions for optimal operation. Outside of this is a normal range of operation considered safe to operate within. This is defined as the Safe Operating Window.

If we move just outside of the Safe Operating Window, we see “Weak Signals” which tend to occur frequently and are apparently minor events that are easy to miss or ignore as they do not seem important. For example, these minor events could be an unusual sound in the equipment, an unusual smell or colour or minor deviation from procedures. Ignoring weak signals can lead to “normalisation of deviation” and this behaviour can result in actual events of higher severity.

If we have a significant departure from the Safe Operating Window, outside of the weak signal range, we move into a Safe Operating Window Excursion (SOWE). Examples of SOWEs include activation of a key control, high temperature on pumping equipment and failures of monitoring equipment.

Any process safety event which occurs where there is no layer of protection between the event occurring and a fatality or major explosion outcome apart from luck is classified as a Near Miss Fatality (NMF). An example of an NMF would be manually pouring lead azide, where there are no controls in place at all.

Figure 1 below is a visual representation of a Safe Operating Window.

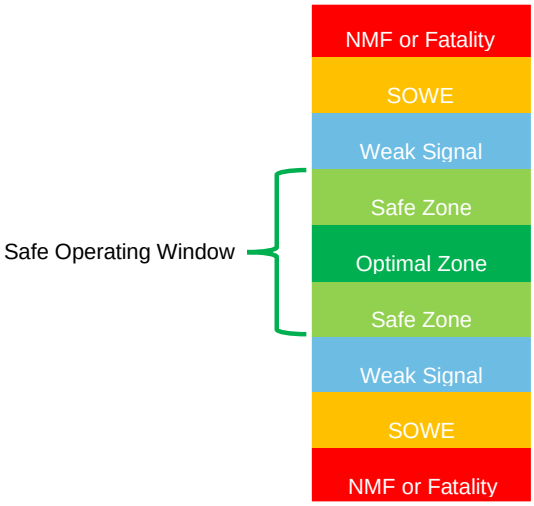



*Figure 1: Visual Representation of the Safe Operating Window for a process*

In order to minimise the number of NMFs or fatalities, we need to be reporting all weak signals and SOWEs such that an investigation can be completed if warranted and improvements implemented. If the system is working correctly, we should see significantly more weak signals than anything else, and very few NMFs.

Figure 2 below, shows the what the process safety triangle should theoretically look like to minimise process safety NMFs.

