

Regulations Pertaining to the Installation of a Tank Holding 25,000 Litres of Kerosene on
Commerical Premises

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Research, Study & Presentation Skills, Element 1: Literature Review

Introduction

"Regulation 8 of DSEAR requires you to make suitable arrangements to deal with accidents, incidents and emergencies involving dangerous substances."¹ (Safe Use and Handling of Flammable Liquids 2015, clause 124) "The main hazards from the use of flammable liquids are fire and explosion."² (Safe Use and Handling of Flammable Liquids 2015, clause 27) A risk assessment must be carried out to identify fire and explosion risks and prevention, mitigation and control measures necessary.³

Siting

Identify pathways to receptors for proposed sites, channelling spills where they can safely be collected, risk assess following Ciria Report 736 guidelines.⁴ Beware enclosed channels vapour may flow into then not evaporate.⁵

The concept of the source–pathway–receptor model is illustrated in Figure 2.3.

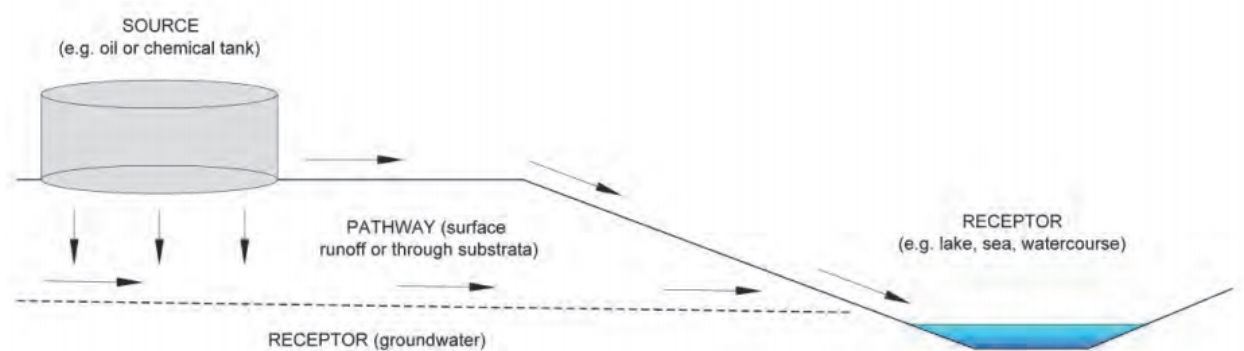


Figure 2.3 **Concept of the source–pathway–receptor model**

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Figure 2.3 page 11 Walton, 2014 “Containment systems for the prevention of pollution”

Design in access for firefighting vehicles and two fire escapes and 'tertiary containment'⁶: drainage to capture polluting liquids which **escape secondary containment**. Calculate its capacity as maximum contaminated liquid during spill and fire combining rain, tank contents, firefighting and cooling liquid.⁷ (Calculate total rainfall for a once-in-ten-years storm from twenty-four hours before till eight days after any incident, using the table and map on page 45 of Walton, I. L. W., “Containment systems for the prevention of pollution”, 2014) , and “Containment of Bulk Hazardous Liquids at COMAH Establishments” page 8 to calculate allowances for foam, firefighting liquids, liquid surge and wind-blown waves.)

25,000 litres of kerosene could yield 3,571 cubic metres of flammable vapour or 60m² 1m high⁸

Plan firefighting strategies that reduce pollution.

“Minimum recommended separation distances for single ‘small’ tanks from site boundaries, buildings, process areas and fixed sources of ignition 6m” (Safe Use and Handling of Flammable Liquids 2015, table 1 clause 69 page 22) and combustible materials.⁹

Secure storage & delivery areas within security-protected area or enclose with “substantial 1.8m+ high welded-mesh or chain-link fencing” (The Storage of Flammable Liquids in Tanks 2015, clause 264) kept locked except in use, opening easily outwards, keys restricted to authorised personnel.¹⁰

Base and Bund Construction

An affordable, highly fire-resistant clay or concrete bund should be constructed as outlined in Masonry Bunds for Oil Storage Tanks (CIRIA/Environmental Alliance) with concrete or steel grid flooring not highly insulated to prevent static build-up risk tested annually, with fire-resistant low-insulation coating or paint. Design to last minimum fifty years.⁴⁴ A solid concrete base should be “lean-mix concrete blinding” without membrane underneath so it acts monolithically with the prepared gravel base (Walton, 2014: section 7.2.11). The bund should slope, gravity-draining water away from the tank to where water can be siphoned (to prevent electrical risk) outside.⁴² Legal bund minimum capacity is 110% tank volume.¹¹

