

White Paper

Turning Tank Farm Management Into a Competitive Advantage



Executive Summary

Tank farms are a crucial area in refinery and terminal operations, and have a significant impact on their overall business results, and yet they are one of the most neglected areas of automation in the facility. With growing complexity in the off-sites piping network, increased workload of operators, and a continuing drive for higher efficiency and throughput, safe and effective tank farm management has become an even greater challenge across the industry.

Oil & gas firms need a comprehensive solution for controlling off-sites material movement. They seek to achieve inventory savings while guarding against costly incidents and improving the productivity of personnel—all contributing to greater profitability.

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Introduction

Off-sites operations such as tank farms and terminals provide receiving, shipping and storage facilities for liquid and gaseous products processed by or produced in a refinery, petrochemical complex or other process plant. These operations rely on a wide range of equipment assets—from tanks and pipelines to pumps and valves, etc.

When it comes to managing a tank farm, the goal is to oversee material inventory and movements as safely, reliably and efficiently as possible. The tank farm environment, being a hazardous area, requires continual monitoring of process parameters. Monitoring and controlling the volume of tank liquid is important to ensure accurate data is used for financial statements and plant planning/scheduling.

Inaccurate measurements may result in suboptimal capacity usage, accounting errors and even environmental incidents through spills.

Accurate and reliable tank level monitoring is especially important to prevent overfill situations. Recent catastrophic incidents at off-sites facilities can be traced to ineffective safety technology leading to loss of level control and, ultimately, to loss of containment.

Many oil & gas industry firms are now turning their attention to improved automation of oil movement and storage. Typically neglected over many years, control systems for off-sites facilities have tended to include only basic instrumentation, and their operation is both manpower-intensive and highly reliant on the memory and knowledge of the plant personnel.



Through the implementation of advanced automation technology, refiners and terminal operators can improve their off-sites performance with more reliable movements that reduce incidents and improve supply chain execution to take advantage of changing business opportunities.

Today's Operating Challenges

Modern tank farms face many obstacles to optimizing their operations. These include: handling highly valuable liquids safely and efficiently, tracking capacity and certified/available stock, monitoring quality and emissions, preventing spillages, and reducing loading and unloading times.

Refinery operations are constantly being asked to move more material through the facility while reducing inventories and eliminating incidents. The complexities of plant design that have evolved over time often result in a piping network that is difficult to manage. Regulatory requirements for product tracking and certification place additional burdens on material movement.

Specific challenges faced in the movement area include:

- Frequent line-up errors
- Heavy workload on off-sites operators
- Increasing demand for data integration
- Loss of in-house expertise
- Lack of off-sites automation
- Increased drive for throughput

To ensure maximum return on investment, tank farm equipment must be operated at optimum load and utilization. Furthermore, to achieve a long-term competitive advantage, processes need to be flexible and expandable to accommodate new or changing requirements.

Accurate inventory is a critical aspect of any tank farm. However, the complex and dynamic nature of this environment can make it difficult to pinpoint current tank levels or predict future inventory. This can result in increased operational expenses to fulfill existing commitments, an inability to execute future orders, and ultimately, a reputation for poor customer service.

Throughout the process industries, terminal and tank farm infrastructures are aging. When funds are being allocated for efficiency increases or improved operations management, tank farms are traditionally considered last, with most major investments going into the process area. As a result, many tank farms employ operational tools and systems that are not very sophisticated, and are often either home grown or no longer supported by the original application provider.

