The Process Safety Professional in a Net Zero World

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Introduction

Businesses and industries around the world are developing and implementing 'Net Zero' programs. The objective of these programs is transform their activities such that their organization has no net emissions of greenhouse gases. (The word 'net' allows companies to implement carbon capture programs that offset some of their carbon dioxide (CO_2) emissions.) Many Net Zero programs have a target year for completion — frequently the year 2050 — hence the widely used phrase 'Net Zero by 2050'.

Moreover, the development of a Net Zero program will require that the company's suppliers and customers to make equally radical changes. For example, if a chemical facility decides to replace natural gas fuel with electricity, then the companies and utilities that supply the gas and electricity will need to change the manner in which they operate.

The scope of Net Zero programs is enormous; successful implementation will require input from a wide range of professional disciplines. In this paper we look at ways in which the process safety community, and the techniques that it has developed over the course of the last 30 years, can be used in the development and implementation of Net Zero programs — particularly for those companies that operate industrial facilities.

Four Analogies

In order to frame the manner in which the process safety community can help with Net Zero programs it is useful to develop analogies between process safety and net zero programs. This will help identify areas of overlap, and identify areas in which process safety professionals can male a contribution.

Argument by analogy has its limits; eventually all analogies break down. However, the comparison between the two topics is close enough to provide useful guidance. Four analogies are used. They are:

1) A sense or crisis and that "something must be done".
2) The importance of regulations.
3) Consistency of reporting.
4) The use of management elements.

Analogy #1 — A Sense of Crisis

The techniques that make up process safety management (PSM) have always been in place. For example, companies have always had operating procedures and training programs, and hazards analysis has always been a part of the design process. But, during the 1980s, a series of very bad incidents at chemical facilities around the world created a sense of crisis, a feeling that "something must be done". There was a sense of "public outrage".

The worst of these incidents occurred in the city of Bhopal, India in the year 1984. A release of highly toxic chemicals led to the death of thousands of people in the local community, and many more were grievously injured. It is believed to be the worst industrial accident that has ever occurred. Many factors played into this catastrophe — suffice to say that the facility's process safety systems and programs failed badly.

Following the Bhopal catastrophe, a series of chemical plant accidents in the United States and other nations in the late 1980s showed that there was a clear need for what we now call process safety management regulations. Public pressure was such that industry and political leaders knew that "something must be done". Indeed, it would probably be correct to

say that the formal discipline of process safety management started in the late 1980s. In response to this pressure organizations in different nations developed new and much more thorough approaches to process safety.

In the United States a group of HSE executives working with the Organization of Resource Counselors voluntarily created a process safety management standard. These executives, all came from chemical companies such as Monsanto, Dow, DuPont and ICI Americas. However, the systems that they developed applied equally well to refineries and pipelines.

At roughly the same time Lord Cullen was developing a new generation of Safety Case standards following the Piper Alpha catastrophe. His findings and recommendations had a profound impact on offshore safety management systems around the world. These recommendations were also adopted in many other industries, such as railway operations.

It appears as if we are witnessing a similar sense of public outrage with regard to the climate crisis. Obviously the scope of that crisis is far more extensive than that of the relatively narrow world of process safety. Nevertheless, an analogy between the two situations can be drawn. In the year 2022 the climate crisis has become a matter of daily news. We are routinely witnessing floods, droughts, wildfires and rising sea levels — all seem to be both more severe and more frequent. Once more, there seems to be a rising sense of public outrage, and a feeling that "something must be done" — but what needs doing and who is to do it are poorly understood. There are many, many articles, web pages, social media posts and blogs that describe the climate crisis; there are far fewer publications that provide practical, realistic guidance as to what we can actually *do* in response.

This is where process safety professionals can help with the design, implementation and management of Net Zero programs.

Analogy #2 — Regulations

In the United States one of the last actions of President H. W. Bush was to sign the Amendments to the Clean Air Act, in the year 1990. That Act contained a provision that called upon OSHA (the Occupational Safety and Health Administration) and the EPA (the Environmental Protection Agency) to develop what we would now call process safety management standards. (OSHA is concerned with worker safety, so its focus is on events "inside the fence". Being an environmental agency, the EPA is more concerned with events that impact the public.)

OSHA took the lead. The agency had to develop, implement and enforce a process safety standard. This was outside their normal scope of work. Most safety standards are prescriptive in nature. Process safety is, however, fundamentally non-prescriptive and performance-based. Recognizing that they did not have the requisite expertise, OSHA managers took the just discussed standard that had been developed by the industry executives and adopted it with very few changes. (The regulation's formal title is 29 CFR 1910.119; it was published in the year 1992.) The fact that the agency adopted a standard written by experienced industry managers explains why PSM has been successful in the succeeding years — it is practical and realistic.

In the United Kingdom and many other nations Safety Case rules were being enhanced.

