

WHITEPAPER

The Calculated Benefits of Electronic Permit to Work Systems



PROMETHEUS GROUP



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Permit to Work (PTW) systems are key to ensuring the safe execution of hazardous work activities. PTW procedures are usually supported by a Job Safety Analysis (JSA) process and a range of related procedures for high risk activities such as confined space, hot work, etc. Different activities require different processes and authorizations which must be learned by personnel and properly applied. A significant majority of operational facilities worldwide utilize manual paper based PTW procedures and forms.

A number of electronic PTW (ePTW) systems are now available in the marketplace. This raises the question of whether we should continue to rely on personal knowledge, memory, and pieces of paper to manage these critical safety-related matters. This whitepaper explores the benefits of implementing Prometheus ePAS (an ePTW system), including the improved efficiencies it can deliver in areas such as:

- Job Safety Analyses
- Planning and approvals
- Isolation management
- Shutdown performance

Conservative estimates of efficiencies gained through the implementation of an ePTW system which integrates JSA functionality and isolation management will demonstrate how quickly such systems can deliver a substantial Return on Investment.

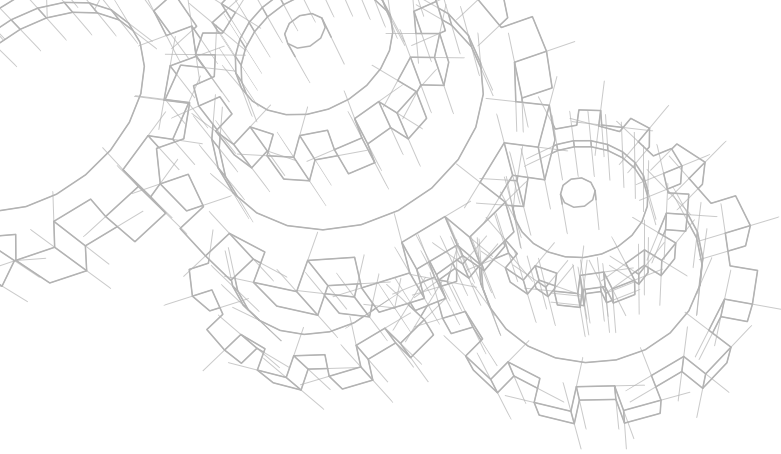
This paper focuses on defining the quantifiable benefits of ePTW, particularly with regard to improved efficiency. Other benefits such as improved safety benefits and protection of corporate social reputation are also addressed.

Efficiency

Manual PTW procedures and their accompanying paper support documents are labor-intensive and often ambiguous. Personnel spend many hours filling out forms, writing out tags, and moving the paper forms from place to place with an associated loss of wrench time. Working time is also lost because work parties are waiting for their permit.

The potential efficiency benefits of ePTW systems include:

- Reduced time to perform Job Safety Analyses
- Early identification of work conflicts. This eliminates the effort wasted in planning and implementing controls only to find the work cannot proceed
- Faster permit planning with equipment items and isolation points selected from equipment lists
- The ability to reuse pre-approved isolation lists
- Quicker electronic approval of permits as there is no need to physically move the forms
- Faster permit issues reduce lost wrench time
- Reduced permit volume through improved work packaging



Permit to Work Request and JSA

The first step in most permit processes is the permit request. The second step is the related JSA for the task to be performed. In many cases, this involves filling in a permit request form, undertaking the JSA, and then delivering them to a supervisor or permit authority. These tasks alone can take from a few minutes to an hour or more.

Prometheus ePAS integrates the permit request and JSA processes. This allows the permit request and JSA to be prepared and submitted, often in just a few minutes. There is no need to physically deliver the paperwork. In fact, at this stage there is no “paperwork” at all, as work requests and JSAs can be prepared and submitted online.

Prometheus ePAS can deliver time savings of 50 to 75 percent for this activity alone. A permit request that took 20 minutes in a paper system can be reduced to as little 10 or even five minutes. This is achieved by minimizing typing through the use of dropdown lists, integration with ERP, EAM, and CMMS systems, and copying previous requests.






Typical medium to large operating facilities have between 200 and 1,000 requests per month. Implementing ePAS in these facilities would result in savings of 33 to 250 hours per month. Assuming an average hourly rate of \$80 per hour means the savings could be anywhere between \$2,600 and \$20,000 per month.