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To prevent leakage and fire spread, fit metal waterstops on inside faces of movement joints. Avoid double-skinned tanks or manholes to lower risk.¹² “Storage tanks must be constructed meeting suitable standards.” (<https://www.gov.uk/guidance/storing-oil-at-a-home-or-business>) Steel deforms least under fire or heat, preventing contents leaking or catching fire.¹³

Tank and bund should be tested for hydrostatic load resistance before use or by manufacturer. “The specific gravity should be taken as not less than 1.0, even where the contained liquid has a lower specific gravity. This is to allow for the possibility that a bund will be filled with firefighting or cooling water” (Walton, 2014).

Supports

The heavy full tank must be supported on masonry, concrete or steel supports¹⁵ fireproof for two hours¹⁶, anchored to resist flotation¹⁷. “One end is secured and the other left free to move”¹⁸ (The Storage of Flammable Liquids in Tanks 2015, clause 111) allowing thermal expansion. “Pipework is connected to the secure end.”¹⁹ (The Storage of Flammable Liquids in Tanks 2015, clause 111) Design tank layout around efficient pipework.²⁰

Tank Material

Kerosene has very low or no corrosiveness and no reactivity with steel. Hot steel absorbs some carbon from kerosene, hardening it. Therefore steel is ideal for tank and pipework as it can be earthed.³⁶ Steel deforms least under fire or heat, preventing contents leaking or catching fire, therefore a welded steel tank is advised.⁴³

Ventilation

Open-air above-ground tanks and pipework receive maximum ventilation, are easily accessible and inspectable. “Keep the diameter and length of pipework to the minimum practicable”²¹ so less material can leak out of pipes, less area to develop faults, less exposed to ignition sources. Metal pipework with welded joints is advised.²² “Joints and connections should be kept to a minimum and should not be positioned where they might leak onto electrical equipment, hot surfaces or other sources of ignition, or where they might prevent the use of an escape route.”²³ (The Storage of Flammable Liquids in Tanks 2015, clause 109) Fit hydrostatic relief valves where thermal

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expansion of trapped kerosene eg between shut-off valves could damage pipework.²⁴ Label filling and discharge pipes for kerosene.²⁵

Overfill Prevention

A contents measurement gauge measuring temperature, pressure and volume of contents should be fitted²⁶, eliminating dipsticks, a friction ignition risk.²⁷ Independent LAH and LAHH alarms should be fitted, audible at refuelling tanker parking too. Manual override shut-offs should be installed at tanker and tank ends.

