Proven in the Past, Prepared for the Future

Bluewater systems are currently employed in the transfer of many different products across a broad range of applications. Among the products presently being handled are crude oil, liquefied gases, chemicals, condensate, diesel, fuel, potable water, naphtha, Orimulsion etc. As well as systems for import/export to and from refineries, tank farms, power stations, and chemical plants, Bluewater's diverse range of applications presently includes:

- Calm Buoy systems for export of Orimulsion, condensate and natural gas liquids, and for import of naphtha for power plants.
- Calm Buoy systems for the semi-permanent mooring of tankers via a hawser arrangement.
- Complete Single Point Mooring (SPM) systems, including buoy, pipeline end manifold (PLEM), submarine and floating hoses, onshore-offshore pipeline arrangements.
- Conventional Buoy Mooring (CBM) system with PLEM for LPG offloading and CBM system and pipeline for a power and desalination plant.
- Numerous CALM systems worldwide, designed for offloading stabilised crude and condensates from offshore production facilities.

Looking to the future, Bluewater is preparing today for the operating imperatives of the future. The markets are changing.

Supply for existing product markets is shifting to ever-more remote shores, while demand in new product markets continue to accelerate.

The key to success and viability in the face of these and other future challenges is Bluewater's unique combination of technology, know-how and flexibility, underpinned by the vital ingredient – commitment.

For further information on Bluewater's Buoy Systems, please contact:
Tel: (+31) 23 568 2828, email: info@bluewater.com or visit our website at www.bluewater.com
Expertise, Dedication and Commitment

Bluewater ensures that each system is tailored to the exact needs of your application. For Offshore Terminal systems, Bluewater provides a full ‘terminal-to-tanker’ package, comprising:

- Mooring and fluid transfer system
- Pipeline End Manifold (PLEM)
- Offloading facilities
- Installation services
- Offshore pipeline
- Shoreline metering and pumping stations

Employing dedicated professionals to identify and fully analyse all safety, environmental and operational impacts, Bluewater’s buoy systems are designed to operate to the highest standards of safety and to minimise risk to personnel and / or damage to the environment.

Bluewater’s client commitment extends beyond the installation of your buoy terminal, with comprehensive training and documentation packages and a dedicated after sales support service focused on customer satisfaction throughout the life of your system:

- Rapid response to queries
- with onsite assistance, if required
- Single point of contact
- Spare parts service
- Expertise, Dedication and Commitment
- Engineering and supervision services
- Advice, problem solving and knowledge exchange

Worldwide Applications of Bluewater Buoy Systems

Bluewater is the only Buoy System Supplier of both Turntable and Turret type buoys.

For further details visit our website: www.bluewater.com

Offshore Terminals

SPM Buoy technology has proven its reliability and cost effectiveness, particularly in isolated conditions, in areas where natural harbours are scarce or where the costs of new man-made harbours and jetty structures are prohibitive.

The SPM loading and offloading concept is not limited by tanker size, accommodating all system types and including Ultra Large Crude Carriers (ULCCs). It is suitable for the transfer of all fluid media, including crude, fuel oil, refined products, potable water, liquefied gases, slurries etc.

With an SPM buoy system, the harbour facilities for tanker loading and offloading are effectively extended into deeper water. This relieved congested harbours and overcomes the difficulties of upgrading quaysides and jetties where larger product carriers can often be limited in space and water depth for mooring or manoeuvring.

The Benefits

Environmentally sensitive and above all safe, an SPM solution delivers benefits of cost, reliability and efficiency to your terminal or installation:

- Cost Effective
  - No need for port infrastructure
  - No need for tugs, pilots
  - No docking requirements
  - Easy and quick implementation
  - Easy and quick installation
  - Minimal manning requirements
  - Rapid turnaround
  - Easy maintenance
  - All-weather functionality
  - Minimum maintenance requirements

- Reliability / Availability / Efficiency
  - No tanker size restrictions
  - Easy manoeuvring
  - All-weather functionality
  - Minimum mooring requirements
  - Rapid turnaround
  - Flexibility to accommodate future growth and new applications
In a typical SPM buoy / terminal application, the loading buoy(s) is anchored offshore and serves as a mooring point for tankers to load / offload their gas or fluid product for transfer between the onshore facility and the moored tanker. Although the SPM buoy is clearly a key component, a number of other components are integral to such a system.

