

## Process Safety - the Ultimate Team Sport

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If we think about a business, there are many parallels with a sporting team. There is a leader of the business, or the coach. There are department leaders, or the captain. There are personnel across the business with different skills and roles, or the players and trainers. Ultimately there is the company objectives or the scoreboard.

So how is this related at all to process safety? When it comes to process safety in a business, different parts of the organisation have different roles to play. We understand that the striker, goal shooter or forward, to name a few positions, have a very specific tasks on the field. A player skilled in offence may not fare well in defence. That is not to say they cannot learn to play in new positions, but when they are in defence they need to play defence.

We sometimes hear different roles or disciplines claim that process safety is their domain but given the breadth of impact and influence over a company, it must be a multi-discipline approach. Consider for example the engineering input into designing and operating a processing plant. You may have a series of pumps with interconnected piping. A true multi-discipline approach would include the chemical engineer focused on with the product being pumped, the mechanical engineer focused on with the rotating equipment, the civil engineer focused on with the piping routes and equipment foundations and the electrical/instrumentation engineer focused on the power supply and control systems. Expanding beyond the engineering disciplines, procurement is involved in sourcing of equipment and spares to meet the safety requirements, as specified by the engineers. Product quality may be focused on ensuring that the plant functions as intended, and the products do not pose a threat to the facility. Finance may be focused on accounting for product, and for example, if there are losses it could indicate a leaking pipe. Each of these roles have a specific skill set and task, like key positions on a sporting team. Like a sporting team it is critical to have everyone working toward the same objective, whether it be winning games or delivering safe production.

This paper will use a sporting team as an analogy to describe a multi-discipline approach to process safety. To assist with broad understanding across multiple roles, it will explore past incidents which could have been prevented or mitigated with a multi-discipline approach.

### 1. Introduction

Process safety is often thought to be a very complex engineering activity, and while there are some elements that are complex, this idea dismisses the breath of process safety across an organisation. Process safety can be defined as follows:

“Process safety is about managing the integrity of operating systems by applying inherently safer design principles, engineering and disciplined operating practices. It deals with the prevention and mitigation of incidents that have the potential for a loss of control of a hazardous material or energy. Such loss of control may lead to severe consequences with fire, explosion and/or toxic effects, and may ultimately result in loss of life, serious injury, extensive property damage, environmental impact and lost production with associated financial and reputational impacts.” (Kerin, 2019)

## 2. Process safety in an organisation

To effectively manage process safety in an organisation there are a range of functional areas that require effective leadership. These are:

- Knowledge and competence
- Engineering and design
- Systems and procedures
- Assurance
- Human factors
- Culture

These areas span across all aspect of an organisation and involve a range of different people to deliver the desired outcomes. The different people involved include groups like the following:

- Operators – including control room and field based operators
- Maintenance personnel - different trades, such as mechanical, electrical, instrument etc.
- Different engineer disciplines, such as chemical, mechanical, electrical, structural etc
- Technical authorities
- Finance personnel including procurement
- Human resources
- Safety advisors
- Supervisors
- Managers
- Directors

A typical organisational matrix structure is shown in Figure 1.