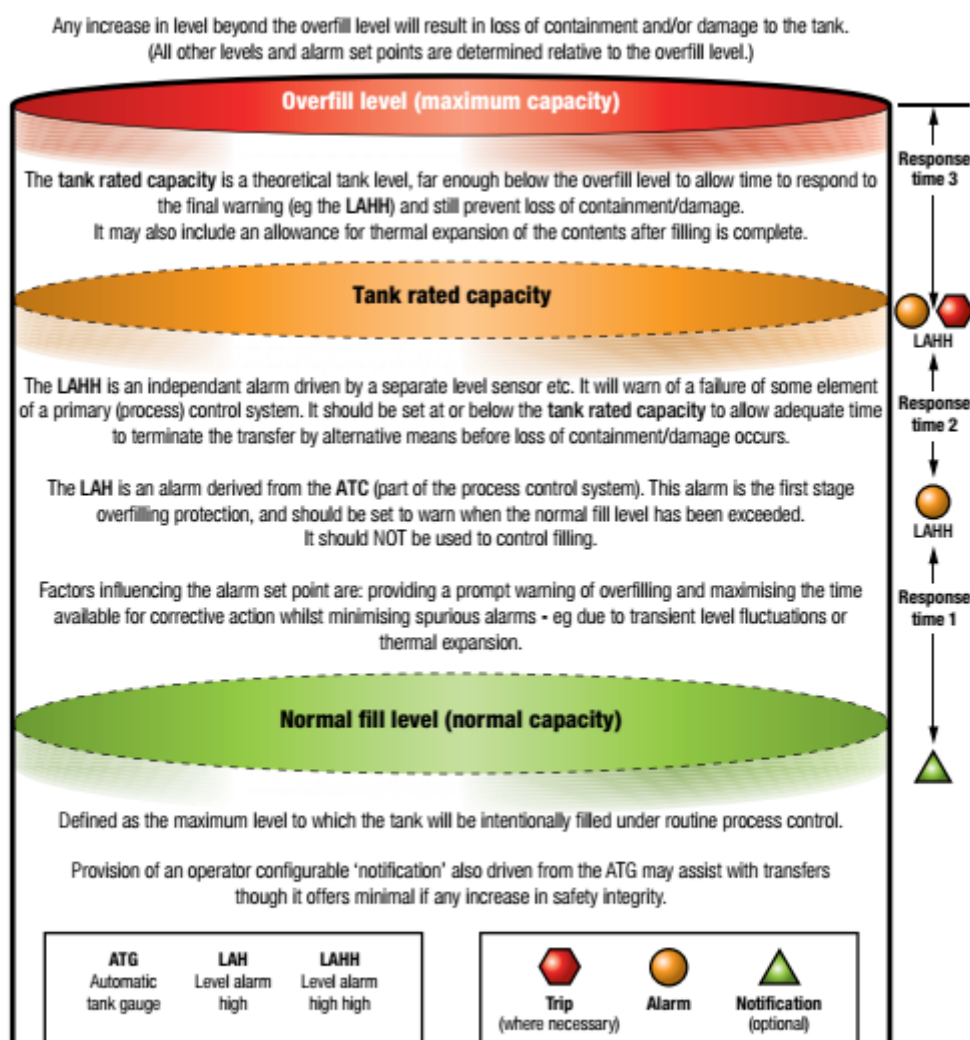


Figure 9 Overfilling protection: Tank levels (based on API2350)

Figure 9 p.33 "Storage of flammable liquids in tanks" HSE

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Bright lighting for night-work that is not an ignition risk should be installed, away from vents.⁴⁷

Vents

Vents prevent excessive pressure buildup inside the tank from thermal expansion or filling and collapse from negative pressure from emptying or thermal contraction. Pressure-vacuum valves, handling both, and emergency relief vents for expansion from fire overheating fuel, should be fitted “at least 3m from sources of ignition, air intakes, buildings, walkways and the site boundary” [144 storeflamm] on top of the tank the higher of 5m above ground level or 0.3m above the tank ensuring it is higher than the filled tank.

Corrosion

"Internal corrosion may result from the accumulation of water in the tank"²⁸ (The Storage of Flammable Liquids in Tanks 2015, clause 98) Install two permanent in-line valves to the drainage point so that, if water collects below the kerosene, it can be drained safely.²⁹

Zoning

It is recommended to carry out a Hazardous Area Classification (HAC) determining the potential extent of any flammable atmosphere spillages could cause.³⁰ “A hazardous area classification study should be recorded in a plan and elevation”³¹ (Safe Use and Handling of Flammable Liquids 2015, clause 66) identifying chemicals and zones under normal operation, accidents, fire etc. stored with a Safety Data Sheet on kerosene on-site. Adequate firefighting equipment, foam and CO2 extinguishers, PPE and should be provided, with training and signage on actions to be taken in case of fire.

Standardised signage (as per Safety Signs and Signals: Guidance on Regulations, 2015) should be installed, especially at entrances to hazardous areas.³²

Ignition Risk Prevention

Inside, all ignition risks and sources of heat such as heat, fire, sparks, (including rubbing metal), exhaust, static and electrical equipment should be excluded. Only dead work using equipment manufactured as suitable explosion-protected equipment standard for use in explosive atmospheres under ATEX issued under Permit-to-Work should be carried out within the HAC.³³ “Such

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equipment will be CE marked and carry the Ex symbol in a hexagon.” (Electricity at work: Safe working practices, 2013) Notices and staff training should require wearing natural fibre clothing and, if non-conducting coatings are applied to the bund floor, conducting anti-static footwear. Light alloys such as aluminium should not enter the HAC and only regularly inspected spark-resistant tools used. All equipment must be electrostatically bonded and earthed, checked before liquid flow and after maintenance and annually.³⁴ “Unearthed metal components, in transfer systems or repairs, may need additional earthing straps.”³⁵ (Safe Use and Handling of Flammable Liquids 2015, clause 73) The electricity supply to the generator must have separate neutral and earth conductors. Circuit breakers must be set to trip under lowest possible fault conditions, but enough current must remain to keep protective devices operational in fault conditions.⁴⁸

Pumps are an ignition risk, instead gravity drainage with siphoning should be designed for spillages.⁴⁵

“Precautions should be taken to prevent vapours being ignited by the discharge of static electricity. The movement of process liquids during pumping, filtering, emptying, filling and spraying can cause electrostatic build-up.” (Safe Use and Handling of Flammable Liquids 2015, clause 72)

“Static electricity generated by flammable liquids should be reduced by avoiding the freefall of liquids and restricting pumping speeds.” (Safe Use and Handling of Flammable Liquids 2015, clause 75) Splash filling should be prevented.