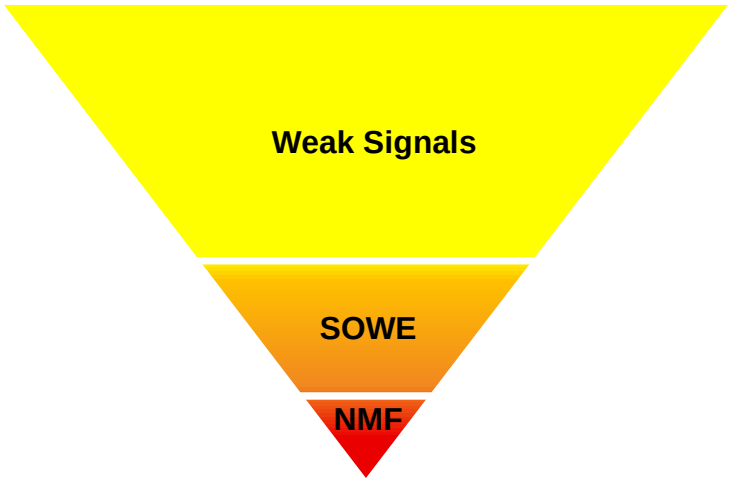


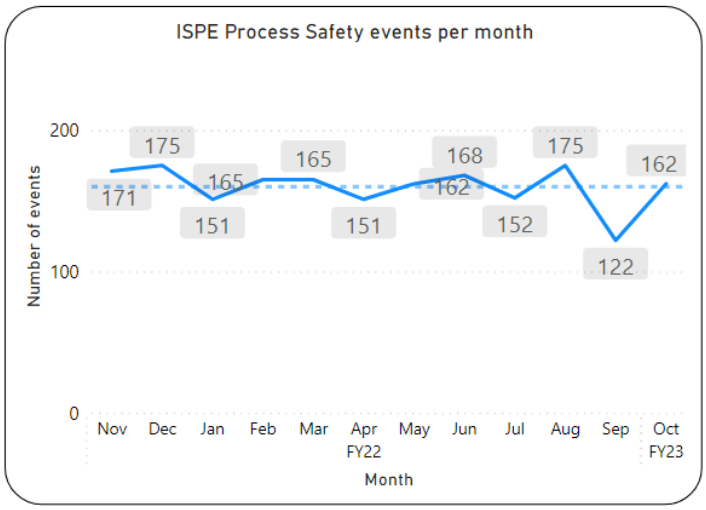

*Figure 2: Process Safety Triangle*

## ANALYSING THE DATA

### REPORTING TRENDS OVER TIME

Each month the process safety event data is downloaded from SAP and uploaded into Power BI Desktop to be able to understand what the data is telling us.

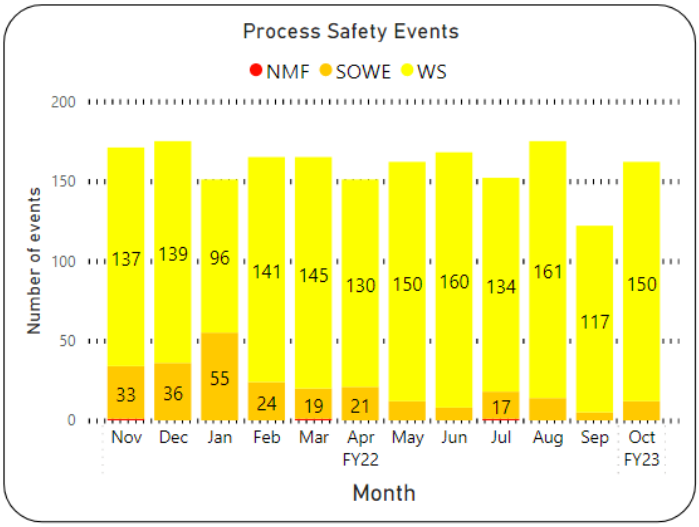
We look at the number of events reported each month, as shown in the graph below.



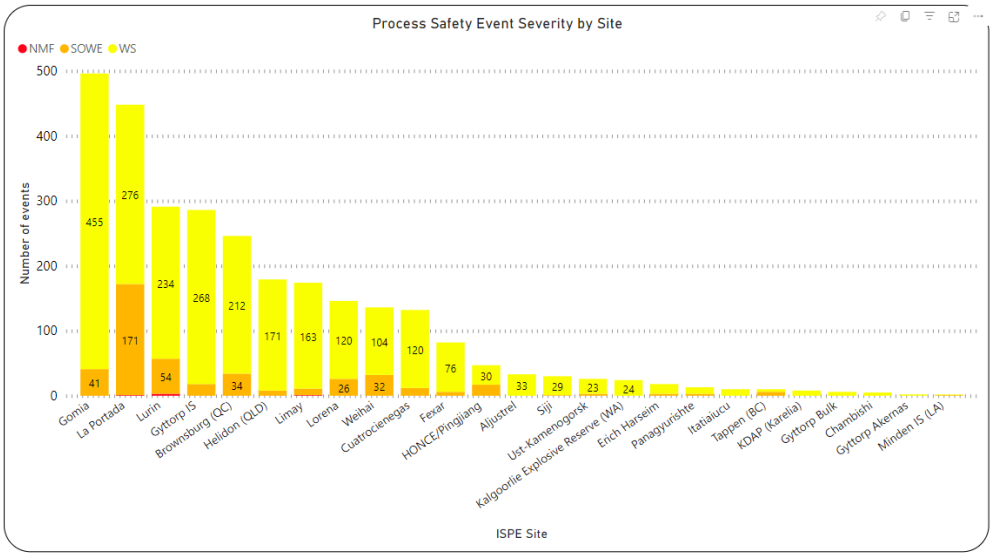

We use this analysis to look for trends over time. As you can see in the above graph in our Orica IS&PE plants there is an average of about 160 process safety events reported per month. There is a significant deviation from this average seen in the September data, with only 122 process safety events reported. From a deep dive into the September reporting, it was found that reporting dropped off as our plants were running with a lower operating time than the other months as this is the end of our financial year and the demand for products was lower.

