SOUTH PORTLAND FIRE DEPARTMENT
STANDARD OPERATING GUIDELINES

SOG #:	6.525	**Effective Date:**	1/1/2022
Title:	Tank Farm & Terminal Operations	**# of pages:**	10
Category:	Special Operations	**Classification:**	Red

1. PURPOSE: To establish guidelines for operations in Tank Farm and Marketing Terminal facilities.

2. POLICY: Tank Farms and marketing terminals located within the City of South Portland are major tactical hazards that require special pre-fire planning consideration. The Facilities located in South Portland serve as the primary distribution point for petroleum products in the Southern Maine area and beyond. Products arrive at these facilities by ship and over the road. Large quantities of products, primarily flammable and combustible liquids, are stored at these locations and are distributed to service stations and other users by tank truck or through additional underground pipelines.

   General Emergencies: In the event of an emergency within a tank farm or marketing terminal, a command system should be established as per SOG "Incident Management System" and expanded as necessary. Specific information to be considered by the initial incident commander includes:
   - The specific location within the facility.
   - The type of emergency leak, spill, fire or no fire, EMS).
   - The size of any spill, leak or fire.
   - The source of any spill or leak (tank truck, loading rack, bulk storage tank, and/or pipeline).
   - The operation of any automatic systems.
   - The number(s) and location(s) of any bulk storage tanks involved.
   - Product involved (crude oil, gasoline, ethanol, etc.).

   Large Scale Emergencies: Major incidents at tank farms and marketing terminals will generally involve either a leak or a spill of a petroleum product. The situation may or may not involve a fire. Tactical priorities to consider include:
   - Ensuring the safety of personnel and citizens.
   - Determining evacuation distances based on type of incident and wind direction.
   - Determining the correct type of foam to use, the necessary flow rate, and the water supply necessary to sustain operations.
   - Covering spills with an appropriate foam blanket to control fire and/or prevent ignition.
   - Controlling potential sources of ignition.
   - Air monitoring to determine effectiveness of foam blankets.
   - Containing the spill or run-off.
   - Identifying and controlling the source of the spill or leak.
   - Maintaining an adequate foam blanket until product can be picked up.

- Keeping all personnel out of the spill area.

In order to achieve these tactical priorities, the incident commander should consider establishing:

- *Command Post* - in a location suitable to direct operations.
- *Operations Center* - at the site or at the City of South Portland EOC. Representatives of all companies operating within the complex will assemble at this location to provide information or advice. The responsible party for the facility involved in the incident will report to the Operations Center.
    - Command will assign a Command Officer and at least one company to the Operations Center. The Operations Center will provide support as directed by Command.
    - Complete sets of site plans and photographs are maintained in the Administrative Offices and a few are available on IAMRESPONDING.
    - All public contact, including PIO and Liaison functions will be conducted at the Operations Center, unless specifically needed at the Command Post.
- *Staging* – in a suitable location to accommodate Level 2 Staging as per SOG "Staging Areas."

Pipeline Emergencies: Pipeline systems deliver products to facilities, from facilities, and within facilities at a high rates of flow. In the event of any major spill, including tank overfilling or a ruptured pipe, orders must be given to shut down the pipeline. This may involve Command or the Dispatch Center contacting the affected agency to relay this instruction. The telephone numbers are in CAD. It takes several minutes to fully stop the incoming flow.

Loading Rack Emergencies: Truck loading racks are located at several facilities within the City of South Portland. Product is transferred at high flow rates to and from tank trucks at these racks. There is a potential for large spills and/or fires if a tank is allowed to overflow or if a fill line ruptures or becomes disconnected.

Loading racks have automatic deluge sprinkler systems which are activated by heat or flame detectors with manual activation provided as back-up. In the event of a large spill at the rack, the deluge system should be manually activated to cover the spill.

The automatic deluge system should be shut down as soon as fire control and/or a good foam blanket have been achieved since once the stored foam supply is exhausted, the system will discharge plain water that will damage the foam blanket. AFFF hand lines should be in position when the system is shut down. A fire department connection may be provided to allow a 2 1/2 inch AFFF hose line to be connected to supplement the flow through the deluge system.

