Virginia Area Contingency Plan (VACP)

Petroleum Oil Incident Annex

Annex EE

March 2025

Table of Contents

00 - Introduction

Response to oil spills can vary greatly and can involve only a few people or thousands; however, one of the most important aspects of initial actions is identifying and classifying the oil discharged. The initial action taken by responders is sometimes the most important and usually sets the tone and direction of the response.

01 - Purpose

The purpose of this Annex is to provide first responders with general information for responding to oil spills in or near the marine environment. Each incident may vary greatly with regard to responder and civilian safety as well as response strategies. This annex will provide the responder with basic information to assess the incident, ensure proper notifications are made and provide some guidelines for initial actions to take to protect nearby persons, critical infrastructure and environmentally sensitive areas. This annex is a guide only and therefore may be missing critical information; responders should always approach each incident with caution until more information can be obtained.

02 - General terms, references and safety guidelines

Each response will be different depending on many factors such as the product discharged, medium into which it was discharged, cause of discharge, time of year and time of day to name only a few. Yet many factors, terms and situations will stay the same. Initial responders are tasked with gathering incident specific information, evaluating the circumstances based on known or suspected situations and developing an initial response strategy based on experience to secure the immediate area. This section will outline key terms related to oil spill response and safety concerns generally encountered on incident sites.

- **Terms**
  - Benzene- A volatile component of unrefined crude oil products. This component is a known carcinogen with a very low Threshold Limit Value (TLV), of 0.5ppm.
  - Boiling Point- The temperature at which a liquid's vapor pressure equals the surrounding atmospheric pressure so that the liquid rapidly vaporizes. (The temperature at which a liquid converts to a gas)
  - Flash Point- The lowest temperature at which a flammable liquid gives off sufficient vapor to form an ignitable mixture with air near its surface or within a vessel (the lowest temperature at which it will produce a flame but not combust).
  - Hydrogen sulfide- A component of unrefined crude oil products. This component can displace oxygen in the area near the discharged product causing an oxygen deficient environment.
  - Immediately Dangerous to Life and Health (IDLH)- The maximum concentration from which one could escape within 30 minutes without any escape-impairing symptoms or irreversible health effects.
  - Lower Explosive Limit/Upper Explosive Limit (LEL/UEL)- Minimum and maximum concentrations of a flammable gas or vapor between which ignition

can occur. All concentrations between the LEL and UEL are in the explosive range, and special precautions are needed to prevent ignition or explosion.

- Polycyclic aromatic hydrocarbon (PAH)- May be formed from incomplete combustion of oils if a fire is present at the discharge site. PAHs are a known carcinogen.
- Specific Gravity- The ratio of the density of a substance to the density of a reference substance (water). If the ratio is less than 1 the substance will float, if it is greater than 1 the substance will sink.
- Threshold Limit Values/Permissible Exposure Limits (TLV/PEL)- The maximum airborne concentration of a material to which most workers can be exposed during a normal daily and weekly work schedule without adverse effects.
- Vapor Density- The ratio of the density of a substance to the density of a reference substance (air). If the ratio is less than 1 the substance will float, if it is greater than 1 the substance will sink.
- Vapor Pressure- The pressure a saturated vapor exerts above its own liquid in a closed container. The lower a substance's boiling point, the higher its vapor pressure; and the higher the vapor pressure, the greater the material's tendency to evaporate into the atmosphere.

* Terms gathered from (International Spill Control Organization, 2014) and (Pipeline and Hazardous Materials Safety Administration, 2016)

- **General Safety and Response Guidelines**
  - Most unrefined products contain some levels of benzene and hydrogen sulfide. Responders need to be aware of the potential for exposure during response operations. Hydrogen sulfide is an acute exposure hazard as an exposed person may fall unconscious due to lack of oxygen. Once unconscious death can be caused by insufficient oxygen. An exposure to even low concentrations of benzene can cause chronic systemic effects and cancers.
  - Personal protective equipment (i.e. SCBAs) should be worn by all initial responders until air monitoring has been conducted and the atmosphere certified safe.
  - Due to the low flash point and relatively high vapor pressure, Group I and II oils present a higher fire and explosion hazard. Because of this all-nearby ignition sources should be secured if safe to do so and no containment booming should be done until air monitoring determines it is safe to do so.
  - Every effort should be made to evacuate persons downwind in the event of a fire as the smoke generated from the burning products may be toxic.
  - Group IV and V oils may react differently depending on the time of year the incident happens. As ambient air and water temperatures drop these Groups of oils may begin to sink underwater. Also, weathering may cause these oils to sink as well so initial responders may need to plan for subsurface collection or monitoring.

