Safety Improvement: Planning to do better

You cannot improve what you do not know. Measurements are a common tool used in business to assess all manner of processes and outcomes – client satisfaction, staff performance, growth, and financial progress to name a few. An unsafe business, however, essentially negates all enhancements when the consequences of accidents outweigh the business improvements.

On the other hand, measurements can be tedious when they serve alternate agendas. Measurement for the sake of measurement, measurement to satisfy curiosity, and measurement to keep people busy are good examples of where the impact does not warrant the effort.

Effective & well thought-out operational procedures, awareness & training, involvement & commitment, and discipline & attention to detail will reduce the number of adverse safety events.

However, accidents happen and an environment that promotes participation & freedom-from-victimization will empower the businesses to improve operational safety.

All safety-related anomalies should be considered; this means not only accidents, but also incidents and near-misses. A program that considers all events that could have or do cause damage, loss, injury or fatality, is a program likely to succeed.

A Safety Improvement Program (SIP) in the diving business must contain several elements to ensure success. This article will discuss a progression of steps, illustrate a typical process using a real-life example, provide practical & simple tools to decide on suitable measurements, and offer insights into an effective SIP.

After all, a diving business needs to know how it is doing and how it can do better.

A Safety-based Monitoring Program: The Basics

One needs to know what is important. Events with the potential to cause negative consequences, ranked considering the more severe and the more important, will determine what is at the top of the list. A review period needs to be selected to determine what events have occurred in the past and the frequency thereof; this will help decide if monitoring is in fact needed.

Aspects requiring continuous monitoring, including those leading to damage, loss, injury or fatality, should be clearly identified.

Management should approve the program and then encourage and observe progress with commitment and acknowledgement.

Accidents, incidents and near-misses are obvious and informative indicators, but violations of procedures, lack of attention to detail, ill-discipline and ignorance can also illustrate areas of concern. Suitable ‘predictors’ (used to assist predicting the number of future events and usually referred to as denominators) in the diving industry are usually easy to identify: number of dives, number of cylinder fills, number of boat launches, number of students certified, and number of operational days are good

examples.

Possible incidents are numerous - one must take care to be practical and realistic. Very low occurrences will not provide meaningful measures. The illustrative list below might include some of the potential hazards to consider:

- Cylinders not secured
- Not wearing PPE
- Not following procedures
- Ignorance of rules
- Not updating staff
- Not practicing drills
- Not recording drills
- Clients denied diving
- Equipment not serviced
- Boat/vehicle breakdowns
- Briefing steps skipped
- Things left behind
- Missed buddy checks
- Equipment failures
- Spills
- Contamination
- Damage to reefs
- Client non-compliance

The founding principle of HIRA (Hazard Identification & Risk Assessment) should be applied, each hazard assessed considering the probability of an event, the frequency of exposure, and then a realistic measure of the worst-case scenario.

Next, we identify the type of indicator:

- *Leading indicators* measure the risks where preventative actions can be applied.
- *Lagging indicators* measure the outcome from the risk. i.e. too late to prevent.

Usually the lagging indicator determines the need to measure, however, it would be wise to then select a correlating leading indicator based on the Critical Control Point (CCP).

Sensible ways to select which risks to consider, based on real occurrences experienced in the business, or preferably potential identified occurrences before they have actually occurred, could include:

- Focusing on high-risk & high impact (significant consequence) events.
- Identifying the CCP's – those steps that control the hazard rather than the outcome: e.g. cylinders not secured rather than cylinders that have fallen over.
- Focusing on processes that could result in multiple outcomes: e.g. possible damage, loss, injury and/or fatality.

One must, however, caution against 'overkill'. One should not overburden staff with measurements that will prove onerous to maintain and consume excessive amounts of their time. Staff have many other obligations and so often, in the dive business, they are often already overworked.

The Monitoring Process: A Step-by-step Explanation

The monitoring process can be explained though the following 12 steps:

1. Determine the risks using the HIRA process.
2. Decide on which risks to measure – focus on those with the greatest impact.
3. Decide on the appropriate type of indicator - lagging or leading.
4. Develop clear definitions of what is to be measured.
5. Train everyone who will be performing measurements.
6. Implement the monitoring process.
7. Set realistic and achievable safety-related goals.
8. Provide regular feedback.
9. Refine & improve the process.
10. Analyze repetitive events to determine root causes.
11. Use the results to adjust operational procedures to improve safety.
12. Continue to monitor to see if the goals can be achieved.

Without management providing resources, observing, taking an interest in the process, and making decisions based on the results the entire monitoring process will likely be a waste of time.

An Adverse Event: Illustrating the Process

Abstract theory does not always explain how to embark on such a process. A real and much-feared but relatively infrequent risk for a large-scale cylinder filling facility, and one that has led to injuries and fatalities, is carbon monoxide (CO) poisoning.

Infrequent does not imply negligible. There is always a probability that exposure to CO in breathing gas can lead to very serious consequences. This is a significant risk. Even one fatality is too many.