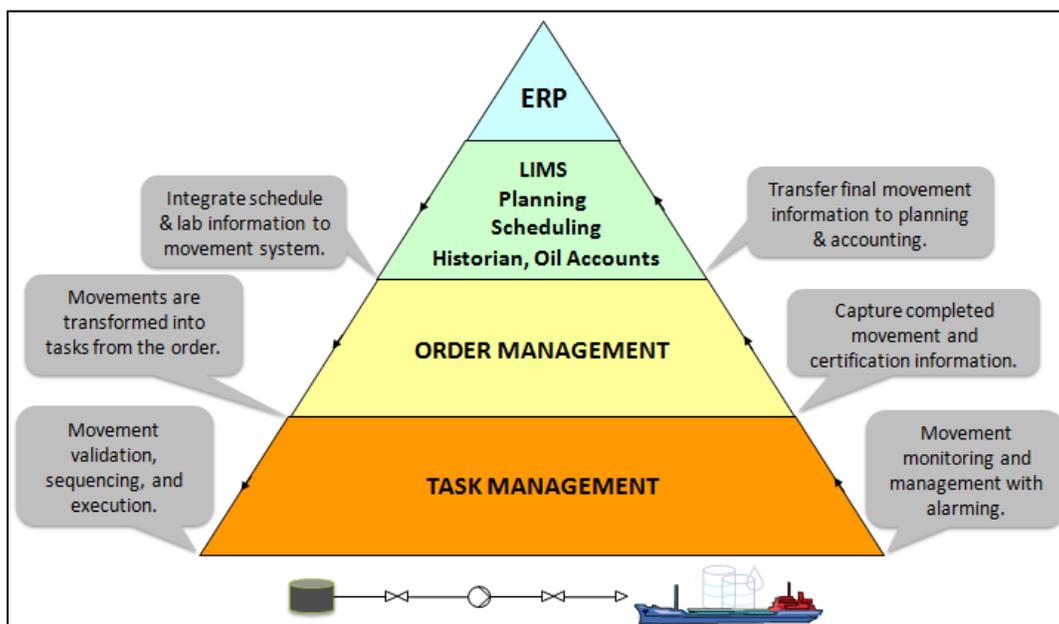
At many oil & gas storage sites, movement line-up errors occur due to the complexity of pipe networks, insufficient levels of automation and a loss of staff expertise. These errors can result in product downgrading, contamination and spills. Indeed, a single incident from a line-up error can be worth up to \$1M to the facility.

High operator workload is also impacting off-sites operation. These facilities must get by with fewer operators and cope with the loss of know-how caused by a retiring workforce. As many tasks are performed manually, the risk of error increases with diminishing expertise, as does the time to realize that something has gone wrong: both can have a major impact on safety as well as quality performance. Together, these problems can lead to misalignment of the piping network due to a lack of knowledge retention, and where shipping or pipeline schedules are involved, additional demurrage and failed delivery fees or penalties may occur when timetables slip.

Furthermore, issues related to integration of data reconciliation, enterprise resource planning (ERP), and planning and scheduling can also have a significant impact on the bottom line. This impact ranges from undetected losses (custody transfer, leaks, etc.) to the inability to meet shipping or receipt commitments.

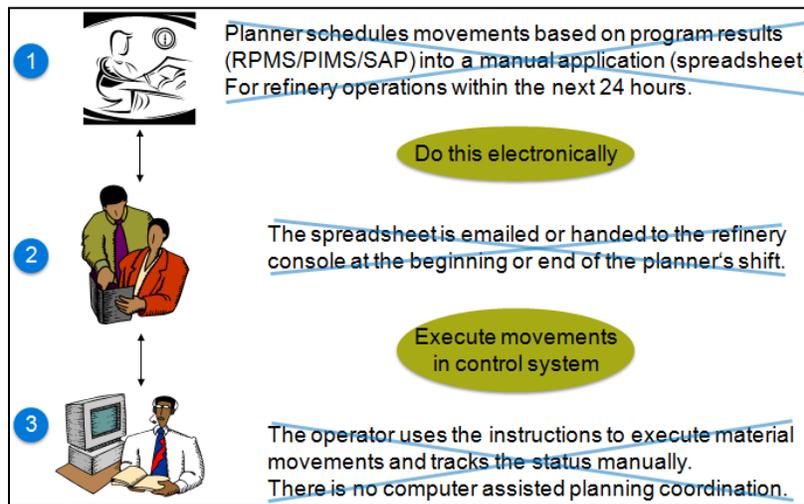
Optimizing Facility Workflows

Optimization of tank farm management starts with the appropriate workflows to improve efficiency, streamline communication and knowledge transfer, and minimize the potential for costly mistakes. This approach centers on planning, execution, monitoring and analysis of all off-sites movements as part of an overall collaborative strategy.