“Additional care is needed for liquids with low conductivity up to and including 50 pS/m” such as kerosene,³⁶ restricting pipe flow to 1m/s since “water may be present even if it has not been deliberately introduced (for example, condensate)”. (Safe Use and Handling of Flammable Liquids 2015, clause 74)

Training and notices should warn of electrostatic risks to avoid such as solvent use, rubbing during cleaning and hot water jetting.

Signage

“The contents of containers and pipes, together with the nature of those contents and any associated hazards, should be clearly identifiable. Marking of pipework is particularly important at filling and discharge points.” (Safe Use and Handling of Flammable Liquids 2015, clause 176)

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Refuelling

Tanker parking should be away from all traffic for uninterrupted refuelling, level, with slight drainage slope of kerosene-resistant material, barricaded to prevent tanker movement during transfer,³⁷ provided with tanker earthing connection, obvious, accessible carbon dioxide and foam fire extinguishers⁴⁶ and fire alarms and a quick-action shut-off valve the operator can stop unloading immediately if problems observed.³⁷

An authorised person, which may be the tanker driver, should supervise transfer constantly.³⁸ An authorised site representative must first be notified and check:³⁹ that fuel delivered matches tank specified contents, that the tanker offloading pump matches tank & pipework and is electrically protected; that tanker, hose, inlet and tank are electrostatically bonded and earthed; hoses and valves used are compatible with kerosene; that empty tank capacity is sufficient for load being delivered. Protocol covering all details of fuel transfer must be written and followed.⁴⁰

Ensure splash filling avoided by immersing fuel pipe below liquid surface or to tank bottom.

Avoid above ground level work on-site.⁴¹

Hosepipe will be necessary to remote fill without sight of the tank.

Hoses must be supported to keep bend radius above manufacturer's minimum;⁴² stored out of sunlight, heat, damage, inspected daily for leaks, damage, pressure tested annually.

An electrically continuous hose with self-sealing connections and flow control valve should be stored in a lockable cabinet with flow meter controlling a shut-off valve, keys signed out by authorised personnel. Installation of a lockable weatherproof refuelling such as those linked in appendix one is recommended.

“An effective means of communication should be provided between personnel involved in the loading/unloading operations, and other parts of the site such as the control room. If radios are used they should be suitable for use in hazardous areas.” (The Storage of Flammable Liquids in Tanks 2015, clause 208)

Inspection and Maintenance

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Finally, management must design protocol for inspection and maintenance routines of all equipment and personnel training, to maintain safety standards and record-keeping of inspection results and all work done and training.

References:

- 1 Safe Use and Handling of Flammable Liquids clause 124
- 2 Safe Use and Handling of Flammable Liquids clause 27
- 3 Safe Use and Handling of Flammable Liquids clause 144
- 4 Walton, I. L. W., "Containment systems for the prevention of pollution: Secondary, tertiary and other measures for industrial and commercial premises C736" CIRIA (London) 2014 p44
- 5 Walton, I. L. W., "Containment systems for the prevention of pollution: Secondary, tertiary and other measures for industrial and commercial premises C736" CIRIA (London) 2014 p19
- 6 Containment of Bulk Hazardous Liquids at COMAH Establishments: Containment Policy: Supporting Guidance for Secondary and Tertiary Containment HSE/SEPA/Environment Agency (London) 2008
- 7 Walton, I. L. W., "Containment systems for the prevention of pollution: Secondary, tertiary and other measures for industrial and commercial premises C736" CIRIA (London) 2014 p 44 and Containment of Bulk Hazardous Liquids at COMAH Establishments page 7
- 8 kerosene LEL = 0.7 therefore $25000/0.7 \times 100 = 3,571,429$ litres of explosive atmosphere. Divide by 1000 = 3,571 cubic metres of flammable vapour can arise from 25,000 litres of kerosene
3,571 cubic metres of flammable vapour could arise from 25,000 litres of kerosene or 60m² or 60m x 60m x 1m high
- 9 The Storage of Flammable Liquids in Tanks: table 1 clause 28 p. 69: table of minimum distances
- 10 The Storage of Flammable Liquids in Tanks clauses 264-265
- 11 Walton, I. L. W., "Containment systems for the prevention of pollution: Secondary, tertiary and other measures for industrial and commercial premises C736" CIRIA (London) 2014 section 4.2.2
- 12 Masonry Bunds for Oil Storage Tanks CIRIA/Environmental Alliance (London) (undated)
- 13 The Storage of Flammable Liquids in Tanks clauses 84, 89
- 14 Fixed tanks that meet the design standard are any made to British Standard 5410, or OFTEC standard OFS T200 or British Standard 799-5, if your container is metal
<https://www.gov.uk/guidance/storing-oil-at-a-home-or-business>
- 15 The OFTEC Easy Guide to Non-Domestic Oil Storage OFTEC (Ipswich) 2006