CO cannot be seen, smelled, felt, tasted or heard. It can only be avoided.

What are the possible sources? Knowing these can assist in determining preventive measures, but this could also provide indicators for measurement of any exposures or non-compliant activities.

Analysing the problem[1]:

- Vehicles near intake
- Boats near intake
- Lack of servicing (oil burning)
- Filters not changed
- Cylinder contaminated
- Generator(s) nearby
- Poor ventilation
- Fire, smoking
- Furnaces
- Kitchen, stoves
- Water heaters
- Clothes dryers
- Gas fridges
- Fires in area
- Biomass pits
- Kerosene lamps
- Adhesives
- Paint stripper
- Welding
- Cleaning fluids

It is hard to dispute that a few, if not several, of these sources exist in most situations and that these toxins could be introduced into a cylinder filling environment?

If known sources can be identified, it is logical to implement suitable risk mitigation strategies prior to commencing with measuring. Risk mitigation may include 'engineering' and 'operational' processes.

Engineering: In the case of CO in the surrounding area the compressor intake can be moved. If CO is generated when compressor overheats, ensure that it is serviced frequently. Filters should contain a CO removal agent and must be changed at the recommended intervals.

Operational processes: Staff training, regular air quality testing, access restriction, and contaminate isolation are some of the measures that should be considered.

Next - what indicators could be measured? We have two choices:

A lagging indicator, defined say as the number of divers with CO poisoning diagnosis.

A leading indicator, defined say as the number of analyses failing a CO test, or even more sensibly, rising CO levels observed over time.

A denominator, or predictor, could be selected from any of the following:

- Number of clients
- Number of divers
- Number of cylinder fills
- Number of operational days

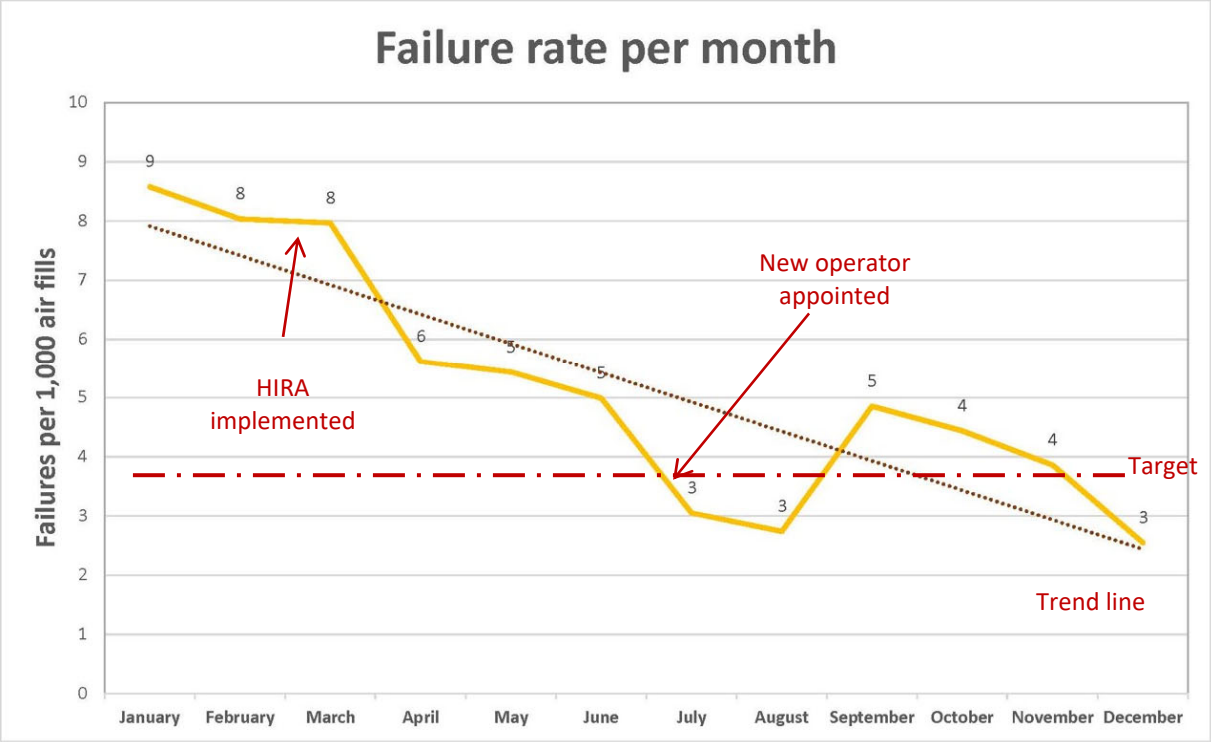
A logical choice would be the number of cylinder fills performed by the filling station.

[1] Burman, F. Alert Diver, Spring 2017, Page 68. Divers Alert Network, Durham, U.S.A

The measure could thus be the failure rate of CO analysis results measured against 1,000 air fills a month. One often needs to multiply the response measure in order to achieve a meaningful value.