Although regulations require that companies take action, they are not necessarily seen as being a burden or an imposition. For example, in the early 1990s many managers in the process industries already wanted to implement a process safety program, but they had trouble finding the time, people or funds to do so. Now they had their justification. In the early 1990s one engineer said to his manager, "I have always wanted to upgrade our operating procedures. Now you have to provide me with the funds to do so because it's the law". Another plant manager at about the same time stated that he personally welcomed the new regulations. He recognized that they were needed — the industry had to do better.

With regard to climate change, rules are still being developed. For example, the proposed rule from the United States Securities and Exchange Commission (the SEC) will require businesses to inform the investment community about their climate-related work, and to describe the climate-related risks that they face. (The rule does not require that companies actually *do* anything — it is assumed that the response will be based on pressure from the investment community.)

Analogy #3 — Consistency

One of the most important benefits of the early rules and standards for process safety was that they created consistency across the process industries. For example, during the 1960s and 70s, process safety pioneers — men such as Trevor Kletz and H. G. Lawley — had developed techniques such as the Hazard and Operability (HAZOP) method for hazards analysis. This early work was important, but its use was restricted to a small number of industry leaders such as ICI.

A process safety management standard that could be used by all companies was needed. This standardization was provided by the organizations and regulators just discussed. It was now possible to compare companies with one another. This made activities such as auditing easier. It also made the transfer of information and skills — such as how to conduct a HAZOP — much simpler.

With regard to climate change and Net Zero, many businesses and industries have implemented climate change programs. But the scope, level of detail and goals of those programs differ widely from one another. One of the strongest justifications for the SEC rule is that it will allow investors to compare companies with one another on a consistent basis.

For example, many companies now include information in their financial reports to do with their climate programs. They may also identify the financial risks that they face as a consequence of climate change. But the structure of these reports, the information that they provide, and the level of detail offered varies so much that it is becomes very difficult for a outsider to compare companies with one another.

In response to this difficulty, financial regulators around the world are creating standards that help create an apples-to-apples environment, and that make "greenwashing" more difficult. In the United States, for example, the Securities and Exchange Commission (SEC) has published a proposed rule that calls on publicly traded companies to report on their climate programs and climate-related risks.

Rules such as this will be invaluable at creating consistency of reporting. But they are mostly written by people with expertise in financial and legal systems. They will not necessarily have a good grasp of the basic science behind climate change. Nor will they necessarily understand the engineering challenges that are implicit in so many of the proposed solutions to the climate crisis.

Analogy #4 — Management Elements

The fourth analogy between the worlds of process safety and climate change is to do with management elements. The process safety rule is now 30 years old. During that time many companies and professional organizations have come up with improved ways of organizing process safety. But they all have basically the same elements, such as hazards analysis, management of change and training. Some of the elements of process safety management are industry-specific. But others can be applied to climate programs, as can be illustrated with the following three examples.

Technical Information

Technical programs such as process safety rest on a foundation of accurate and complete technical information. In the case of process safety this means that one of the first actions that companies took 30 years ago was to update documents such as P&IDs and equipment data sheets.

We are in that position now with regard to climate change. Companies need to provide the public with reliable information as to what they are doing. An information baseline is needed in order to develop realistic targets, and to measure subsequent progress.

Note the use of the term *technical* information. As already discussed, standards such as those from the SEC are written mostly by people with a financial and legal background. Yet climate change is a matter of physics, thermodynamics and ecology. Only when the role of those topics in climate change is properly understood can we develop a sensible financial strategy.

Hazards Analysis

Having established the technical information base, the next step in a process safety program is to conduct a hazards analysis. Until the hazards are identified it is impossible to either eliminate them or reduce their severity or likelihood. So it is with climate change, it is necessary to determine what is happening, and what is causing it.

This way of thinking is also needed when it comes to responses to climate change. For example, electric vehicles (EVs) are touted as a solution to the pollution and greenhouse gas emissions created by internal combustion engines (ICEs). Yet, the comparison may not be as favorable as it first appears. EVs consume electricity generated by power plants that burn fossil fuels, the mining and treatment of lithium and other specialized materials uses large amounts of fossil fuel energy, and disposal of batteries is an environmental challenge.

Techniques that use systems analysis — fault trees and why trees, for example will be particularly useful in understanding the causes of climate events, and in evaluating the viability of proposed solutions.

Participation

The most important management element in a process safety program is *participation.* It is vital that everyone involved in the program understand the goals and that they feel that they can make a difference. Note that this element is called *Participation*. It involves communication, but it goes beyond just being told about what is happening.

On process facilities, it is difficult but possible to develop an effective participation program. Most of the people involved with the program are technically qualified, and have a grasp as to how the process works, and what may go wrong.

With regard to climate change, participation is a much more formidable challenge. There are so many people with different points of view, so many agendas (hidden or otherwise), and such different challenges depending on local circumstances.

Conclusion

The development and implementation of Net Zero programs is an extraordinary and formidable challenge that will call on all professionals to make a contribution. Process safety professionals have their part to play. The application of process safety principles and management systems can make a contribution toward achieving net zero goals.