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- 16 The Storage of Flammable Liquids in Tanks clause 111 p.30
- 17 The Storage of Flammable Liquids in Tanks clause 102 p.29
- 18, 19 The Storage of Flammable Liquids in Tanks clause 111
- 21 The Storage of Flammable Liquids in Tanks clause 106
- 22 The Storage of Flammable Liquids in Tanks clause 174
- 23 The Storage of Flammable Liquids in Tanks clause 107 quote
- 24 The Storage of Flammable Liquids in Tanks clause 142
- 25 Safety signs and signals: The Health and Safety (Safety Signs and Signals): Guidance on Regulations L64 Health and Safety Executive (London) 2015 3rd Edn.
- 26 The Storage of Flammable Liquids in Tanks clause 136
- 27 Safe Use and Handling of Flammable Liquids clause 139
- 28 The Storage of Flammable Liquids in Tanks clause 99
- 29 The Storage of Flammable Liquids in Tanks clause 146
- 30 regulation 7(1) of The Dangerous Substances and Explosive Atmospheres Regulations 2002
<https://www.legislation.gov.uk/ukxi/2002/2776/regulation/7/made>
- 31 Safe Use and Handling of Flammable Liquids clause 66
- 32 Explosive Atmospheres: Classification of Hazardous Areas (Zoning)
- 33 The Electricity at Work Regulations 1989: Guidance on Regulations HSR25 3rd Health and Safety Executive Edn. 2015 clauses 69-84
- 34 Safe Use and Handling of Flammable Liquids clauses 81, 82
- 35 Safe Use and Handling of Flammable Liquids clause 73
- 36 see: https://www.ccohs.ca/oshanswers/prevention/howto/flammable_static.html
- 37 The Storage of Flammable Liquids in Tanks clause 139
- 38 Schedule 12 of the Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009
<https://www.legislation.gov.uk/ukxi/2009/1348/regulation/7/made>
- 39 The Storage of Flammable Liquids in Tanks clause 203
- 40 The Storage of Flammable Liquids in Tanks clause 206
- 41 Electricity at work: Safe working practices HSG85 Health and Safety Executive (London) 2013 3rd Edn.
- 42 Walton, I. L. W., "Containment systems for the prevention of pollution: Secondary, tertiary and other measures for industrial and commercial premises C736" CIRIA (London) 2014 page 14

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43 The Storage of Flammable Liquids in Tanks clauses 89, 91

44 Walton, I. L. W., "Containment systems for the prevention of pollution: Secondary, tertiary and other measures for industrial and commercial premises C736" CIRIA (London) 2014 page 164 section 10.3.1

45 Walton, I. L. W., "Containment systems for the prevention of pollution: Secondary, tertiary and other measures for industrial and commercial premises C736" CIRIA (London) 2014 page 145 section 10.3.4

46 <https://surreyfire.co.uk/co2-fire-extinguishers/> and
<https://surreyfire.co.uk/foam-fire-extinguishers/>

47 Lighting at work HSG38 HSE Books (London) 1998

48 The Electricity at Work Regulations 1989: Guidance on Regulations HSR25 Health and Safety Executive (London) 2015 3rd Edn.