- Safety Data Sheets are often used to pinpoint specific characteristics of the oil, but responders should be aware that these are often estimates or generalized and the owner of the oil will be the best source of this information till scientific sampling and observations can be conducted (USCG National Strike Force, 2015)

* Information from Emergency Response Guidebook (Cloutier, Cushmac, 2016) and Oil Subcommittee Expertise

03 Most commonly transported oils in Hampton Roads

Hampton Roads is a large and busy port with many commodities imported as well as exported by vessel and rail. The increase in production of crude products in North America and the costly and lengthy process of obtaining permits for new pipelines have made rail the transport mode of choice for crude oil products, especially at new crude production sites (Crosby, Fay, Groark, Kani, Smith, Sullivan, 2013). The most commonly transported oils through the Hampton Roads Area are:

- Waste Oil- Group II or III
- Bunker Oil- Group II, III or IV
- Jet Fuel- Group II
- Domestic Crude- Group I
- #2 Diesel- Group II

* While there is a high correlation between the various oil properties, these correlations should be used cautiously as oils vary so much in composition (Jokuty et al., 1995). Clarifying the term “Domestic Crude” for this part of the annex shall include Bakken, Dilbet, and Tampa crude oil products.

100 - Quick Response Guide - Group I

Table 1 * SAFETY MESSAGE, Guidance not legally mandating*

Characteristics Of The Five Types Of Oil Classifications				
Gasoline Products (Group I)	**Diesel-like Products and Light Crude Oils (Group II)**	**Medium-grade Crude Oils and Intermediate Products (Group III)**	**Heavy Crude Oils and Residual Products (Group IV)**	**Low API Oils - heavier than water (Group V)**
Examples – Gasoline, Bakken Crude (due to flashpoint)	Examples – No. 2 fuel oil, jet fuels, kerosene, West Texas crude, Alberta crude	Examples – North Slope crude, South Louisiana crude, No. 4 fuel oil, IFO 180, lube oils	Examples – Venezuela crude, San Joaquin Valley crude, Bunker C, No. 6 fuel oil	Examples – Very heavy No. 6 fuel oil, Residual Oils, Vacuum Bottoms, Heavy slurry oils
• Very volatile and highly flammable (flash point near 100°F/40°C)	• Moderately volatile (flash point varies 100-150°F/40-65°C)	• Moderately volatile (flash point higher than 125°F/50°C)	• Slightly volatile (flash point greater than 150°F/65°C)	• Very low volatility
• High evaporation rates; narrow cut fraction with no residues	• Refined products can evaporate to no residue; crude oils do leave a residue after evaporation is completed	• Up to one-third will evaporate in the first 24 hours	• Very little product loss by evaporation	• No evaporation when submerged
• Low viscosity; spreads rapidly to a thin sheen	• Low to moderate viscosity; spread rapidly into thin slicks • Specific gravity of <0.85; API gravity of 35-45	• Moderate to high viscosity • Specific gravity of 0.85-0.95; API gravity of 17.5-35	• Very viscous to semisolid • Specific gravity of 0.95-1.00; API gravity of 10-17.5	• Very viscous to semisolid • Specific gravity greater than 1.00; API gravity less
• High acute toxicity to biota	• Moderate to high acute toxicity to biota; product-specific toxicity related to type and concentration of aromatic compounds	• Variable acute toxicity, depending on amount of light fraction present	• Low acute toxicity relative to other oil types	• Low acute toxicity relative to other oil types
• Does not emulsify	• Can form stable emulsions	• Can form stable emulsions	• Can form stable emulsions	• Can form stable emulsions
• Will penetrate substrate; non- adhesive	• Tend to penetrate substrate; fresh spills are not adhesive • Stranded light crudes tend to smother organisms	• Variable substrate penetration and adhesion • Stranded oil tends to smother organisms	• Little penetration of substrate likely, but can be highly adhesive • Stranded oil tends to smother organisms	• Little penetration of substrate likely, but can be highly adhesive • Stranded and submerged oil tends to smother