## REVIEW OF THE PROCESS SAFETY TRIANGLES

We look at the Process Safety Triangles per month. Both, over all sites globally over time, as shown below.




But also, by each site over a 12 month period, as shown below.



This graph tells us a number of things:

- Some sites report significantly more than others. Gomia is one of our largest and most complex sites and has a very good reporting culture and you can see that their process safety triangle looks very good – 90% of the events are weak signals, 10% SOWEs and no NMFs.
- Generally, the process safety triangles look good, with a couple of exceptions:
    - La Portada has a very large proportion of SOWEs – investigation into this showed that we were having the same process safety event multiple times every month. Further investigation revealed that there was an equipment limitation, and a project was initiated to overcome the equipment limitation.
    - Lurin is also a large and complex site, yet the number of events reported were lower than expected and their safety triangle had a lot of room for improvement, with 2 NMFs reported over the 12 month period. A significant investigation was initiated to understand these observations. The low number of events reported was explained by the fact that this site was a new acquisition and were in the process of changing over to the reporting system used by Orica. There is an action to review the number of events reported by Lurin every month to ensure the reporting numbers increase to expected levels, and that investigations are completed for all SOWEs to understand root cause and rectify the problems to reduce the number of NMFs occurring.
- There are a number of other sites which also appear to be underreporting. Some of these are very small sites and simply do not have the number of process safety events of the larger sites, but others needed to be investigated. Since this data was generated, 2 of these sites have actually been closed due in part to the process safety risks due to aging plant equipment.

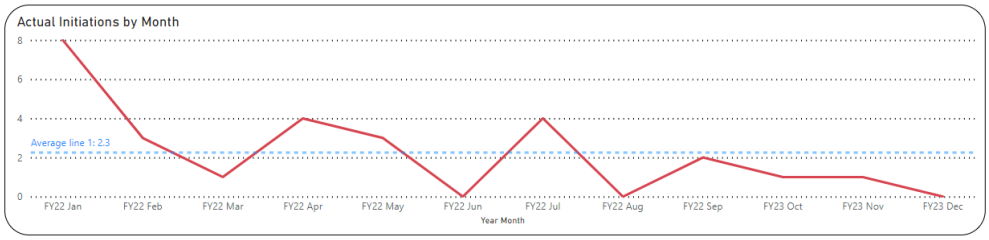
**Commented [MH1]:** What does equipment limitation mean in this context?

**Commented [MH2]:** What had been the expectation this being a new site? Has this been a result of due diligence?

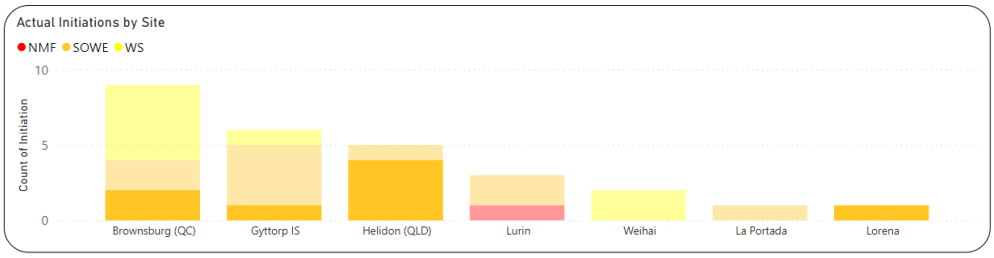
**Commented [MH3]:** Did the aging equipment result in potential events? How do you measure 'appear to be underreporting'?

## ACTUAL INITIATIONS

Another metric that we looked at was the number of actual initiations per month over time.




