

Firewater System Modeling for Bulk Fuel Storage Facility

The facility consists of more than 145 bulk storage tanks with capacities ranging from approximately 1,000 to 15,000 m³, spread across an area of roughly 50 acres. Seawater from a nearby tidal estuary is used as the cooling and firewater source, pumped into a central firewater tank and distributed across the site.

CHALLENGE

The terminal operator needed to verify whether the existing firewater system could meet regulatory fire protection requirements under credible fire scenarios. Specifically, the operator needed to understand how much water could be delivered to each tank area with the current pumps, piping, and valve configuration, and whether the system complied with the Energy Institute IP 19 code. The complexity of the network and the large number of tanks made manual calculations impractical, while incorrect flow distribution risked over-supplying some tanks and under-supplying others during an emergency.

SOLUTION

P&I Design developed a detailed hydraulic model of the site firewater system using CHEMCAD, leveraging the software's Excel Data Map functionality. Valve positions for each tank offtake were mapped directly to Excel, allowing rapid calibration of flow rates delivered to individual tank areas. Firewater demand scenarios were modeled based on the site emergency response plan, distinguishing between tanks on fire (10 L/min·m²) and adjacent tanks requiring preventive cooling (2 L/min·m² within an 82 m radius). The model was used to evaluate current performance, test upgraded pump and pipework options, and define the level of flow control required to reliably meet demand. Pressure losses were calculated using CHEMCAD's Hazen-Williams piping model, providing confidence in predicted system behavior.



- **Industries:** Fuel storage and terminal operations
- **Region:** United Kingdom
- **Project Type:** Firewater system hydraulic modeling and optimization

RESULTS

The simulation showed that while pump and pipework upgrades were necessary to increase overall firewater capacity, hardware upgrades alone were insufficient. The model demonstrated that controlled flow distribution was essential to ensure each tank received the correct amount of water during a fire event. By implementing defined control strategies, the terminal could meet firewater requirements across multiple fire scenarios. The Excel-linked model was subsequently reused as tanks were taken out of service and fire scenarios evolved, enabling rapid reassessment without rebuilding the model.

TANGIBLE BENEFITS

- Clear verification of compliance gaps against Energy Institute IP 19 firewater requirements.
- Reduced capital risk by identifying precisely where pump, pipework, and control upgrades were required.
- Improved confidence in emergency response capability through quantified, tank-by-tank firewater delivery rates.
- Faster decision-making using an Excel-based interface that allowed immediate visualization of compliant and non-compliant scenarios.
- A reusable digital model that continues to support operational changes and future investment justification.

Key Firewater Design Parameters

Scenario	Water Demand	Purpose
Tank on Fire	10 L/min·m ²	Active fire suppression
Adjacent Tanks	2 L/min·m ²	Preventive cooling

FIGURE 1 - Example two-pump firewater distribution flowsheet illustrating multiple tank offtakes and controlled flow paths. (Representative System Drawing)

