



## Oil Movements and Blending Management for Global Refineries

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*Geelong refinery in Australia at which Visa-OM is being implemented*



Offsites Management has traditionally been a 'backwater' of refinery operations, with many sites not automating their refinery operations because of the large costs involved in controlling typically infrequent movements. Low-levels of automation have precluded these sites from the benefits of modern offsites management systems which typically require close integration with process automation systems. Visa-OM, a new, award-winning offsites application from Yokogawa enables operators in refineries with high or low levels of automation to track and manage complex oil movements and potentially save hundreds of thousands of dollars per year.

Refinery tank farms provide the operational facilities for feedstock and product management where raw materials, intermediate products and batched final products are stored prior to being used in the refinery or sent to market. Movements between tanks, process units and other terminals, normally occur continuously throughout the day and inventory monitoring is vital to the profitability of the business; losses must be both identified and minimized. Each movement has the potential for inaccuracy, spillage or loss. With refinery tank farms ranging in size between 50 - 300 or more vessels, management is complex and demanding.

Lack of information on the level and direction of flows between tanks and related pipelines is often a problem, as is knowledge of the composition and physical properties of the stock involved. Tank gauges may allow operators to know the level of a tank and if it is rising or falling, but detail of oil flows between tanks, and density data, is often unavailable.

### Visa-OM: Refinery Operational Tool

To meet the demand from refinery operators for an easy to use operational system that provides the required information, Yokogawa has developed Visa-OM, an oil movements tool that is designed to manage movements across oil plants. Visa-OM can be implemented in refineries with high or low levels of automation, making it particularly attractive for retro-fitting to older refineries.

Visa-OM incorporates mass balancing techniques, raw measurements and other data to analyse the information in terms of movements of refinery material. Integrated within Visa-OM are the Exaquantum plant information management system (PIMS) and the Visa model-based suite of advanced value-added operational excellence applications.

Three key Visa-OM operational tools are tank movement ranking, stock accounting and advanced alarm alerts. The tank ranking report tells operators at a glance which tanks will next require their attention and when this attention will be needed. For example, tanks have different fill start times and different

flow rates; With Visa-OM operators know when they have to stop pumps, shut off valves and other relevant actions. In the absence of Visa-OM, operators need to remember the correct timing of activities for all tank operations.

The stock accounting function provides a daily report on levels of refinery stock with volume correction factors and related calculations. Stock differences may be due to evaporation, leaks, under-metered pumping and other reasons. Visa-OM provides a complete exception analysis which accounts for differences in tank masses between recorded and measured stock amounts. The stock account can take each exception and create retrospective movements to account for differences, without leaving Visa-OM.

The advanced alarm system warns operators of unexpected or unusual behaviour. For example, if a tank begins to fill when there is no movement defined for it, Visa-OM will alert the operator. Conversely, if a movement to a tank is defined, but there is no change in its level, Visa-OM will likewise issue an alert. There are a total of about 50 advanced alerts provided.

Using Visa-OM, operators are also able to make preliminary estimates of bulk properties, prior to lab measurements. Visa-OM keeps track of material compositions and properties of oil products; if a site manager is looking for a tank containing a hydrocarbon with a particular property, he already has initial knowledge on what is and is not suitable.

An additional benefit is superior control of a movement. Even when there are multiple flows in and out of individual tanks, by using mass balance/data reconciled techniques Visa-OM is able to accurately track movements, and record data on material stocks and movements and equipment usage. This provides operators with live information on material change between tanks and other process units and helps lead to fewer occasions of unmeasured movements. This could occur, for example, when multiple simultaneous movements in and out of a tank normally prevent determination of each individual flow directly.

Visa-OM also enables refinery management to monitor losses, which can cost hundred of thousands of dollars per year. Environmental safety is likewise improved by helping to prevent the overfilling of tanks and by alerting operators to unplanned or mid-directed movements.

#### Customer benefits

- Greater reliability and availability.
- Reduction in product losses.
- Reduced support costs.
- Reduced risk of movement errors.
- Greater environmental security
- Reduced number of unmeasured movements,
- Reduced man hours for oil accounting

### Complex Movements

At the heart of Visa-OM is the object-oriented plant model. This enables users to build and modify the informational relationships that exist between the raw data (both real-time and historic) associated with the tanks, lines, pumps, valves and process units around the refinery. The plant model interfaces with the plant DCS, PIMS, LIMS, PLC, ERP and MRP systems, and incorporates key characteristics and relationships. Included in the model is every relevant tank farm configuration, data connection and calculation, material or technical characteristic, local or plant wide report, monitor and alarm, tank and pipeline manager, system balance and stock reconciliation. To prevent unnecessary complexity the model only incorporates details of the refinery to the level that is required for supervising movements and unnecessary data is not included.