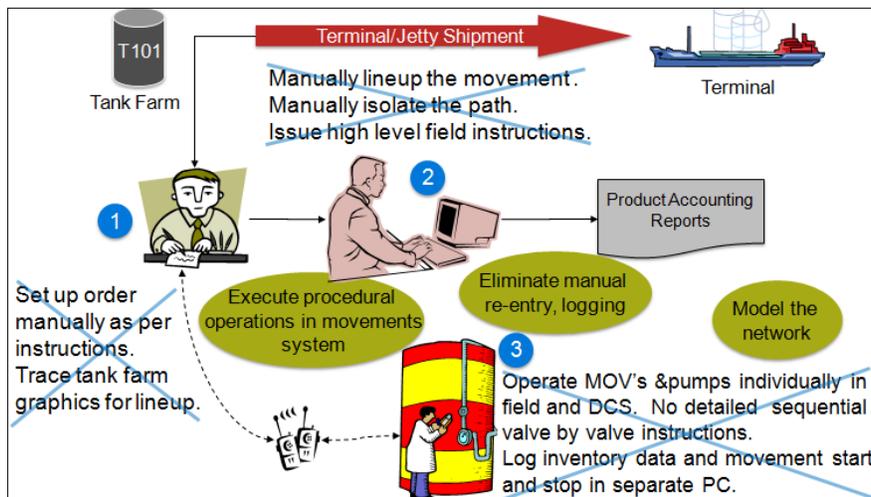


The ideal process for managing tank farm workflows starts at the task control and management level, and ascends through order management to planning/scheduling, historization, laboratory information management systems (LIMS) and ERP. Unfortunately, too many sites still rely on paper-based order management with task control and management residing in the panel operator's head. By converting these functions to an automated system, facilities can start integrating their business applications so the quality of information improves. Critical data can be retrieved quickly, allowing for planning to be revised when situations change. With the elimination of manual logging, product movements become electronically calculated, line-ups are automatically double-checked and volumes are reconciled. The system can even look for anomalies in flow rates, abnormalities in valve functions and buildup of contamination, as well as monitor alarms as needed.

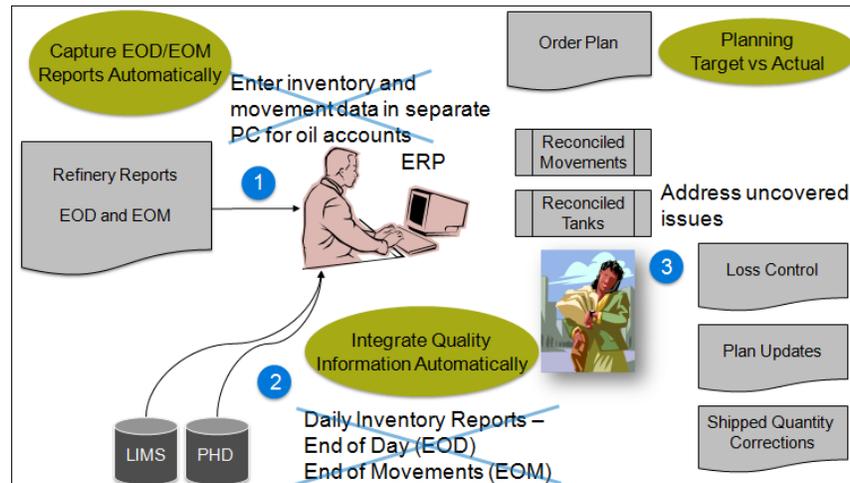
The first step in a sound tank farm management strategy is to automate planner to operations functions in order to prepare an accurate calculation of what activities will be required over the next day. Operators should no longer be required to manually enter critical planning and operational data into different computers.