*Chart from (NW Area Committee, 2015)

110 - Group I Oil

Group I oils are highly volatile and may contain high concentrations of toxic compounds. Due to the high volatility, the majority of the discharge of Group I oils will evaporate within 1 to 2 days. When introduced to water, Group I oils will quickly disperse into the water column causing severe impacts to the surrounding environmentally sensitive areas. Group I Oil spills routinely result in no cleanup possible due to quick dissipation and the higher vapor pressure.

- 111 - Phase I - Discovery or Notification –

  - Upon discovery of a large discharge of Group I Oil immediately retreat a safe distance upwind and secure the area. Benzene may be present in levels that exceed the PEL, if possible, begin air monitoring or follow the evacuation table for the product found in the Emergency Response Guide. The flashpoint for Group I Oils is near 100°F/40°C, secure all ignition sources if it is safe to do so.

110 - Group I Oil (Cont.)

- Begin making notifications
  - Federal- National Response Center 800-424-8802
  - State- Virginia Emergency Operations Center 800-468-8892

- 112 - Phase II - Preliminary Assessment and Initiation of Action –

  - Wind direction, outside temperature, and ventilation concerns will guide the response actions on whether containment and cleanup are feasible.
  - The risk of containment boom creating an explosive environment may outweigh letting the product naturally spread and dissipate.
  - Attempt to secure all heat sources, such as lighting, exposed wiring, vehicle engines or other equipment capable of producing a spark or flame.
  - Air Monitoring must be conducted in order to utilize containment boom and should also be done prior to any close inspection of the discharge source.
  - Utilize the Endangered Species Index (ESI) maps and local knowledge to determine environmentally sensitive areas or critical infrastructure and take action such as exclusion or diversion boom to protect them.
  - Product spreads quickly, continually assess the need to increase safety distance.

- 113 - Phase III - Containment, Countermeasures, Cleanup, and Disposal –

  - Having a Low Viscosity allows several different types of skimmers to be used to recover Group I oils effectively. Simple weir skimmers, drums with sorbent lining or groves, and water jet skimmers can collect this product well; manual methods, however, such as brushes and rope mops may be ineffective.
  - Pay special attention to generators and pumps as they may be a source of ignition for explosions, sparks, or flames.
  - On-site storage will need to be identified prior to beginning recovery operations.

114 - Considerations

Group I oils are highly volatile and therefore can be highly toxic or flammable/explosive. Air monitoring should be started as soon as possible to protect responder and surrounding human populations. Initial response strategies such as containment booming or skimmer recovery should be initiated only after a safety evaluation has been conducted. Since Group I oils can rapidly evaporate and leave little to no residue, leaving the oil to naturally dissipate may be a viable response strategy.

Bakken Crude Oil Chemical Properties	Average Low	Average High
Flash Point	32 F	73 F
Initial Boiling Point	85 F	104 F
Butane Level	2.4%	3%
Propane	.6%	1.2%
Hydrogen Sulfide	0ppm	5ppm
Vapor Pressure	8.7 pounds	11 pounds

*This range is found by both the (EPA, 2015) study and the limits tested by the American Fuel & Petrochemical Manufacturers in 2014.

Due to this low flash point and higher than average vapor pressure a fire and explosion hazard exists and has occurred during several oil discharges involving this product. This oil should be considered a Group I oil.

In the Deepwater Horizon spill in the Gulf of Mexico, small droplets of light oil released below the surface were kept submerged by the movement of the ocean water despite having API gravity greater than 10, because the turbulence was enough to overcome the buoyancy of the small particles of oil (Joint Analysis Group, 2012).