As noted, a sophisticated data reconciliation engine is embedded within Visa-OM. This is automatically configured during the creation of the plant model. Properties of mixtures are calculated or estimated as additional material is added to tanks. This is particularly useful for tracking crude inputs and residues. Movements are reconciled against flow meters and tank level changes to ensure accurate inventory balances and to protect against spills, material contamination and other losses. Any adjustments to the plant model are automatically reflected in the reconciliation calculations.

The Visa-OM model can be easily modified to cater for changes in the refinery, including such items as new tanks and pumps. Its model-based nature also makes it possible to perform mass balancing at the refinery level as well as unit level. A further benefit is that operators can check the route being used by a movement is continuous.

Reports can be used by human or computer systems, viewed on screen, printed and stored in electronic or manual files. The key benefits of Visa-OM are primarily derived from its intelligence based model; integral to the performance is the built-in mass balancing for error detection/correction providing a powerful remedy for inevitable errors which must be rectified, and built-in materials tracking. Above all, Visa-OM unites, interprets and enhances information about the physical refinery equipment, the materials contained and processed within it, and the discrete, inter-tank movements by which the material is handled.

While Visa-OM is independent of the DCS, through the Exaquantum OPC interface, it can interface with DCSs from Yokogawa and other manufacturers to provide their displays with information not normally available, but which are highly useful to tank farm operations. This information is typically gained through manual or higher-level inputs (e.g. lab systems). Examples would be material categories, volume correction factors and densities.

With the comprehensive tools and alarm system warning operators of abnormal and hazardous operations operators can supervise the equipment safely, accurately and productively.

The Visa-OM model incorporates:

- Tanks
- Process Units
- Valves
- Manifolds
- Pumps
- Jetties
- Loading gantries
- Pipelines
- Connections
- Groupings

## Flow Level Pressure

### Australian Investment

In 2004 Shell Australia decided to replace OMOSS, its 15 year old, locally developed oil movements system which have been running in its two Australian refineries at Geelong in Victoria and Clyde in New South Wales. These linked to the refineries' DCS control, supervisory and management, mass balancing and finance systems. Shell was becoming increasingly concerned about the obsolescence of the existing systems and was seeking state-of-the-art, model based solutions to reduce cost of ownership and standardise applications within a number of Shell refineries.

Shell Australia commissioned Yokogawa to develop a replacement oil movements system (Visa-OM) based on its Exaquantum PIMS process historian and Visa value added applications.

Key functionality of Visa-OM

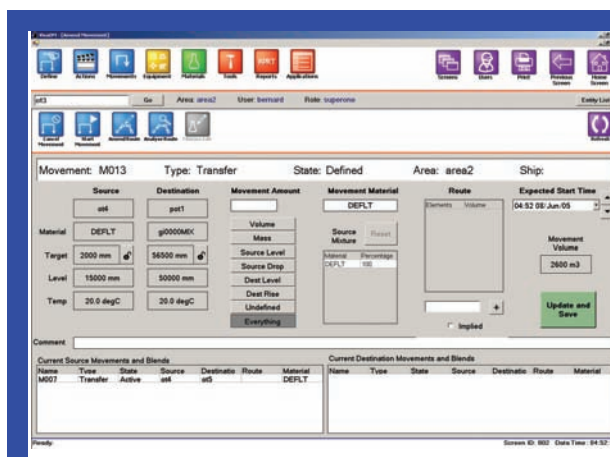
- Scan and record all relevant raw process data in a long term data historian.
- Process data to derive and record additional parameters.
- Tank inventory management/oil movements.
- Real time live displays/reports including flows, dips, tank ranking.
- Alarm system.
- Tank compositions and stocks.
- Tools for batch coding, tracking.
- External links, with log system.

Guidelines in Shell's Early Involvement of Main Automation Contractor programme were formative for the project methodology. This involves both supplier and end user cooperating in the development of the functional design and application specifications together with an agreed scope and pricing. The project has benefited from the combined best knowledge, experience and systems of all involved parties and consequently has run smoothly. The projects were managed and engineered by Yokogawa Australia with technical and development support from Yokogawa GMSC in the UK.

