The Importance of Enterprise Asset Management (EAM) for the Oil and Gas Industry
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INTRODUCTION

The world runs on oil and gas, and with the innovation of fracking and other shale extraction techniques, more industry processes are being carried out on American soil than ever before. As such, it is critical that companies take measures to improve compliance and efficiency. This represents a significant logistical challenge, however, due to the fact that a tremendous amount of the regulation of the oil and gas industry is handled by state-run environmental protection departments. This means that each state has slightly different regulations and guidelines for oil and gas companies. If a specific firm has dealings with multiple states or even countries, which is often the case with pipelines, it becomes even more difficult to manage all of the different regulatory bodies. As such, one of the most powerful compliance tools an oil and gas company can invest in is an Enterprise Asset Management (EAM) program that incorporates asset performance reliability. Furthermore, EAM can also help companies maximize production uptime and minimize downtime, resulting in an unmitigated win-win for oil and gas companies.
STATE-REGULATED ENVIRONMENTAL STANDARDS

Last year, oil and gas companies were fined $2.5 million by Pennsylvania environmental regulators for violations at well sites and pipeline routes, according to NPR (1). This was the third highest year of fines in the past three decades, and many were associated with permit limits. These fines are based on the opinion of the Pennsylvania’s Department of Environmental Protection in regard to how severe it interprets the violations to be. Chief among these considerations is whether the DEP determines that a specific violation is intentional or unintentional, which can be challenging for some companies to prove. In the event that a well site or pipeline exceeds its permit limits, it is easiest to determine the intentionality of the overage if the parent company has been using an Enterprise Asset Management program. A good EAM program will track all maintenance, servicing and usage and allow companies to present a summary of their activities to environmental regulatory bodies in order to demonstrate that they did everything in their power to avoid the violation, which will in turn lead to significantly reduced fines.

Enterprise Asset Management programs can also help to protect oil and gas companies from ever having to deal with violations and fines in the first place. A great example of this occurred last year in Texas, when an oil and gas firm was replacing equipment on a wellhead, according to Times Leader. A problem emerged, however, when a subcontractor failed to follow standard operating procedures and did not warm the wellhead prior to getting to work. Due to the subfreezing temperatures, failure to warm the wellhead led to damage to a wing valve, which became stuck in the open position. Unable to resolve this situation on its own, the company had to contact Wild Well Control of Houston for help. It took nearly a day for the problem to be resolved, and in that time the company not only lost revenue, but it also had to pay a fine of $77,000 to the Department of Environmental Protection. One aspect of EAM is asset criticality ranking. When evaluating a

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(1) stateimpact.npr.org/pennsylvania/2014/02/27/dep-fined-oil-and-gas-companies-2-5-million-last-year/
company’s operations, an EAM specialist will assign each asset a criticality rank, which basically determines how essential that asset is for production to continue without disruption. Assets with particularly high criticality ranking need to be protected with things like spare parts and preventive maintenance programs. In the case of the Texas oil and gas firm, the wellhead would likely be ranked very highly as a critical asset. If they had been following an effective EAM strategy, then systems would likely have been in place to mitigate the risks associated with this single point of failure. It is plausible, therefore, that if this firm had enlisted the aid of EAM consultants, that the impact wellhead failure and the ensuing fees could have been minimized or prevented altogether.

**EAM OBJECTIVES**

So what does an Enterprise Asset Management program do exactly? In the oil and gas industry, a good EAM program optimizes the financial and operational performance of a company’s physical assets and work processes. It can reduce the frequency and severity of asset failure and improves the companies chances of meeting or exceeding production goals. They also aid in the implementation of standardized, scalable practices, processes and technology for future growth. Finally, they assist in the development of reporting and key performance indicators to provide sound decision making in managing assets.

Enterprise Asset Management programs evolve over time, so they can be implemented by any company regardless of its current situation. As an EAM program becomes more mature and sophisticated, it increases in performance over five stages.

1. **Reactive plans**: Most companies employ a reactive plan, which means that they fix assets after they fail. Their governance is limited, maintenance is always rushed and three to five times more expensive, making work much more stressful.

2. **Planned maintenance**: EAM programs help to get them to the level of planned maintenance, wherein assets are evaluated in terms of their criticality and service maintenance is planned to mitigate the chances of unexpected disaster.

3. **Predictive maintenance**: As EAM programs mature, companies can eventually get to the level of predictive maintenance, which benefits from robust reporting and big data analysis. Predictive maintenance schedules determine when regular services, like greasing and parts replacement, need to occur, so they are performed before issues emerge.

4. **Optimization**: Companies can eventually get to the point where their maintenance is about optimization, starting with reliability. This level incorporates life cycle cost tracking, root cause analysis and the elimination of asset defects.

5. **Enterprise**: Finally, the best and most prepared firms can get to the level of enterprise, which is categorized by alignment, shared vision and integration across supply, operations and engineering.
Basically, the process of an EAM program implementation and improvement leads to optimized project design and efficiency gains in maintenance, planning, scheduling and purchasing. It also improves the accuracy of inventory of assets and locations while providing historical records of maintenance and servicing. Further down the line, companies can enjoy optimized inventory levels and spare replacements for their most critical assets. This leads to improved reputation with shippers, producers and regulators, as well as reduction in lost throughput, spills and property damage. Finally, EAMs improve employee morale by imposing less stress on them due to drops in emergency, reactive maintenance.