Bulk Storage Tank Emergencies: When bulk storage tanks are involved in an emergency, tactical consideration must be given to the type of tank involved. Bulk storage tanks may be of the following types of construction:

- Cone Roof Tank – A sealed container tank with a fixed top.

- Covered Floating Roof Tank – A combination of an internal floating roof assembly, that floats on top of the stored product, and a fixed exterior roof.
- Open floating roof – A tank shell with an external roof assembly that floats on top of the stored product.

Spills - Tanks are required to have high level alarm system as well as a high-high level alarm to reduce the risk of spills. In the event that a large spill does occur, the area must be covered with an effective foam blanket to suppress ignitable vapors. An ignited overflow spill will probably result in a major fire in the dike area around the tank as well as a fire at the surface level of the tank.

It is always important to control the spill fire before attempting to control the tank surface fire, since a spill fire would continue to reignite vapors coming from the tank. With the spill fire contained, efforts can be made to control the tank surface fire. The spill area must be secured with a foam blanket for the duration of the incident.

Rim Seal Fires - Floating roof tanks may experience "rim" fires involving the seal area around the floater. The preferred method for extinguishing rim seal fires is the use of fixed foam delivery systems. If fixed systems are not available or are inoperable, these fires are generally controllable with small diameter hand lines.

The structural stability of floating roofs must be constantly evaluated during operations. No water or finished foam should be applied directly onto the roof, and roof drains should be opened if at all practical. Excess weight on the floating roof may cause it to tilt or sink, causing fire conditions to intensify rapidly. In a covered floating roof tank, rim fires may occur in the space between the floating roof and the fixed roof, making access for hose streams difficult or impossible.

Full surface fires – Full surface fires present significant logistical and tactical problems. Prior to attempting extinguishment of a full surface fire it is essential that an adequate, uninterrupted supply of water and foam concentrate is on hand (See Appendix 1 for a list of current foam storage locations). Application rates can be found in facility pre-plans. Also see Appendix 2 for and application chart.

Whenever practical, fixed extinguishing systems should be used. These systems contain distribution pipes and delivery devices for topside or subsurface injection. Foam concentrate and proportioning are supplied my mobile apparatus. In a catastrophic event or fire however, these systems may be damaged or inoperable. NFPA 11 recognizes three application methods for foam used at storage tank fires:

- Type I: foam applied gently without disturbance (Moeller tubes, are being discontinued).
- Type II: foam applied via foam chambers, applied gently to lesson disturbance.
- Type III: foam applied by ground monitors or hand lines, direct application to fuel surface.

Semi-fixed foam systems shall not be used prior to consultation with the responsible party.

A conservative flow rate of 0.16gpm/ft^2 of surface area can be used to determine a flow rate. However, consideration should be given to tank size and general conditions. For tanks larger than 150' in diameter, larger application rates of 0.20gpm/ft^2 up to 0.24gpm/ft^2 should be considered. To determine the area of a tank shell, use the formula:

$$(\pi d/2) \times h$$

Where "d" is the tank diameter and "h" is the tank height.

In addition to foam for an initial extinguishment, a second supply for maintenance of a foam should be on hand.

Exposure Protection - When exposure protection is required, large volume water streams should be used for reach and cooling capacity. Water application must be managed to avoid breaking-up any foam blankets or increasing the problems of fuel spills.

Steam production should be used as a guide to protecting exposures: If steam is created when water strikes the surface of the tank, the need for protection is indicated. Tanks generally require little protection on vertical surfaces below the liquid level.

Considerations for Crude Oil: Crude Oil Fires present additional dangers due to the risk of boil-over and froth-over. Both phenomena result in catastrophic ejection of burning heavy oils requiring an exclusion zone up to 2000' in all directions.

Considerations for Ethanol: All incidents involving ethanol or ethanol blended fuels require the use of Alcohol Resistant AFFF foam. Ordinary AFFF will not be effective on ethanol based fuels. Care must be taken to identify the fuel involved and select the proper extinguishing agent. See Appendix 3 for current ethanol storage locations.

The purity of E85 and E95 fuels may limit visible flame when these fuels are involved in a spill. Spills involving E85 and E95 should be considered on fire unless determined otherwise. Use of TIC will help during size-up to determine if a spill is in fact on fire. There are also tanks of 95% ethanol used at the racks to blend fuels in a few of the terminals. (Gulf, Citgo, Mobil) Extreme caution should be used when dealing with emergency situations involving this product.