36: "Solvents and fuels produced from petroleum (e.g., benzene, toluene, mineral spirits, gasoline, jet fuel) can build up a charge when they are poured or flow through hoses. They tend to hold a charge because they cannot conduct electricity well enough to discharge when in contact with a conducting material, like a metal pipe or container, that is grounded. When enough of a charge is built up, a spark may result. If the vapour concentration of the liquid in air is in the "flammable range" and the spark has enough energy, a fire or explosion can result." from:

https://www.ccohs.ca/oshanswers/prevention/howto/flammable_static.html

Appendix One: examples of double-locked remote fill system cabinets

<https://www.landonkingsway.com/products/fuel-fill-point-cabinet/>

<https://www.acetank.com/fuel-safe/ace-fuelsafe-remote-fill-systems/>

<https://www.bellflowsystems.co.uk/oil-fill-point-cabinet.html>

Bibliography

Bird, J. O. "Electrical Circuit Theory and Technology" Routledge (New York) 2017

Coles, Mark (2006) "Earthing and Bonding in Hazardous Locations" IEE Wiring Matters
Available at: www.iee.org

Regulations Pertaining to the Installation of a Tank Holding 25,000 Litres of Kerosene on Commercial Premises

Containment of Bulk Hazardous Liquids at COMAH Establishments: Containment Policy: Supporting Guidance for Secondary and Tertiary Containment HSE/SEPA/Environment Agency (London) 2008 Available at:
https://www.sepa.org.uk/media/426907/comah_containment_policy_supporting_guidelines.pdf

Controlling fire and explosion risks in the workplace: A brief guide to the Dangerous Substances and Explosive Atmospheres Regulations Leaflet INDG370(rev1) HSE Books 2013 (London)
Available at: www.hse.gov.uk/pubns/indg370.htm

Dangerous Substances and Explosive Atmospheres Regulations 2002: Approved Code of Practice and guidance L138 HSE (London) 2013 2nd Edn.
Available at: <https://www.hse.gov.uk/pubns/priced/l138.pdf>

The Dangerous Substances and Explosive Atmospheres Regulations 2002
<https://www.legislation.gov.uk/uksi/2002/2776/regulation/7/made>

Electricity at work: Safe working practices HSG85 Health and Safety Executive (London) 3rd Edn. 2013
Available at: <https://www.hse.gov.uk/pubns/priced/hsg85.pdf>

The Electricity at Work Regulations 1989: Guidance on Regulations HSR25 Health and Safety Executive (London) 2015 3rd Edn.
Available at: <https://www.hse.gov.uk/pubns/priced/hsr25.pdf>

Explosive Atmospheres: Classification of Hazardous Areas (Zoning) and Selection of Equipment Health and Safety Executive (London) (Undated)
Available at: <https://www.hse.gov.uk/fireandexplosion/zoning.pdf>

Lighting at work HSG38 HSE Books (London) 1998
Available at: www.hse.gov.uk/pubns/books/hsg38.htm

Masonry Bunds for Oil Storage Tanks CIRIA/Environmental Alliance (London, undated)

Regulations Pertaining to the Installation of a Tank Holding 25,000 Litres of Kerosene on Commercial Premises

Available at: <https://bundling.co.uk/Downloads/Ciria-EA%20Guidelines%20for%20Masonry%20Bunds%20to%20Oil%20Storage%20Tanks.pdf>

The OFTEC Easy Guide to Non-Domestic Oil Storage OFTEC (Ipswich) 2006

Safe Use and Handling of Flammable Liquids HSG140 HSE Books (London) 2015 2nd Edn.

Available at: www.hse.gov.uk/pubns/books/hsg140.htm

Safety and environmental standards for fuel storage sites: Process Safety Leadership Group

Available at: www.hse.gov.uk/comah/buncefield/fuel-storage-sites.pdf

Safety signs and signals: The Health and Safety (Safety Signs and Signals): Guidance on

Regulations L64 Health and Safety Executive (London) 2015 3rd Edn.

Available at: <https://www.hse.gov.uk/pubns/priced/l64.pdf>

Schedule 12 of the Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009

<https://www.legislation.gov.uk/ukxi/2009/1348/regulation/7/made>

The Storage of Flammable Liquids in Tanks HSG176 HSE Books (London) 2015 2nd Edn.

Available at: www.hse.gov.uk/pubns/books/hsg176.htm

Traynor, T. et al “Safety and environmental standards for fuel storage sites

Process Safety Leadership Group: Final report” Health and Safety Executive (London) 2009

Available at: <https://www.hse.gov.uk/comah/buncefield/fuel-storage-sites.pdf>

Unloading petrol from road tankers. Dangerous Substances and Explosive Atmospheres Regulations 2002. Approved Code of Practice and guidance L133 HSE Books (London) 2003

Available at: www.hse.gov.uk/pubns/books/l133.htm

Walton, I. L. W., “Containment systems for the prevention of pollution: Secondary, tertiary and other measures for industrial and commercial premises C736” CIRIA (London) 2014

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https://www.ccohs.ca/oshanswers/prevention/howto/flammable_static.html