The next step, operations execution and monitoring, involves modeling the off-sites network. The goal is to enable electronic execution of a wide range of tasks that may have once depended on the intellectual property possessed by a handful of staff members. For instance, an automated system will have knowledge of a facility's piping, off-sites connections and available resources. It will make use of real-time data to know what pipes are already in use, which lines contain incompatible materials that might be flushing, etc. This type of information allows the system to determine how best to execute specific operations, where to undertake them, and which equipment to use.



The final stage is comparing the operational plan to actual results. This process is enhanced through an automated solution that tracks product movements by electronically capturing key data such as gross/net volumes, flow rates, temperature fluctuations and density changes on an hourly, daily or monthly basis. Facility managers will no longer have to count on operators scribbling notes on paper. Instead, they can use an accurate feedback system to gain a better understanding of the products contained in their off-sites and the limits on moving them from one location to another. This allows for tighter planning, reduced inventories and improved business results.



Value of Automation Technology

Like other process industry operations, tank farms, storage areas and loading/unloading sites have a need for improved automation technology. As bulk liquids are moved from one location to another, there is a large transfer of high value material, which makes it imperative for oil & gas companies to efficiently manage their inventory and maximize return on investment.

Increased automation and information management reduces tank farm incidents, increases plant agility and improves accounting accuracy. This results in reduced product cost and faster time to cash, while at the same time increasing customer satisfaction.

Traditionally, tank farm automation was based on the territorial principle, whereby production area control and equipment status monitoring were implemented by panel devices and local system displays located in control rooms distributed over the production area.

A growing number of oil & gas firms are now choosing to deploy comprehensive tank farm management solutions. With these systems, the optimal product-to-tank assignment can minimize unsatisfied product demand. Improved utilization of available tanks minimizes the need for additional investment in storage. Effective tank farm management also allows the introduction of new products and an increase in volume for existing ones.

Selecting the right partner to implement a tank farm management system will put the end user in the best position to fully exploit evolving market potential and make the most of existing operations.

Major automation suppliers like Honeywell Process Solutions have developed robust movement management software suites for controlling facility-wide material movement operations. These solutions enable flexible, efficient movement of oil and other materials. They are designed to produce inventory savings while guarding against costly incidents and improving the productivity of personnel—all contributing to refinery profitability.

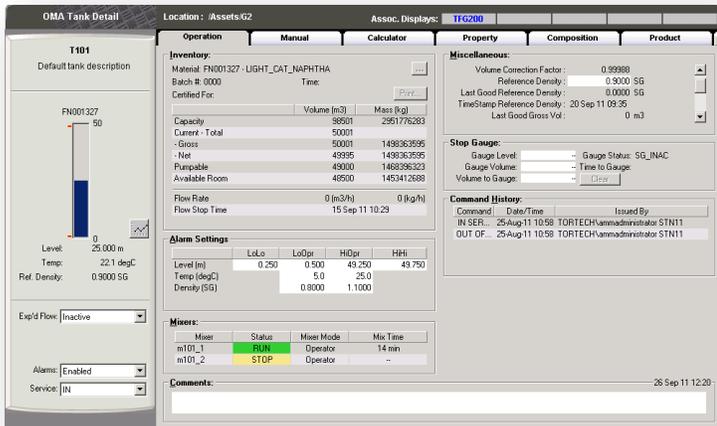
Advances in industrial wireless are also proving to be a preferential alternative to conventional instrument cabling of tank farms with significantly lower installed costs as well as higher reliability and security levels. The latest solutions provide mobile tools for field operators that contains all of the field procedures involved in preparing the line setup for movements, and communicate updated equipment status in real-time to the control system using mobile handheld devices.