3. REFERENCES:
   - None

By Order Of:

James P. Wilson
Fire Chief

Appendix 1
Foam Storage Locations (1/1/2022)

AR-AFFF

Apparatus:	
200 gallons	Engine 44
30 gallons	Engine 48
500 gallons	Engine 49
Trailers:	
825 gallons + (1) extra tote	Mobil Oil
825 gallons	Gulf Oil
825 gallons + (1) extra tote	Citgo
Storage/Rack Systems	
1475 gallons	Mobil Oil (Storage & Rack)
165 gallons	Gulf Oil (Storage)
2475 gallons	Citgo (Storage & Rack)

Consider other sources such as:

- Mutual Aid Fire Departments
- Emergency Purchase from vendors 1-800-RED ALERT (National Foam)

Appendix 1
Foam Storage Locations (1/1/2022)

AFFF

Apparatus:	
500 gallons	Engine 46
Trailers:	
2000 gallons	Portland Pipe Line 2 trailers
990 gallons	Central (SPFD Trailer)
825 gallons +(2) totes	Sprague
825 gallons +(1) tote	Global petroleum
825 gallons +(1) tote	Clean Harbors
900 gallons (55 gallon drums)	Central Fire Station
1 Tote	Enpro on Main Street

Appendix 2
Foam Application Rates

Full Surface Hydrocarbon

Basic equation: Tank Area x Flow Rate x Run Time in Minutes

$\pi r^2(0.16)(65)$

Tank Diameter	GPM Flow	Foam Concentrate Flow (GPM)	Water Flow (GPM)	Total Flow (GPM)	Total Concentrate Required for 65 min (gallons)
200*	5024	151	4873	326560	9797
180*	4069	122	3947	264514	7935
150	2826	85	2741	183690	5511
120	1809	54	1754	117562	3527
100	1256	38	1218	81640	2449
60	452	14	439	29390	882
50	314	9	305	20410	612

***** Consider higher application rates for larger tank diameters

Hydrocarbon Spill

Basic equation: Area x Flow Rate x Run Time in Minutes

(L x W) x (0.16)(15)

Area (Square feet)	GPM Flow	Foam Concentrate Flow (GPM)	Water Flow (GPM)	Total Flow (GPM)	Total Concentrate Required for 15 min (gallons)
100	16	2.56	16	240	38
200	32	5.12	31	480	77
300	48	7.68	47	720	115
400	64	10.24	62	960	154
500	80	12.80	78	1200	192
600	96	15.36	93	1440	230
700	112	17.92	109	1680	269
800	128	20.48	124	1920	307
900	144	23.04	140	2160	346
1000	160	25.60	155	2400	384

Appendix 2
Foam Application Rates

Full Surface Ethanol

Basic equation: Tank Area x Flow Rate x Run Time in Minutes

$\pi r^2(0.3)(65)$

Tank Diameter	GPM Flow	Foam Concentrate Flow (GPM)	Water Flow (GPM)	Total Flow (GPM)	Concentrate required for 65 min
200	9420	283	9137	612300	18369
150	5299	159	5140	344419	10333
120	3391	102	3289	220428	6613
100	2355	71	2284	153075	4592
60	848	25	822	55107	1653
50	589	18	571	38269	1148

Ethanol Spill

Basic equation: Area x Flow Rate x Run Time in Minutes

(L x W) x (0.3)(15)

Area (Square feet)	GPM Flow	Foam Concentrate Flow (GPM)	Water Flow (GPM)	Total Flow (GPM)	Total Concentrate Required for 15 min (gallons)
100	30	0.90	29	450	14
200	60	1.80	58	900	27
300	90	2.70	87	1350	41
400	120	3.60	116	1800	54
500	150	4.50	146	2250	68
600	180	5.40	175	2700	81
700	210	6.30	204	3150	95
800	240	7.20	233	3600	108
900	270	8.10	262	4050	122
1000	300	9.00	291	4500	135

Appendix 3
Ethanol Storage Locations
Updated (1/1/2022)

Location	Tank Diameter	Tank No.
Mobil Oil	100	28
	100	29
Gulf Oil	60	1
Citgo	120	