From this graph you can see that there were a very large number of actual initiations in January 2022 – 8 in total. By clicking on the data point for January FY22 in PowerBI, we can generate a breakdown of which sites had actual initiations during this month, see below.



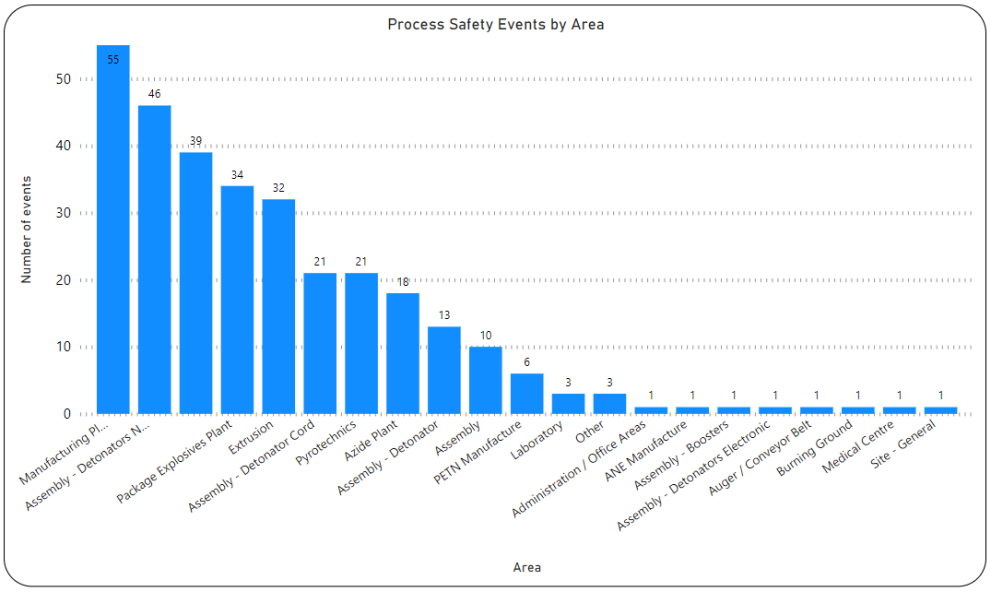

And we see that Brownsburg had 2, Gyttorp had 1, Helidon had 4 and Lorena had one, as they are highlighted by the darker sections in the graph above. All 8 events were reported as SOWE's.

Further investigation into the events at Helidon, where there were 4 actual initiations during the month, showed that all 4 events occurred in shock tube coiling, and were all snap, slap, shoot events. During inspection of the equipment, it was found that there was a faulty cutting blade which was putting tension on the shock tube not cutting correctly, causing the tube to snap, it then slapped against the outer edge of the coiler causing the initiation of the tube. After the problem was corrected in the coiler, no further events have occurred to date. The learnings from the events were also shared with other shock tube manufacturing plants globally to prevent the same incident from occurring elsewhere.

**Commented [MH4]:** Had there been a SAFEX incident notice or was this shared directly with other manufacturers?

## EVENT LOCATIONS

We can also look at an individual site over the 12 month period, looking at which area the events have been reported to have occurred in, as shown in the graph below.