**Buoy Systems**

**Buoy Mooring Arrangement**
The buoy is anchored to the seabed by means of a set of mooring lines (legs) which are fixed to the seabed with anchor points. There are various anchor point constructions, including high strength marine anchors, driven or drilled piles, suction piles and gravity boxes/frames. A typical buoy system is fixed with six mooring legs, comprising heavy duty chains with link diameters varying from 3 up to some 5 inches. The length of the legs is determined by the water depth, tanker size and environmental conditions.

**Submarine Hose String ("Riser")**
The submarine hose string connects a Pipeline End Manifold (PLEM) to the buoy's piping and is designed with sufficient length to adapt to the motions of the buoy.

**PLEM and Subsea Pipeline**
The PLEM (Pipeline End Manifold) is the end connection to the fixed subsea pipeline transporting the product to / from the shore terminal. The PLEM connects the pipeline and the risers. It is fitted with valves which can be remotely operated.

**Tanker Mooring Arrangement**
The tankers can temporarily moor to the buoy for the duration of a loading – unloading operation (generally 24 hours) by means of a hawser arrangement. This is a fibre mooring line with chain sections on both sides to prevent wear and abrasion. The polyester section has a degree of elasticity to dampen the loads and tanker movements in the overall mooring system and is therefore often referred to as a "soft mooring" arrangement.

**Floating Hoses**
Connection of the tanker with the buoy piping is made by use of one or more floating hose strings. The number and size of the strings depends on the size of the tankers involved and the related pumping capacity. The hose diameters are standardised, in accordance with OCIMF Best Practices, and range from 6 inches to a maximum 24 inches (internal bore).

**Shore Terminal**
The onshore plant or terminal facility receiving or exporting the product, including associated pumping and metering systems.

**Weathervaning**
To avoid critical loading of the mooring system, the upper section of the buoy (turret or turntable) is designed to rotate freely. This allows the moored tanker to "weathervane" in response to the forces of wind, waves or current during the loading or offloading operations.

**Tanker Mooring Arrangement**
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The future of tanker loading / offloading operations

With the continued growth of world trade in crude, oil products and a host of other fluids, gases and slurries, Single Point Mooring (SPM) buoy applications are rapidly becoming a preferred method of cargo transfer from tankers to shore and vice versa particularly where fast-track implementation is demanded.

Whether expanding an existing terminal or refinery, or venturing into a new market, territory or application, the benefits of an SPM solution are increasingly pronounced. SPM technology delivers the flexibility that, in turn, delivers significant cost and time benefits.

Leaders in Buoy Technology

Since 1978, Bluewater has been a leader in the design of buoy systems for the safe and efficient conveyance of fluids. With a global client portfolio built upon flexibility, versatility and customer-client collaboration, Bluewater is today responsible for some of the most innovative buoy systems in service throughout the world.

Experience has proven that Bluewater’s Turret buoy concept provides operators with the safest and most reliable terminal solution. Moreover, while both concepts require an equal initial investment, the total cost of ownership of a Turret buoy is at least 20% less than that of a Turntable buoy.

Adding Value

The need for a marine terminal is often a secondary decision, made after the decision to undertake a much larger venture, such as a refinery, power plant or storage facility. It is ideally at this early stage when Bluewater can begin to add value to your project investment by advising on the selection and application of offshore terminals, and assisting in the development of a technical and functional specification for a buoy system.

During this feasibility and pre-design phase, Bluewater would undertake an environmental and functional assessment of your requirements. The environmental assessment addresses the geography, meteorology, nautical and marine conditions and bathymetry (seabed conditions). The functional assessment addresses site details and layout, product (fluid / gas media) composition and behaviour, tanker data, operating conditions, piping requirements etc.

Working at all times with the client, the deliverable of this phase is a detailed specification for a feasible and viable SPM solution.

For the design, construction and installation, there are two main components – the SPM buoy system and the pipeline(s) connecting the buoy system to the onshore terminal. The client can choose to contract each component to a specialist, and to manage those contracts, the interface between the contracts and the interface with the shore terminal. Alternatively, the client can select an EPIC contractor responsible for the complete system. The client then has a single turnkey contract to manage and a single interface.

Bluewater is experienced in both contracting roles.