No. of Permit Requests/Month	Minimum Manual Time Taken	Time Saving Using Prometheus ePAS	Cost Saving Using Prometheus ePAS
200	20 minutes each	33 hours/month	\$2,600/month
1000	20 minutes each	250 hours/month	\$20,000/month

Note: Tables show the minimum manual time taken so results are conservative.

Permit Request Approval and Work Conflict Management

The permit request is typically submitted to the permit authority who will:

-  Validate that the request is complete and the JSA adequate.
-  Confirm that the plant can be released from operational service.
-  Confirm that the work doesn't conflict with other planned work.
-  Identify any additional requirements i.e. special permits/certificates.
-  Determine whether a higher-level risk assessment is required.

These manual checks take time. The identification of potential conflicts can mean reading and reviewing

permits folders or piles of paper permits. Even worse, these may be in multiple locations.

In practice, this activity can take between five and 15 minutes to perform effectively. Prometheus ePAS automatically cross references and highlights work on the same plant items; other automated methods also check for work conflicts. This may reduce the time taken to perform the activity by about 50 percent. Based on the example, permit volumes above this would result in savings of eight to 41 hours/month.

This example calculation excludes the savings from inadvertently approving a request that is later found to conflict with other work and the subsequent planning and preparation work that has been done but cannot go ahead due to the conflict.

Automated identification of potential work conflicts provides superior safety advantages over paper-based systems.

No. of Permit Requests/Month	Minimum Manual Time Taken	Time Saving Using Prometheus ePAS	Cost Saving Using Prometheus ePAS
200	5 minutes each	8 hours/month	\$640/month
1000	5 minutes each	41.5 hours/month	\$3,320/month





Moving Paper

Manual paper-based PTW systems require personnel to physically move paperwork around the organization. In some cases, the paper stays where it is, and the personnel move to it. More complex types of work — such as hot work inside a confined space — require more authorizations and even more time to get the people and the paper co-ordinated.

Conservatively, each permit could require 10 to 20 minutes of movement time. Prometheus ePAS does not require the physical movement of paper. Personnel can access the system and perform their authorization

actions from their access device. Thus, it would be easy to achieve at least a 70 percent reduction in effort in this area, resulting in savings of between 23 to 116 hours per month.

These savings exclude the time lost when paper permits are lost during the movement process and the whole process must start over again!

No. of Permit Requests/Month	Minimum Manual Time Taken	Time Saving Using Prometheus ePAS	Cost Saving Using Prometheus ePAS
200	10 minutes each	16 hours/month	\$1,280/month
1000	10 minutes each	80 hours/month	\$6,400/month

Isolation Planning

The process of planning the appropriate isolations for a given task typically involves the following steps:

- Identify the plant item required to be worked on.
- Check whether it is already isolated on another isolation certificate.
- If so, check whether the isolations are adequate for the work and validate work compatibility.
- If not, use Piping & Instrumentation Diagrams (P&IDs), electrical schematics and other information to identify the isolation points appropriate for the work.
- Write the isolation certificate and isolation tags.
- Have the isolation plan checked by an authorized person.
- Check that the plant is available for release.
- Isolate the plant.

The planning steps (1-7) can take a significant amount of time particularly for work requiring many isolation points. The amount of time becomes even greater if there is no library of pre-approved isolation lists.

A single isolation certificate can easily take 20 to 90 minutes to plan. Prometheus ePAS reduces this planning time by 50 to 75 percent by identifying all isolation points in the equipment list and by including lists of approved standard isolations.

Assuming that standard isolation lists are available for 50 percent of the work, applying the savings to the sample permit volumes results in savings of between 16 and 560 hours.

Shutdowns are discussed in greater detail below, but it is worth noting that the review of one facility following the implementation of Prometheus Group's permit system, identified savings in excess of 700+ hours per outage. In this case, a large, four-unit power station with at least one major shutdown per year has achieved significant, repeatable, and identifiable savings.

Use of pre-approved task/plant isolation lists will deliver consistent, repeatable savings.