120 - Quick Response Guide Group II

Table 2 * SAFETY MESSAGE, Guidance not legally mandating*

Characteristics Of The Five Types Of Oil Classifications				
Gasoline Products (Group I)	**Diesel-like Products and Light Crude Oils (Group II)**	**Medium-grade Crude Oils and Intermediate Products (Group III)**	**Heavy Crude Oils and Residual Products (Group IV)**	**Low API Oils - heavier than water (Group V)**
Examples – Gasoline	Examples – No. 2 fuel oil, jet fuels, kerosene, West Texas crude, Alberta crude,	Examples – North Slope crude, South Louisiana crude, No. 4 fuel oil, IFO 180, lube oils	Examples – Venezuela crude, San Joaquin Valley crude, Bunker C, No. 6 fuel oil	Examples – Very heavy No. 6 fuel oil, Residual Oils, Vacuum Bottoms, Heavy slurry oils
• Very volatile and highly flammable (flash point near 100°F/40°C)	• Moderately volatile (flash point varies 100-150°F/40-65°C)	• Moderately volatile (flash point higher than 125°F/50°C)	• Slightly volatile (flash point greater than 150°F/65°C)	• Very low volatility
• High evaporation rates; narrow cut fraction with no residues	• Refined products can evaporate to no residue; crude oils do leave a residue after evaporation is completed	• Up to one-third will evaporate in the first 24 hours	• Very little product loss by evaporation	• No evaporation when submerged
• Low viscosity; spread rapidly to a thin sheen	• Low to moderate viscosity; spread rapidly into thin slicks • Specific gravity of <0.85; API gravity of 35-45	• Moderate to high viscosity • Specific gravity of 0.85-0.95; API gravity of 17.5-35	• Very viscous to semisolid • Specific gravity of 0.95-1.00; API gravity of 10-17.5	• Very viscous to semisolid • Specific gravity greater than 1.00; API gravity less than 10
• High acute toxicity to biota	• Moderate to high acute toxicity to biota; product-specific toxicity related to type and concentration of aromatic compounds	• Variable acute toxicity, depending on amount of light fraction present	• Low acute toxicity relative to other oil types	• Low acute toxicity relative to other oil types
• Does not emulsify	• Can form stable emulsions	• Can form stable emulsions	• Can form stable emulsions	• Can form stable emulsions

• Will penetrate substrate; non-adhesive	• Tend to penetrate substrate; fresh spills are not adhesive • Stranded light crudes tend to smother organisms	• Variable substrate penetration and adhesion • Stranded oil tends to smother organisms	• Little penetration of substrate likely, but can be highly adhesive • Stranded oil tends to smother organisms	• Little penetration of substrate likely, but can be highly adhesive • Stranded and submerged oil tends to smother organisms

*Chart from (NW Area Committee, 2015)

120 Group II Oil

Group II Oils are light oils which are still moderately volatile. Unrefined Group II Oils will leave residue of up to one-third of the discharged amount a few days after initial exposure to the environment; moderate concentrations of toxic compounds can persist. This oil will not dissipate as easily as Group I products and cleanup is often required, as these types of oils can cause long-term contamination to the environment.

- 121 - Phase I Discovery or Notification –

  - Upon discovery of a large discharge of Group II Oil immediately retreat and secure the area. Benzene may be present in levels that exceed the PEL, if possible, begin air monitoring or follow the evacuation table for the product found in the Emergency Response Guide. The flashpoint for Group II Oils is 100-150°F/40-65°C; secure all ignition sources if it is safe to do so.
  - Begin making notifications
    - Federal- National Response Center 800-424-8802
    - State- Virginia Emergency Operations Center 800-468-8892

- 122 - Phase II Preliminary Assessment and Initiation of Action –

  - Wind direction, outside temperature, and ventilation concerns will guide the response actions on whether containment and cleanup is feasible.
  - The risk of containment boom creating an explosive environment may outweigh letting the product naturally spread and dissipate.
  - Attempt to secure all heat sources, such as lighting, exposed wiring, vehicle engines or other equipment capable of producing a spark or flame.
  - Air Monitoring must be conducted in order to utilize containment boom and should also be done prior to any close inspection of the discharge source.
  - Utilize ESI maps and local knowledge to determine environmentally sensitive areas or critical infrastructure and take action such as exclusion or diversion boom to protect them.
  - Product spreads quickly, continually assess the need to increase safety distance.