Honeywell's Comprehensive Solution

With over 40 years of blending and movement management experience, and more than 200 installed sites worldwide, Honeywell takes a unified, yet flexible approach to tank farm management to deliver significant cost savings and increased profitability.

The Honeywell Movement Management suite consists of three tightly integrated modules: Inventory Monitor, Movement Monitor and Movement Control. These software applications are integrated with Honeywell's Experion® Process Knowledge System (PKS) for a complete operator experience. They also support integration with other manufacturers' distributed control systems (DCSs).

Honeywell's unique Blending and Movement Management hardware architecture supports redundancy and provides data access from Level 1 to Level 4 for improved reporting and business decisions.



The Inventory Monitor module enables operations personnel to collect, validate and manage accurate information on the status and contents of refinery tanks, and forms the foundation of the Movement Management suite. It offers the vital functions needed for accurate tank inventory monitoring and alarming:

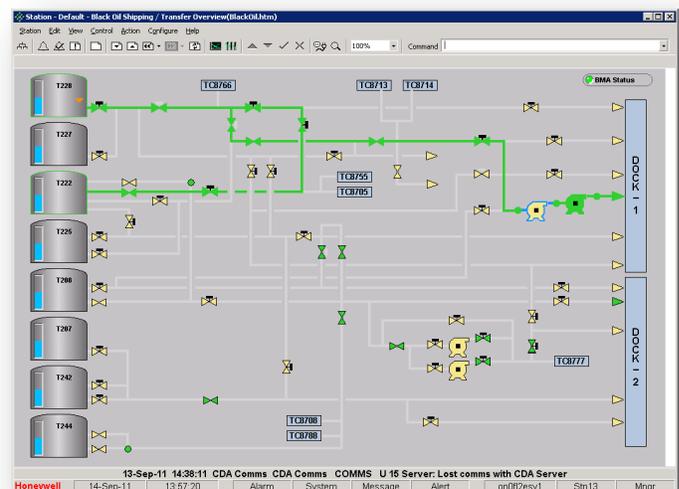
- Integrate tank qualities and track tank composition
- Interface to the user's lab application to support tank quality certification and assurance
- Interface to the user's DCS to monitor field elements
- Provide completed information for reports, business systems and higher-level applications

The Movement Control and Movement Monitor applications provide operations personnel with a checklist of the movements to be executed, allow a movement to have the optimal set of equipment associated with it, ensure the movement is appropriately lined up prior to establishing flow, monitor the status of the movement, and ensure all movement data are comprehensively and accurately recorded. This is all achieved via:

- Movement planning and logging (also referred to as "order management")
- Movement monitoring and alarming
- Movement control
- Direct equipment control

Movement Monitor is capable of receiving and manually executing movement orders, and automatically monitors and reports on those movements. Movement Control builds on this capability and the Inventory Monitor application by providing automated movement planning, line-up, execution, monitoring and reporting.

Integration of Honeywell's OneWireless™ solution with movement management technology can reduce the cost to achieve off-sites management benefits. Wireless sensing and remote operation help to improve the safety, reliability and efficiency of off-sites facilities without the need for significant automation infrastructure investments. Wireless networks make it possible to easily obtain point measurements in the most remote and hard-to-access locations without interrupting normal operations. Wireless



systems can work consistently and reliably in areas previously considered impractical. And, lower cost per I/O with wireless may justify projects that wouldn't have been feasible with wired transmitters.

Thanks to the Movement Management suite, movement data needs only be entered once and retrieval is quick and easy. Information reported by the system can be used to compare a movement's plan versus actual data, and to derive KPIs to drive continuous improvement in operations.

When the complete solution is implemented, collaboration in the execution of refinery or terminal business decisions is enhanced greatly. For example, production schedulers can use movement management applications to communicate movement orders to operations personnel and they, in turn, can execute these orders without re-entering the same data. Production accountants can also access the actual movement data recorded by the applications to perform inventory balances and business accounting functions by automatically transferring the data to Honeywell's Production Balance application.