No. of Permit Requests/Month	Minimum Manual Time Taken	Time Saving Using Prometheus ePAS	Cost Saving Using Prometheus ePAS
200	20 minutes each	16 hours/month	\$1,280/month
1000	20 minutes each	80 hours/month	\$6,400/month

No. of Isolation Certificates/Months	Minimum Manual Time Taken	Time Saving Using Prometheus ePAS	Cost Saving Using Prometheus ePAS
200	6 minutes each	20 hours/month	\$1,600/month
1000	6 minutes each	100 hours/month	\$8,000/month

Isolation Point Tags

A significant number of facilities write isolation point tags by hand. This activity is generally loathed by personnel, and issues around the quality and legibility of handwriting are quite common.

Descriptions of isolation points also present an issue in paper-based systems. It's common for personnel to abbreviate an isolation point's name, leading to de facto short names which can be confusing to personnel who are not familiar with the facility. This can result in incidents caused by misidentified isolation points.

Let's assume we have an average of six isolation points per isolation certificate. Manually writing the tags takes about one minute each. This means an average of six minutes is required for each isolation certificate. Using our sample permit volumes, handwriting of isolation tags can take up between 20 and 100 hours per month. Electronic systems that automatically print the tags will save 100 percent of this time.

An electronic PTW system reduces human error and saves significant time writing isolation tags.

Cross-Referencing Isolation Points

Another key isolation activity is cross-referencing; the process of checking that planned isolation points do not conflict with the state of existing isolation points

on active isolation certificates. For example, isolation certificate B needs valve V456 in the shut isolated state whereas isolation certificate A, which is on issue, has the same valve V456 in the open state. This is clearly a contradictory state and could result in a serious permit breach.

This potential breach is sometimes only discovered when the Authorized Isolation Representative goes to the isolation point to isolate it, only to find it is already isolated in the opposite condition. This can result in a breach if it is not effectively identified and implementation halted. It's also a complete waste of time.

Manually cross-referencing isolations can take anywhere between one and five minutes depending on the size of the size and the current permit volume. Applying our sample average isolation points and permit volumes, manual cross-referencing takes between three and 83 hours per month. An electronic PTW system should automatically cross-reference isolation points and prevent the printing of the conflicting isolation point tags, thus eliminating the time required for cross-referencing entirely.

Automated cross-referencing delivers improved safety performance by preventing isolation conflicts.

No. of Isolation Certificates/Months	Minimum Manual Time Taken	Time Saving Using Prometheus ePAS	Cost Saving Using Prometheus ePAS
200	6 minutes each	20 hours/month	\$1,600/month
1000	6 minutes each	100 hours/month	\$8,000/month
	Cumulative Savings	96.2 - 568.1 hours/month	\$7,144 - \$43,568/month



Reuse of Formal Risk Assessments

Many facilities have more formal/higher-level risk assessment processes — in addition to their JSAs — that are applied to more hazardous works such as hot work in hazardous areas. These are usually based on published risk management standards such as ISO 31000 or organizational risk management processes. These risk assessments are typically prepared by a team of people such as the work party and other specialists.

Some facilities allow the reuse of risk assessments while other sites prohibit the practice. There are arguments both for and against this practice in paper-based systems. However, an ePTW system such as Prometheus ePAS with risk assessment capabilities supports the reuse of risk assessments. This includes enforceable re-approval steps that ensure that the risk assessment is relevant to the planned scope of work.

If 10 percent of permits require this additional higher-level risk assessment, a reuse rate of 30 percent and 60 minutes to prepare a risk assessment gives us a potential saving of between 6 and 30 hours per month.

Shutdowns, Turnarounds, and Outages

Shutdowns are periods of intense activity which require large volumes of permits and isolations. It is difficult to manage this volume using manual, paper-based systems which means that the risk of a permit breach or isolation conflict is significantly higher during shutdowns. Additionally, poorly planned work scopes and the need for plant testing can lead to significant losses in wrench time.

Prometheus ePAS provides significant value in the management of the increased number of permits and isolations required during shutdowns. The benefits fall into several areas including:

- Faster planning and approval of work
- Easier to check for work and isolation conflicts
- Improved management of work scope change or isolation changes
- Potential for faster return to service of plant through appropriate permit and isolation packaging
- Reduced lost wrench time

No. of Isolation Certificates/Months	Minimum Manual Time Taken	Time Saving Using Prometheus ePAS	Cost Saving Using Prometheus ePAS
200 (6 RAs used)	60 minutes each	6 hours/month	\$480/month
1,000 (30 RAs used)	60 minutes each	30 hours/month	\$2,400/month

Prometheus ePAS provides these specific functions to aid in the above:

- Automated cross-referencing
- Ability to reschedule permits or defer the work
- Ability to see potential work conflicts on a plant layout view of the site, cross-referencing, and automated hazard conflict checking between permits
- Enabling the safe sharing of isolation certificates by multiple permits

Many of these benefits have been previously discussed in this paper. Let's take a look at how ePTW systems can assist with a faster return to service and improved wrench time.