A fictitious but busy cylinder filling station with a clear CO contamination record might measure the failure rate as the number of incidents per actual air-fills, multiplied by 1,000 to give realistic values.

This graphic illustrates a run-chart with certain events recorded to explain changes in failure rates:



Implementation for the SIP: How We Can Do Better

Training is an essential aspect of any improvement program. Staff should be thoroughly briefed, the measures clearly defined and explained, and responsible members identified and trained in how to collect and record the data.

Implementation is usually the most difficult step to achieve. The beginning is usually characterized by much enthusiasm and ambition - everyone wants to be involved. The outcomes will surely reflect well on them and management acknowledgement carries with it the usually expectations of financial rewards.

The reality is that commitment to the program diminishes with time; especially where results are not as expected and the 'rewards' clearly wishful-thinking. It is important to provide regular feedback, display commitment and interest by management, and

continue to explain the needs.

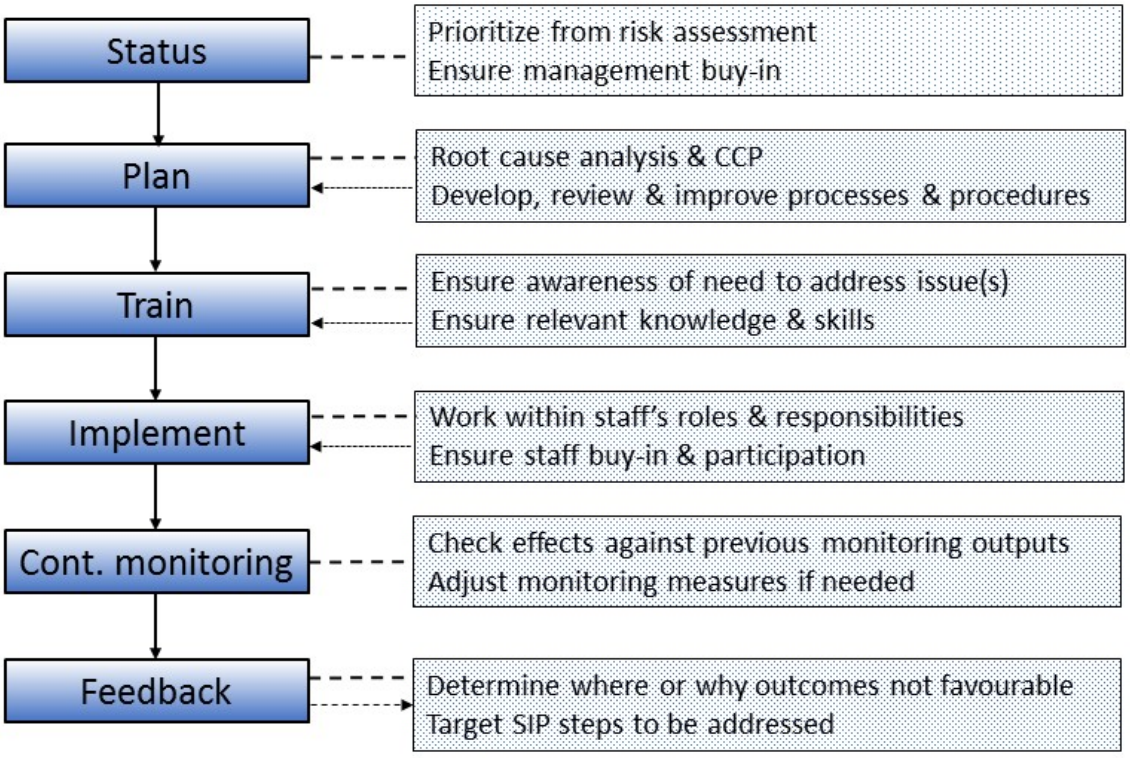
Feedback should be given at least monthly, and run-charts updated similarly. Staff should be encouraged to participate, and there is some merit to using a carrot and stick method to retain their commitment. Financial rewards are not the only incentive.

The most important part of this process is determining whether or not the program is working. The results should be analysed and perhaps subjected to renewed root cause analyses. Perhaps the CCPs are not really the points around which unfavorable events are centered. Are your targets unrealistic, or even too low?

At this stage, risk mitigation measures could be re-assessed for impact, processes further streamlined, recourse and training re-assessed; all the while monitoring should continue.

The Complete SIP

Simple flow diagrams are often the most effective way of illustrating what might read as a complex and confusing program. The following illustration is intended to summarize the process in a language that can perhaps be more easily comprehended.



A Last Word

The Divers Alert Network, committed to enhancing the safety of diving and working with industry to provide education, resources, and relevant analytical information, manages a real-time and on-going incident reporting system[2]. This process is currently based on actual diving-related incidents including near-misses, damages & loss of property incidents, and non-fatal & fatal injuries. Adding to this worldwide database of incidents will assist in providing objective insights into common incidents, the relative severity thereof, and allow the industry to address the causes in a sensible & realistic manner, on a truly global basis.

[2] https://www.diversalertnetwork.org/research/incidentReport/