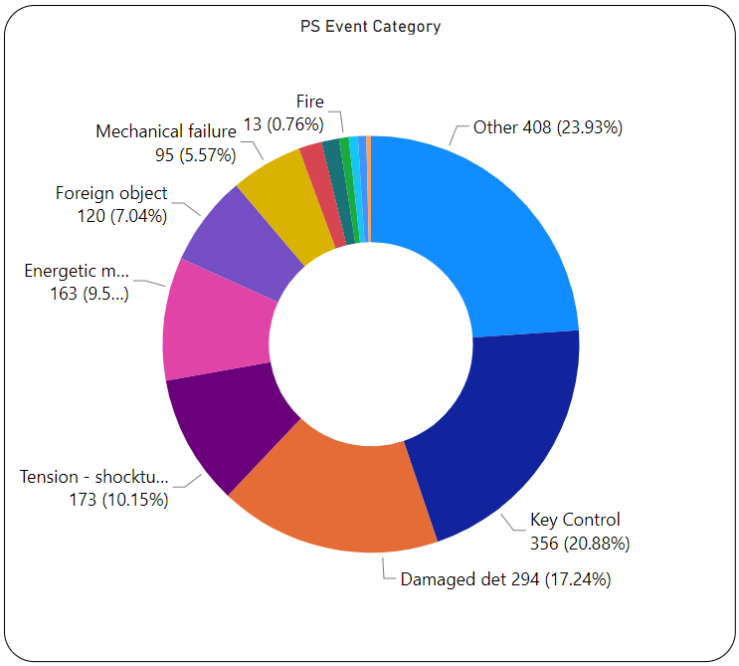


This graph shows us that we have some room to improve in the reporting system that we are currently using. The vast majority of the events were designated to occur in the “Manufacturing Plant”, which is too generic to get any useful insights from this data. Also, we have the non-electric detonator assembly area being reported under a number of options – “Assembly – Detonators Non Electric”, “Assembly – Detonator” and “Assembly”. With 3 area classifications being used, it skews the data represented here. Both of these observations have lead to a review of the options available in the reporting software as well as additional training for those responsible for reporting the events.

## BREAKDOWN BY EVENT CATEGORY

The analysis of the data by event category highlighted that the most populated event categories were common to most plants. In the graph below, you can see that five of the categories represented over 87% of the events. These being Other, Key Control (missing or failure), Damaged Detonator (or cap), Tension – Shocktube, Energetic materials in the wrong place, Foreign Object and Mechanical Failure.

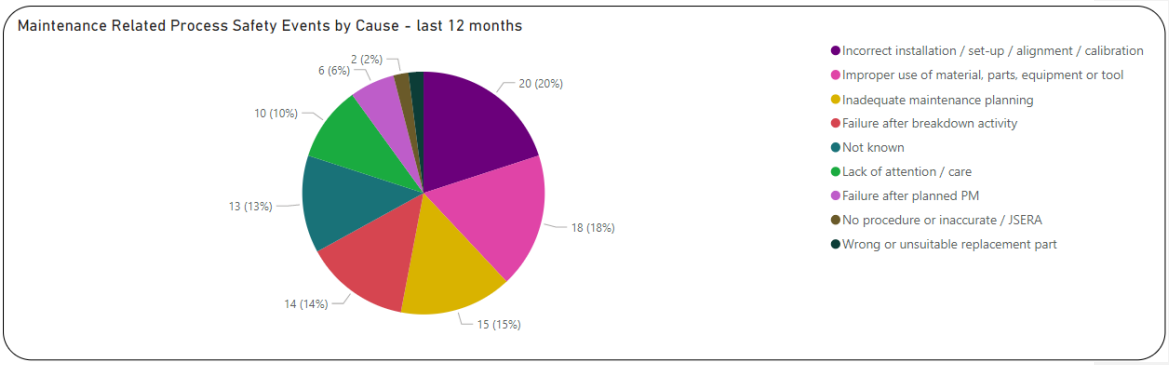
Identifying the areas where we needed to focus out efforts.




Looking further into this data we discovered that about 40% of all of the events were maintenance related, so a deep dive into the maintenance related events was performed.

## DEEP DIVING INTO THE DATA

Once we realised that approximately 40% of our process safety events were due in some way to maintenance, we drilled down further into the data to understand why.




From the above graph, it was identified that a large number of the causes could be corrected by increasing resource levels and improved training and supervision. As such an improved training program was implemented to overcome events caused by incorrect installation / set-up, alignment / calibration, improper use of materials, parts, equipment or tools, inadequate maintenance planning and failure after unplanned repair / maintenance.

## CONCLUSION

By improving the way we analyse the process event data being reported by our sites, we have been able to target our approach towards reducing high severity events. Prioritising the sites, processes and category of events which occur most frequently allows for a very targeted global approach towards improving our process safety in our IS&PE plants across Orica.