The outage management capabilities of Prometheus ePAS include the ability to link and cascade isolation and other certificates to form appropriate structures and dependencies that support the progressive restoration and re-commissioning of the facility.

Used effectively, these tools can result in a faster return to service. A typical facility will have between two and eight shutdowns per year. Hourly revenues

obviously vary considerably, but we'll assume \$4,000 per hour for this calculation. Using Prometheus ePAS and appropriately structuring isolations, certificates and permits can achieve a conservative return to service saving of between four and eight hours.

Contractors and employee work groups waiting for permits during shutdowns carries a substantial cost. There are many causes for this wait time, but typically include poor shutdown planning, short notice requests, time to prepare permit documents, and scheduling of permit issue times.

The cost of work groups waiting for permits can be substantial. A typical work group of eight people waiting one hour for a permit may cost \$640 (8 x \$80). If there are 10 work groups waiting an hour, then the cost is \$6,400. If we consider this can occur daily for a 10-day shutdown, then the cost rises to \$64,000 per shutdown. The shutdown planning support provided in Prometheus ePAS can help minimize this lost tool time by reducing. A conservative estimate would be a 30 percent reduction, applied to the same shutdown frequency used previously, which would deliver savings as shown in the following table.

No. Shutdowns/ Year	Revenue/Hour	Time Saving Using Prometheus ePAS	Cost Saving Using Prometheus ePAS
2	\$4,000	4 hours/shutdown	\$32,000/year
8	\$4,000	4 hours/shutdown	\$128,000/year
2	\$128,000	30%	\$38,400/year
8	\$512,000	30%	\$158,600/year

No. Permits/ Month	Minimum Manual Time Taken	Time Saving Using Prometheus ePAS	Cost Saving Using Prometheus ePAS
200 (10 audits)	60 minutes each	5 hours/month	\$400/month
1,000 (50 audits)	60 minutes each	25 hours/month	\$2,000/month