**IMPLEMENTING NEW EAM PROGRAMS**

The first step in designing an effective Enterprise Asset Management program is to establish a master data plan. Master data analyzes assets to determine a plan for improving reliability, reporting and continuous improvement perspectives. This stands as the basis for phased and foundational development and implementation.

The next step is to determine location and asset hierarchy conventions. Like the master data, this stage needs to be established prior to the reliability program kick-off. It draws on the current numbering and existing systems such as DCS, PLC, procedures and drawings, and should include projects and standards. In some cases, it can also be implemented in a phased approach using legacy identifications.

Another important aspect of the location and asset hierarchy development is a quick drilldown functionality determination, wherein you identify the location of all assets and spare parts. Locations and assets should be clearly and accurately tagged to ensure that the correct data is being collected and the right equipment is being inspected and repaired.
Once the master data and location/asset hierarchy have been established, it’s possible to move forward with your EAM program, and while it may be tempting to try to rush up the ladder from reactive maintenance to the enterprise level, it’s critical to remember the importance of pacing. It is important to keep things as simple as possible. In order to accomplish this, you should always follow your system hierarchy, which supports work order scheduling. When system hierarchy is synergized with work order scheduling, asset downtime can be planned and scheduled to avoid interfering with production. If an asset like a well valve fails, then the scheduler can immediately determine what other assets are available and ready to be PMed or repaired.

**SPARES, BACKUPS AND REDUNDANCIES MAXIMIZE UPTIME**

The success of this model is based on the availability of the correct spare parts. However, it is helpful to remember that the storage and organization of these parts determines their effectiveness. Therefore, instead of over-investing in spares or keeping “junk drawers,” companies should only keep critical spares and consumables on hand. Once criticality levels have been determined, you can use your industry expertise to identify one-off items, which might be less important. Of course, lead times, cost and vendor relationships should also be considered when stocking spares.

Remember also that some items can be rotated. This means that they can be taken out of storage to replace a failed part of a critical asset. The failed unit can then be serviced or rebuilt and returned to storage in place of the spare. In the future, when the original spare fails, the rotating assets can swap places, and the cycle continues. This significantly reduces the amount of money that needs to be spent on spare parts.

System hierarchies and master data help maximize production, but the other side of this coin is maintenance. It’s not enough to simply swap in stopgaps to keep production moving, you also have to make sure that preventive and predictive maintenance is conducted on a regular basis to keep your various assets in peak operating condition. More than anything, this benefits from asset criticality ranking.
ASSET CRITICALITY AND PRIORITIZATION

Asset criticality ranking is a tool that is issued to determine how asset failures impact organizational performance. It provides your reliability specialists with a detailed profile of attributes that evaluate how essential each asset is to production. In some industries, especially oil and gas, it is easy to lose perspective on what seems to be critical versus what is actually essential. Criticality rankings rate assets across criteria such as safety and environmental impact, operational throughput, maintenance costs and utilization rate. The ensuing grade provides improved insight into exactly how necessary each asset is for production.

Asset criticality ranking informs reliability centered maintenance, which aims to maximize reliability and, by extension, productivity uptime. In order to implement a reliability centered maintenance plan, you need to first start by determining failure modes and effects analysis. Next, you need to determine the appropriate maintenance tasks when an anticipated failure occurs. This provides you with a plan of how to deal with the most common areas of risk as quickly and efficiently as possible when failures occur. Finally, as reliability centered maintenance is conducted over the in-service life of equipment, you must gather data regarding the effectiveness of maintenance. That data should be kept under review and maintenance procedures should be adjusted based on your experience and observations over time.
For example, in the oil and gas industry, well valves are a high risk asset in regard to failure. As such, companies should make sure that everything required for maintenance and emergency repair or replacement is on hand in the event of unexpected well valve failure. This would allow for immediate, timely replacement or repair, minimizing the chances of being penalized by state DEPs.

One of the final aspects of EAM is the functional analysis system hierarchy, which is a detailed and orderly process that is built on a functional analysis of the maintainable items used in a system. The functional analysis system hierarchy seeks to address seven basic questions:

1. What are the functions and associated performance standards of the asset in its present operating context?
2. In what ways does it fail to fulfill its functions?
3. What causes each functional failure?
4. What happens when each failure occurs?
5. What are the consequences of each failure?
6. What can be done to predict or prevent each failure?
7. What should be done if a suitable proactive task cannot be identified?

By answering these questions, you will be equipped with the insight necessary to help streamline operations and ensure maximum uptime for critical assets.
COMPLIANCE

So how does all of this affect compliance and mitigate risk of regulation violation and the resultant fees? Perhaps most importantly, an Enterprise Asset Management Program demonstrates your company’s commitment to asset optimization and smooth operations. This is even more critical in the oil and gas industry where asset failure can lead to devastating environmental repercussions. By monitoring your equipment and ensuring that all assets are in peak operating condition, your company is significantly less likely to suffer catastrophic equipment failure. However, if something does go wrong, then your EAM program will contain paperwork and maintenance records that can be used to prove to the relevant department of environmental protection that your company took all necessary precautions to try to prevent asset failure. This kind of documentation could be all that is necessary to prove that your company was just the victim of bad luck and not negligent or, even worse, grossly negligent.

This all boils down to a win-win scenario. EAM can save you money by maximizing productivity uptime and lowering the costs associated with maintenance, but it can also safeguard you from expensive, reputation-damaging fines and fees.