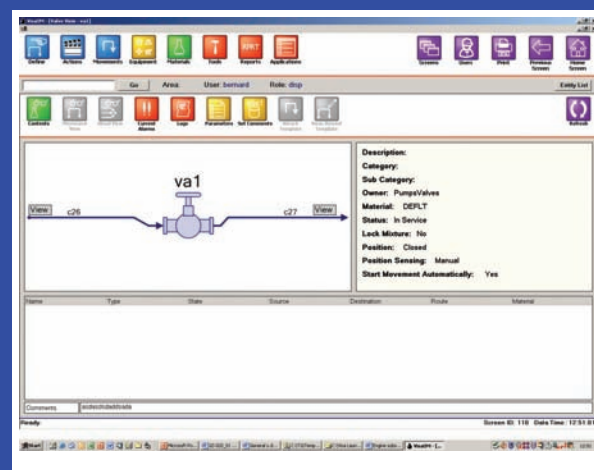
John McGuire, Shell Clyde and Geelong's special projects manager, identified what he believed to be the key to the success of the project: "Oil movements projects have traditionally been complex and involved, with a great deal of custom engineering effort required. This new approach is a more straightforward implementation because of the largely configurable capabilities of Exaquantum and Visa applications."

### Conclusion

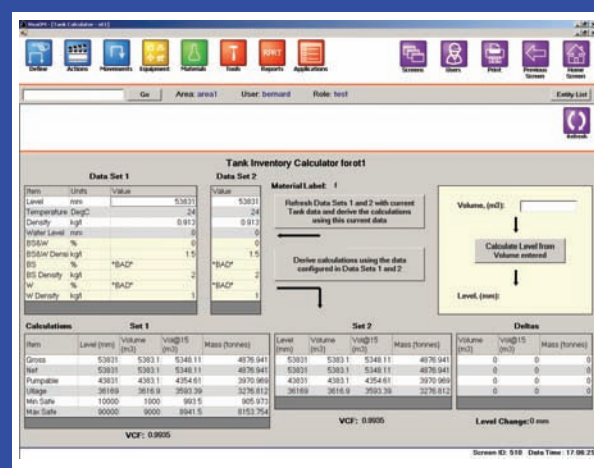
The advanced functionality of Visa-OM and the success of the project for Shell Australia has already been recognised with it winning the 2005 Pace Zenith Award in the Oil, Gas and Hydrocarbons category. These annual awards recognize industrial applications that most successfully demonstrate technological excellence and innovation.



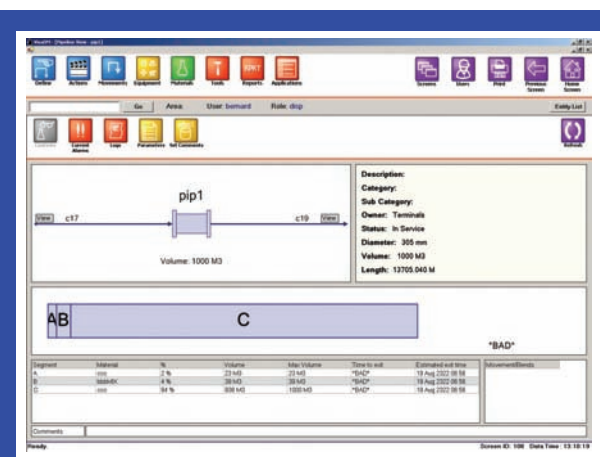
Full Movement Definition



Valve View



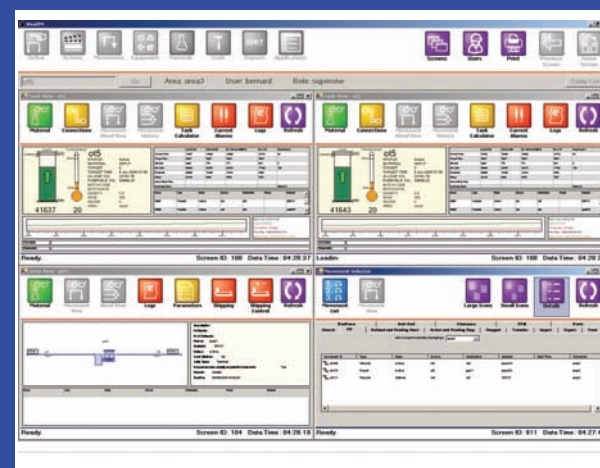
The Tank Calculator



Pipeline View



Tank View



Tiled Multiple Views