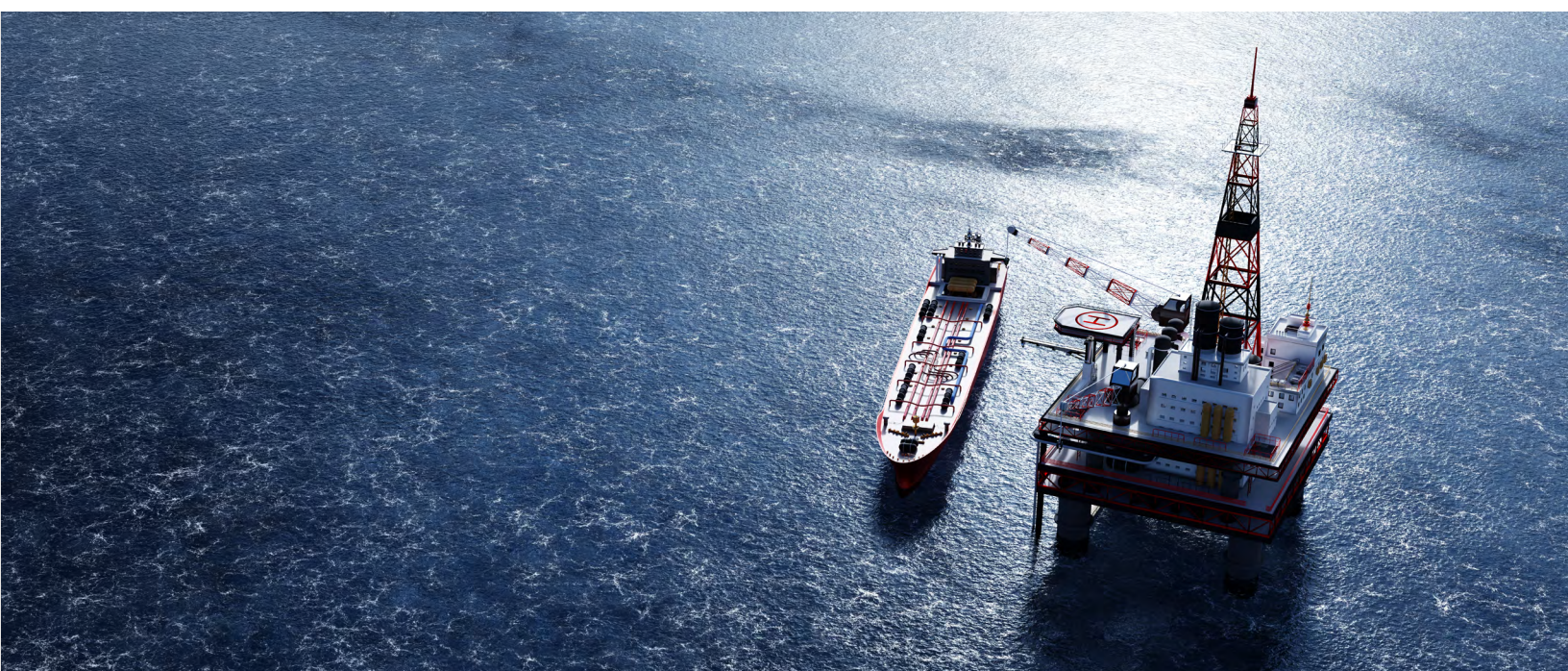
Audit Effort

The audit process is one of the primary mechanisms used to monitor the compliance of PTW systems. The level of audit activity varies from facility to facility and often suffers from operational pressures. For example, facilities may plan to do 10 random audits per month, but only complete two because of a shutdown. Part of the reason for the lower level of activity in the audit is that it can be quite time-consuming.

A limitation of auditing manual PTW processes is that the review of the associated paperwork is only as good as the information written. The dates and times recorded for various approvals may not represent the actual dates and times. In a paper-based system, there is nothing to stop the forms from being completed after the fact. Regular random audits of current permits are really the only way to check that the PTW system is operating in a compliant manner.

Prometheus ePAS uses automated activity logging to generate a real-time transactional record of the permit life cycle. This provides an audit history that serves as irrefutable evidence of the date and times of the permit activities, as well as the names of the personnel performing those activities. Automatically generated audit histories contribute to an improved workplace culture and deliver efficiency savings in both the initial recording and audit/governance process.

Audit trail records are an excellent source of data for desk audits. The person responsible for this task can randomly audit active or completed permits and see who did what and when they did it, as well as look for anomalies. This ready access to information in a single electronic location reduces the effort required to do audits and allows more to be done in the available time. Prometheus ePAS reduces audit effort by at least 50 percent. If each audit currently takes 60 minutes, and a site is auditing five percent of permits per month, the saving is between five and 25 hours per month.



Protecting Equipment

Prometheus ePAS helps to mitigate incidents related to the incorrect restoration of equipment. Some items can suffer significant damage if they are not correctly restored to a safe prestart condition before being operated.

These types of incidents may be infrequent, but the costs in terms of repair or replacement and lost production are significant. They can occur across all industry sectors and are particularly damaging in oil/gas, power generation, and other complex processing plants. The root cause of these incidents is that a step has been missed in the restoration of isolation points. This is either because the restoration plan was incomplete, or the step was simply missed. Some sites use prestart checklists as a defense against missed isolation points. However, the better approach is to ensure they are not missed in the first place.

Prometheus ePAS requires the individual validation using tags of the restored isolation points before the isolation certificate can be closed out. This is a robust mechanism to prevent missed isolations and provides greater certainty of a complete restoration process, rather than simply ticking a box on a form.

It is not easy to quantify the savings of avoiding such incidents. However, such incidents range in cost from \$1 million to \$20 million. Assuming an incident frequency rate of one in 20 years at a cost of \$5 million, the avoided cost is potentially \$250,000 per year. The table below provides a few scenarios.

