

# How Damage Mechanism Assessments can get Process Safety and Asset Integrity Managers communicating effectively

In the period 1996 to 2015 the oil, gas and chemical sector experienced a significant number of mechanical integrity failures that resulted in individual insurance claims in excess of \$50m USD. A recent insurance study (Reference 1) analysed these losses and found that:

- 70% were down to pipework corrosion, and
- 70% of failures occurred during normal operating conditions.

The report stated that, “failure to identify potential damage mechanisms and implement inspection programs to suit .....is considered a fundamental issue underlying most of the losses”.

Under normal operating conditions the prevention of a loss of containment incident is mechanical integrity, implemented through initial design and construction and controlled with an inspection and maintenance programme. If you consider a safety barrier diagram (Figure 1), mechanical integrity is the only preventative barrier.

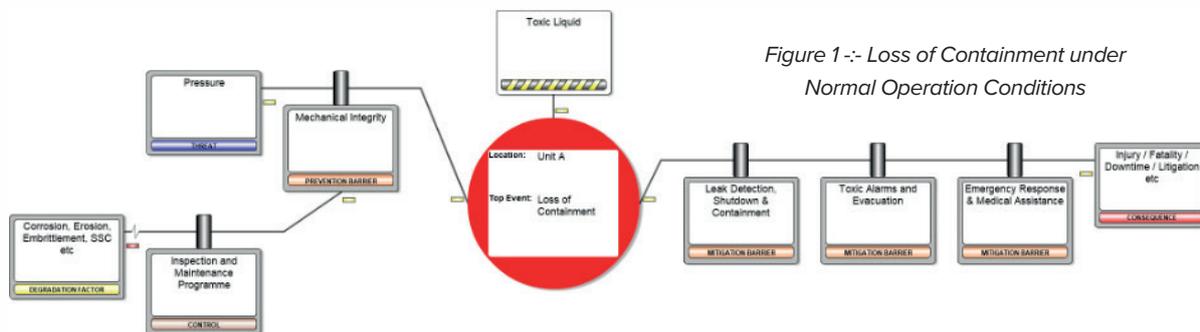


Figure 1 -- Loss of Containment under Normal Operation Conditions

The responsibility for this barrier clearly lies with the Asset Management department, but there is an overlap with the Process Safety department when you consider the full barrier diagram, especially considering the right-hand side of Figure 1.

Given the large number of significant incidents relating to normal operating conditions it is clear that some operators are suffering from underlying issues, either related to asset integrity and/or Process Safety. The following discusses how a Damage Mechanism Assessment/ Review can not only improve the effectiveness of inspection programmes, but also provide valuable input for the Process Safety team.

## Traditional Inspections

Many inspection programs are based on prescriptive, time-based, visual inspection and thickness measurements which provide drawbacks including a lack of technical base for the inspection, an overabundance

of thickness measurements, insufficient resources, and little correlation between risk of failures and frequency of inspections.

## Damage Mechanism Assessment/Review

A Damage Mechanism is defined as a mechanical, chemical, physical, or other process that can lead to damage e.g. Corrosion (Uniform, localized and pitting), Stress Corrosion Cracking (SSC), Erosion, Embrittlement, Thermal-related failures etc. A DMA/R is a systematic analysis process that is designed to determine credible damage mechanisms for pressure-containing equipment: process vessels, heat exchangers, process piping, storage tanks etc). Based on the chemicals being processed, the operating conditions, materials of construction, and environmental, external aggressors the process predicts the type of damage, the most susceptible locations and the likely damage rates.

So how does this get Process Safety and Asset Integrity managers communicating effectively?

For Asset Integrity managers, the information collected and analyzed during a Damage Mechanism Review/ Assessment will greatly improve the production of appropriate and efficient testing plans and the development of robust Integrity Operating Windows (IOWs). These are a fundamental to establishing the life

expectancy using operating conditions and operating history data which can aid in CAPEX planning. By understanding the current condition of the assets, and developing appropriate planning and maintenance strategies, downtime frequency and length can be reduced. This also benefits the process Safety managers as understanding the AIM programme and its applications plays a part in considerations for loss of containment scenario planning and likely loss scenarios. The DMA/R also ensures that normal operating condition is given due consideration in safety studies and define the integrity KPI's and trend mapping.

**For more information, please contact Brad Eccles – [beccles@absconsulting.com](mailto:beccles@absconsulting.com) – [www.abs-group.com](http://www.abs-group.com)**

## References

- 1) Jarvis R. & Goddard A., 2017, An Analysis of Common Causes of Major Losses in the Onshore Oil, Gas & Petrochemical Industries, IChemE Hazards 27 Paper, Symposium Series No 162