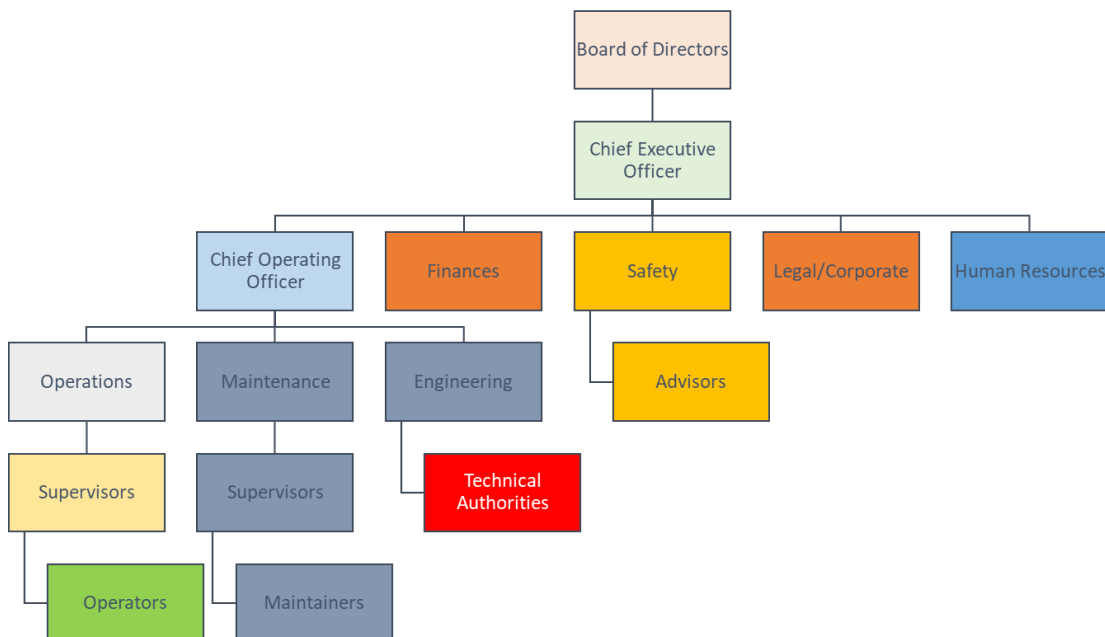


Figure 1: Typical organisation and matrix structure

Each of the different roles come together to deliver the organisational outcome, of safe, reliable production. Typically the decisions about managing the operators are taken by a role similar to the Chief Operating Officer (COO), sometimes called a Plant Director, or Operations Manager. They are accountable for the overall safe operation of the facility. There is one exception to this, where the role of Technical Authority can overrule a decision or recommendation of the COO based on their technical expertise. They are the keepers of the standards.

### 3. Operation of a football team

When describing the structure of a football team it is important to note that there are two key areas, the football department and the executive departments of the organisation. Firstly, the executive department consists of the board members of the team, the CEO and CFO members. The key roles of the executives are to ensure a football team is profitable and is being run in accordance with the clubs' objectives and ethics. Whilst secondly the football department's role within the organisation is to produce the objectives that the club have outlined at board room level. Before we outline the departmentalising of a football department, it is important to note the bridge of communication that exists between the football and executive departments. This is mostly assigned to the head coach of the playing group and also a football director who oversees the operations of the football department on a daily basis. It is these two roles that feedback the communication to the board, providing updates on performance, raising concerns or requests that need to be rectified or fulfilled to improve the on-field performance of the team.

Now we can intrinsically describe the different departments that exist within the football department. First and foremost, we have the coaching groups, that consist of the head coach and his/her assistants that are working towards skill acquisition, tactical nous and improving team performance. The next key department is the medical team consisting of the team doctors, physiotherapists, massage therapists, nutritionists and psychologists. It is the medical team's role to ensure the prevention and treatment of injuries both physical and mental of the playing group to ensure the coaching staff have the whole quota of players available for matchday selection. It is important to note that the team doctor who heads the medical department can override the head coach and rule out a player from being available for selection based on any medical concerns.

Working alongside the coaching and medical departments within a football department is the high performance/sport science departments. This department consists of sport scientists, exercise physiologists, strength and conditioning coaches and wellness coaches. The key roles of the sport science department is to increase performance of the playing group and being a lead indicator to the medical and coaching teams of fatigue and injury prevention. Although the sport science team are in a majority of cases the first department to identify potential injury, they do not have the power to override the decision of a head coach or team doctor to what a player can and cannot do on match day and the training week.

Among the players group there is a subsection called Leadership Group. This consists of Captain, Vice Captain and Deputy Vice Captain. There may be additional senior players as required. This group are responsible for driving standards, media commitments, play a role in team selection and manage some disciplinary matters in the player group.

The final department that makes up the wider football department is the recruiting team. This team consists of the transfer directors, player scouts and also player psychologists. The key role of the recruiting department is to communicate with the head coach and identify what acquisitions are needed to improve on field performance of the team. It is important to note this department can occasionally work independent of the head coach and does not need to adhere to the requests of the head coach to what players are needed.