Incident Costs	Frequency Rate	Avoided Cost Per Year
\$1,000,000	1 in 20 years	\$50,000
	1 in 10 years	\$100,000
\$5,000,000	1 in 20 years	\$250,000
	1 in 10 years	\$500,000
\$10,000,000	1 in 20 years	\$500,000
	1 in 10 years	\$1,000,000
\$20,000,000	1 in 20 years	\$1,000,000
	1 in 10 years	\$2,000,000

Regulation

The Occupational Health and Safety (OHS) regulatory environment is tightening. This places an even greater obligation on corporations to comply with an increasing level of regulation or face significant penalties. Fines of U.S. \$500,000 are becoming more common for single person incidents.

Implementing an electronic PTW system which enforces business rules reduces this risk. Increased penalties offer another compelling reason to adopt the highest OHS standards on our work sites. Avoiding an incident has significant potential cost avoidance returns.

Quantifying the savings of avoided incidents is not simple. However, we can determine a nominal avoided

cost by using a few assumptions. There are two fundamental groups of incidents, namely High Impact Low Frequency events (such as the Piper Alpha disaster) and Low Impact High Frequency events (sprains and cuts – Loss Time Injury type). The tables below provide scenarios using a nominal total cost comprised of elements including:

- Lost production for incident/investigation period
- Lost productivity during the investigation
- Fines from regulations
- Investigation costs
- Legal costs
- Civil claims

		High Impact, Low Frequency Events		
Incident Costs		Frequency Rate		Avoided Cost Per Year
\$5,000,000		1 in 20 years		\$250,000
		1 in 10 years		\$500,000
\$10,000,000		1 in 20 years		\$500,000
		1 in 10 years		\$1,000,000
\$20,000,000		1 in 20 years		\$1,000,000
		1 in 10 years		\$2,000,000

	Low Impact, High Frequency Events	
Incident Costs	Frequency Rate	Avoided Cost Per Year
\$100,000	1 in 2 years	\$50,000
	1 in 5 years	\$20,000
\$200,000	1 in 2 years	\$100,000
	1 in 5 years	\$40,000
\$500,000	1 in 2 years	\$250,000
	1 in 5 years	\$100,000
\$1,000,000	1 in 2 years	\$500,000
	1 in 5 years	\$200,000

Safety and Culture

Many facilities struggle with an appropriate response to incidents. The standard response is an investigation to determine the cause. The investigation may result in a revision of the PTW procedure. This will in turn add another checklist, checkbox, and/or approval to the permit forms.

Procedures and forms become larger and more complex and the workforce is faced with information overload. This makes it even more difficult for them to do their job properly and safely. It is not uncommon for a single PTW procedure to include hundreds of different business rules.

Risk management and PTW activities are not the appropriate place for personal creativity. They must be performed with absolute consistency. Prometheus ePAS is a workflow engine that applies business rules consistently and eliminates human error. This technology assisted process is much better at identifying and preventing mistakes because the information is more visible and approval steps are enforced.

Business rules are applied via workflows in Prometheus ePAS. Additional rules can be applied by modifying these workflows if necessary. The ability to capture

lessons learned and provide a mechanism for these to be assessed, acted on, and shared is leading practice. The lessons learned are incorporated into the JSA process. This allows organizations to implement continuous learning processes and knowledge sharing far more easily than with manual processes.

Prometheus ePAS includes automated logging of the permit life cycle for the entire life of the permit. The value of having this information completely visible should not be underestimated. People are far more careful about what they do and approve if they know there is an irrefutable record of their actions.

Compliance/Audit

Most facilities have experienced compliance issues with their PTW systems. These can range from simple administrative oversights to serious incidents because a key check or control had not been implemented. Humans are not infallible. Oversights will occur even with the best procedures and the best training.

Prometheus ePAS is workflow-driven which ensures every step in the process has been completed with a high level of consistency. The solution prevents personnel from proceeding to the next step until they confirm that the previous step has been completed.

As noted previously, Prometheus ePAS's audit trail functionality provides an enduring record of the permit life cycle that is ideal for current and post-permit auditing. PTW managers can easily and routinely audit permits and look for any unusual behaviors. In the unfortunate event of an incident, the audit trail is the key source of data in an investigation.

Corporate Social Responsibility

There are increasing levels of activism amongst shareholders of public companies. Boards of Directors are becoming very sensitive to decisions and outcomes that damage corporate reputation and impede their corporate social responsibilities.

A major incident can do irreparable damage to a company's international reputation. There are also significant direct costs and loss of company value to contend with.