Benefits to Tank Farms

With a movement management solution such as Honeywell's, tank farm operators can achieve integrated inventory monitoring, movement monitoring, control, execution and tracking within their facility. By doing so, they will realize benefits such as:

Comprehensive movement data collection: Operating personnel, schedulers, and accountants can easily and intuitively enter movements of material whenever and wherever they occur. By capturing all of the material movements occurring within the plant, large quantities of tank and movement data are always available. As a result, important data will not be missed and the reliability is higher than using manual systems.

Consolidated data access: The necessary measurement data is easily retrieved, on demand, in order to properly log and monitor material movement, as well as review past movements. User-specific views of the inventory and activity data are also made available.

Improved productivity of personnel: Ready access to information assists operators, engineers and schedulers. For example, operators in one part of a plant can view and prepare for a scheduled tank swing in another part of the plant. Engineers can also analyze movement records to determine the effect of changing unit feedstock, or the impact of changing an upstream unit's operation. In addition, schedulers and planners can determine whether or not critical shipments have occurred, or where "missing" material resides.

Expanded Operator View: Operators can gain a clear graphical view of material movements thanks to enhanced tank farm graphic displays. Their effort is further optimized by automatic sequence execution that does away with the need to set up the necessary field equipment for task operation. At the same time, the possibility of overlooking an element of a required operation is eliminated.

Reduced yield accounting effort: Movement transaction records are an important input into the Production Balance application, which generates an accurate, rapid and approved material balance around an entire plant, as well as around individual process units. With these tools, accountants also gain access to true production and inventory statistics.

Elimination of path maintenance effort: The use of dynamic path selection for movements eliminates the task of path library maintenance. When path element database maintenance utilities are used correctly, the integrity of the paths is guaranteed, and initial system configuration time is reduced since a path library does not need to be built.

Reduced field operations: By giving preference to remotely operated valves, as well as to manual valves already in the correct position, optimized path selection keeps field operations to a minimum. This feature is especially helpful in tank farms with large numbers of manual valves. When the system locates an already closed valve or a remotely operated valve required to isolate a task from the rest of the piping network, field operations are further reduced.

Effective flotation management: By keeping the piping network from being blocked in, off-sites operators can ensure the thermal pressure relief of lines. Furthermore, they can employ flotation management as a cost-effective alternative to the installation and maintenance of thermal relief valves.

Fewer problems due to advanced task preparation: The ability to check the isolation status of a task at different times in a movement's life span means that the isolation and commitment integrity of the task are maintained, even though considerable time may have elapsed between the planning and the start of the movement.

Fewer incidents – Because operators can review an analysis of direct control requests, they can control valves and other field equipment with a full understanding of the consequences of their actions. Isolation, flotation and commitment constraints will not be violated, and potential problems can be caught before they occur. Monitoring movements as they progress also reduces incidents by alerting when the movement is not progressing as expected, or when an unexpected change in a tank occurs.

Greater shipment accuracy: Effective movement management reduces the likelihood of shipping the wrong finished material, as scheduled shipment orders with the requested material can be predefined by the scheduling department.

Improved performance measurement: The right movement management solution also facilitates the crucial comparative analysis of planned production with actual production results, which can yield new insights for improved performance.

Conclusion

Today, profitability in the oil & gas industry often hinges on the ability to plan, schedule and optimize terminal and tank farm operations based on real-time information with feedback on what is currently happening — and what has actually been done. This is best achieved by an integrated approach to tank farm management, which reduces incidents and improves supply chain execution to take advantage of changing business opportunities.

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For More Information

Learn more about how Honeywell's blending and movement management solutions can deliver cost savings and improve your profitability, visit our website www.honeywellprocess.com/software or contact your Honeywell account manager.

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