As we can see a football organisation consists of multiple compartments that work together in harmony to result in the optimal performance of the football club, as shown in Figure 2 Without the cooperation of each department, a football organisation will find it highly difficult to reach the goals it sets out to achieve.

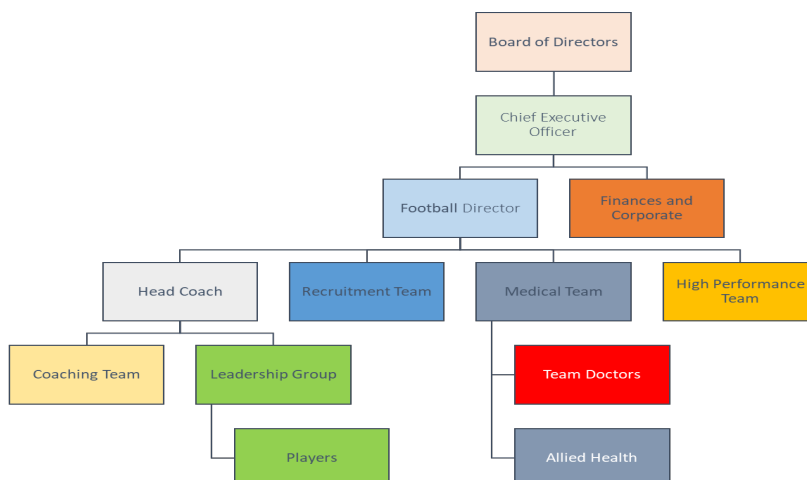


Figure 2: Typical football team organisation structure

Table 1. Key activities and personnel

Football team		Processing plant	
Activity	People	Activity	People
Training sessions	Coaches, high performance team, medical team (inc. Doctor), players, Leadership Group	Planning meetings	Engineers, safety advisors, operations supervisors, operators, maintenance, technical authorities
Fitness assessment	Coaches, High performance team, Doctor	Process safety auditing	Operations supervisors, Safety advisors, technical authorities
Team selection	Coaches, Doctor, Leadership Group	Resourcing	Operations supervisors
Game day	Coaches, players, medical team, Leadership Group	Operations/maintenance activities	Operations supervisors, operators, maintainers
Post-match review	Coaches, high performance team, medical team (inc. Doctor), players, Leadership Group	Post activity review	Engineers, safety advisors, operations supervisors, operators, maintenance, technical authorities

### 3.1 Onfield roles

Now that we have covered the differing departments and compartmentalisation of a football department and executive department of a football club, we can describe the differing on field player roles and rules of the game.

#### Forwards

Let's start with the offensive side of the game, where our forward players are tasked with the main objective of the game, that being to score goals. It is important to note that all teams have different balances of forward players, where one team may have two strikers and an attacking midfield player as the main three attacking threats. Whereas another team may deploy a lone striker up front with two wide attacking players either side, the balance is completely up to how the head coach wants to play the game and set up their team.

#### Midfield

Often referred to the engine room of a football team and the link between attack and defence we have the midfielders. The midfield unlike the forwards have more than just one key role for the team and is again largely based on how a head coach sets up his/her team to play. Some of the key roles a midfield may be deployed to achieve are to ensure a fast style of game by keeping the pass rate up whilst in possession, they will need to track back and plug holes in the defence and also "set the tone" in aggressive tackling and closing down space.

#### Defence

Finally, we can discuss arguably the most important aspect of the team that being the defence. As discussed above the defence is also set up in the way a head coach wants to set up. A team may have 3,4 or 5 at the back depending on the tactics and preferences of the head coach. The key role of any defensive unit of a football team is to limit any goals scored against the team. However, in the modern game a defence also plays a pivotal role in attack, playing precise passes quickly to the front players and also compressing the game into the other team's half.

#### Goalkeeper

The last line of defence for any football team is the goalkeeper. The key role of the keeper is to keep the ball out of the back of the net and ensure no goals are scored against their team. The modern keeper is also a precision passer by hand and foot, to also be able to launch quick attacks once in possession of the ball.