The simple fact is that the company's corporate social responsibility has failed to meet its objectives if there are workplace incidents or, even worse, fatalities. It has been suggested by some that employees will, if they are not already are doing so, choose only to work at companies with good safety records. They are not as likely to join a company with a history of safety-related incidents.

Environment

Release of hazardous chemicals or materials leads to potential injury, plant, and environmental damage as well as any clean-up costs and penalties or fines from regulatory bodies.

Processes like a Job Safety and Environment Analysis (JSEA) are often the first line of defense in preventing the release of hazardous substances. It is concerning that corporations still rely on people filling out pieces of paper to make this process work. They are trusting people's memories, level of hazard awareness, plant knowledge, and maybe some checklists to make this work.

Prometheus ePAS has the capability to support the JSA/JSEA process and provide a database of known environmental hazards and appropriate controls. Managing environmental hazards in this way means that the probability of missing the appropriate treatment of a hazardous substance is decreased markedly. The protective controls will be applied more consistently, and people will become more aware of the appropriate controls.

Regulatory agency penalties can range from a couple of thousand dollars and/or funding of community environmental projects to many millions of dollars. A conservative indication of potential avoided costs is shown in the table below.

Incident Costs	Frequency Rate	Avoided Cost Per Year
\$200,000	1 in 2 years	\$100,000
	1 in 5 years	\$40,000
	1 in 10 years	\$20,000
\$500,000	1 in 2 years	\$250,000
	1 in 5 years	\$100,000
	1 in 10 years	\$50,000
\$1,000,000	1 in 2 years	\$500,000
	1 in 5 years	\$200,000
	1 in 10 years	\$100,000

Summary of Benefits

The summary of benefits shown below was calculated by using the lower permit volumes and the lower avoided cost values. In other words, these are conservative estimates.

Benefits	Cost Saving Using Prometheus ePAS Per Month	Cost Saving Using Prometheus ePAS Per Year
Permit request and JSA	\$2,600	\$31,200
Request approval and work conflict check	\$640	\$7,680
Moving paperwork	\$1,840	\$22,080
Isolation planning	\$2,640	\$31,380
Isolation point tags	\$1,600	\$19,200
Isolation point cross-referencing	\$264	\$3,168
Formal risk assessment reuse	\$480	\$5,760
Shutdown - return to service	\$2,666	\$32,000

Benefits	Cost Saving Using Prometheus ePAS Per Month	Cost Saving Using Prometheus ePAS Per Year
Auditing	\$400	\$4,800
Protecting plant	\$4,166	\$50,000
Regulation - high impact/ low frequency	\$20,833	\$250,000
Regulation - low impact/ high frequency	\$1,666	\$20,000
Environment	\$1,666	\$20,000
TOTAL	\$41,439	\$497,268

Conclusion

Implementing Prometheus ePAS has a wide range of benefits. The conservative calculations used throughout show these benefits can be achieved at many stages of the risk assessment, permit, and isolation process. The advantages extend beyond actual cost savings to avoided costs such as loss of production, compensation, fines, and loss of reputation. Clearly, all corporations using Permit to Work procedures can gain immediate and valuable benefits through the introduction of Prometheus ePAS.

Prometheus Group has compiled this paper based on its experience and knowledge of permit to work processes. The savings calculations used throughout are conservative estimates and may not accurately reflect circumstances at your site. Prometheus Group has an ROI spreadsheet available to assist you in calculating the actual time and cost savings which can be achieved as well as the ROI period for implementing Prometheus ePAS which is able to deliver the functionality and efficiency gains described.

Prometheus Group also offers Prometheus Permitting & Safety, a complete Integrated Safe System of Work (ISSOW) that seamlessly connects with your existing ERP, CMMS, or EAM system to deliver total digital transformation for your control of work systems.



*To learn more about features and functionality,
visit our website and review our Permitting & Safety section.*

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Prometheus Group is a leading global provider of comprehensive and intuitive enterprise asset management software solutions that work within ERP systems and span the full work management life cycle for both maintenance and operations. Developed jointly with end users, Prometheus software enhances the customer experience for planning, scheduling, and executing work for both routine maintenance and shutdowns and turnarounds, all while protecting the workforce with safety solutions and electronic permit to work. Our straight-forward functionality, graphical visualization, and simple processes enable customers to increase productivity, reduce costs, and improve reporting. For more information, please visit www.prometheusgroup.com.