### 3.2 Onfield rules

It is important to note there are a number of on-field rules which determine how the game is played. These include the offside rule, no use of hands except by the goalkeeper, only 11 Players on the pitch, must get the ball requires the ball to be obtained cleanly, and red and yellow cards can be used for infractions, with the red card immediately removing the player for the duration of the game. These rules are set by the football association (The Football Association, 2021).

#### 4. Analogy between an organisation and a football team

There are several areas where there is alignment between the structure of a football team and a processing plant. Similar role types are colour coded in Figures 1 and 2. Nothing that the Technical Authority and Team Doctor are marked red, as these two roles can overrule decisions made above the, based on their expert opinion. Some key activities and associated personnel are detailed in Table 1 to show the similarities between the football team and process plant activities.

#### 5. An example

The example in Table 2 is fictitious, but similar events have occurred through history. The decisions made by those responsible need to take into account a number of inputs to ensure balanced decisions are made, especially when there are safety implications.

*Table 2. Comparison between Football team and processing plant*

<b>Football team</b>	<b>Processing plant</b>
New coach appointed because of poor performance	New plant manager appointed because of poor performance
Due to ongoing poor performance little investment has been made in new players.	Due to ongoing poor performance little investment has been made in the plant or resourcing.
Last training session before important game: Key striker struggling with fitness Goalkeeper unwell	Production meeting: Process safety advisor recommends more frequent inspection of critical pressure relief valves (PRV), because 90% of them failed their last pop test on inspection Plant manager recommends increasing the operating rate of the equipment to increase production leading into the high demand period for products
Team selection: High performance team recommend resting key striker – as coach you overrule this recommendation and select them Doctor rules out goalkeeper due to their illness –want to select them, but doctor overrules	Operations: The Plant Manger rejected the recommendation of increased inspection of PRVs, because they were mostly failing on the low side, not the high side – so assumed to be “safe”, no need for additional shutdowns The technical authority for the rotating equipment has overruled the Plant Mangers decision to increase the rate of the equipment, as the increased rate could lead to catastrophic and unpredictable failure
Game day: First half – team is trailing 2-0, showing fatigue and low morale Undisciplined play leads to a red card for a key defender – one less person on the pitch for the rest of the game	Production: Flow was blocked and pressure increased in the pipeline, toward the maximum allowable operating pressure
Half time: Time to strategize new play with one player less and refocus the team on the objectives	Shutdown: Attempting to shut down the supply pumps
Second half: Key striker scores a goal from an amazing header Lifted morale – there is a chance to at least equalise the game Fatigues key striker stumbles and suffers season ending injury The game is lost	Emergency response: PRV fails to lift, flanges in the pipeline start leaking Senior operator attempts to de-pressure the line by opening a bleed valve but does not follow the correct procedure – they are sprayed with the leaking liquid, which ignites
Post-match review: High performance team recommended resting the key striker – now they are out for whole season, maybe longer – Coach overruled that recommendation Coach wanted best goalkeeper on the pitch but they were ill – coach was overruled by doctor Key defender, a senior player received a red card for an undisciplined tackle from behind – leaving the team a player down Trust and cultural issues emerging between the different roles	Investigation: Plant manager rejected recommendation of more frequent inspection of PRVs Technical authority rejected plan to increase production rate of equipment Procedures not followed in emergency response leading to serios injury Trust and cultural issues emerging between the different roles

## 6. Conclusion

While the idea of comparing a football team to a processing plant may not initially be apparent, this paper has shown similarity between roles, including the roles of advisors and technical authority equivalences. As with a football team, a processing plant has an objective that requires all roles in the organisation to commit to and work on delivering. The underlying culture and discipline are also critical elements in delivering the desired outcome in both type of organisations.

In both settings, the establishment of goals, leadership communication and culture play a vital role in achieving the objectives, where it be creating a successful club through winning games or creating a success business through safe production.

The benefit of making a comparison such as this is to help people across all levels of a plant understand how they contribute to the process safety outcomes, by showing how a similar role in a football team contributes to the team's performance on the scoreboard. While process safety must not be treated simplistically, it does need to have its complexity reduced to support broad understanding and engagement. This is particularly important for roles not directly seen as impacting process safety, because this is the more difficult communication and engagement that is needed. When the whole team are engaged and supporting the objective there is more opportunity for collaboration and success.

## References

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