- Ensure on scene responders are not utilizing containment boom until the site is assessed for safety.

- 123 - Phase III Containment, Countermeasures, Cleanup, and Disposal –

  - Having a Low Viscosity allows several different types of skimmers to be used to recover group of oils effectively. Simple weir skimmers, drums with sorbent lining or groves, and water jet skimmers can collect this product well; manual methods, however, such as brushes and rope mops may be ineffective.
  - Pay special attention to generators and pumps as they may be a source of ignition for explosions, sparks, or flames.
  - On-site storage options will need to be assessed if recovery operations are started.

124 - Considerations

Refined products may be acutely toxic to the surrounding biota and will penetrate into the substrate. Unrefined products may present a smothering hazard to the surrounding biota and will adhere to the substrate. Identification of product discharged will help to determine protection and response strategies. Consultation with wildlife managers such as the National Oceanic and Atmospheric Administration or the United States Fishing and Wildlife Service to coordinate wildlife recovery and treatment is recommended.

Refined products may not be as toxic to humans but may present a flammable or explosive hazard to responders. Unrefined products may contain volatile organic compounds that can be either toxic to humans, flammable or both. Consider responder exposure when implementing defensive tactics.

130 - Quick Response Guide Group III

Table 3 * SAFETY MESSAGE, Guidance not legally mandating*

Characteristics Of The Five Types Of Oil Classifications				
Gasoline Products (Group I)	**Diesel-like Products and Light Crude Oils (Group II)**	**Medium-grade Crude Oils and Intermediate Products (Group III)**	**Heavy Crude Oils and Residual Products (Group IV)**	**Low API Oils - heavier than water (Group V)**
Examples – Gasoline	Examples – No. 2 fuel oil, jet fuels, kerosene, West Texas crude, Alberta crude	Examples – North Slope crude, South Louisiana crude, No. 4 fuel oil, IFO 180, lube oils	Examples – Venezuela crude, San Joaquin Valley crude, Bunker C, No. 6 fuel oil	Examples – Very heavy No. 6 fuel oil, Residual Oils, Vacuum Bottoms, Heavy slurry oils
• Very volatile and highly flammable (flash point near 100°F/40°C)	• Moderately volatile (flash point varies 100-150°F/40-65°C)	• Moderately volatile (flash point higher than 125°F/50°C)	• Slightly volatile (flash point greater than 150°F/65°C)	• Very low volatility
• High evaporation rates; narrow cut fraction with no residues	• Refined products can evaporate to no residue; crude oils do leave a residue after evaporation is completed	• Up to one-third will evaporate in the first 24 hours	• Very little product loss by evaporation	• No evaporation when submerged
• Low viscosity; spread rapidly to a thin sheen	• Low to moderate viscosity; spread rapidly into thin slicks • Specific gravity of <0.85; API gravity of 35-45	• Moderate to high viscosity • Specific gravity of 0.85-0.95; API gravity of 17.5-35	• Very viscous to semisolid • Specific gravity of 0.95-1.00; API gravity of 10-17.5	• Very viscous to semisolid • Specific gravity greater than 1.00; API gravity less than 10
• High acute toxicity to biota	• Moderate to high acute toxicity to biota; product-specific toxicity related to type and concentration of aromatic compounds	• Variable acute toxicity, depending on amount of light fraction present	• Low acute toxicity relative to other oil types	• Low acute toxicity relative to other oil types
• Does not emulsify	• Can form stable emulsions	• Can form stable emulsions	• Can form stable emulsions	• Can form stable emulsions
• Will penetrate substrate; non-adhesive	• Tend to penetrate substrate; fresh spills are not adhesive • Stranded light crudes tend to smother organisms	• Variable substrate penetration and adhesion • Stranded oil tends to smother organisms	• Little penetration of substrate likely, but can be highly adhesive • Stranded oil tends to smother organisms	• Little penetration of substrate likely, but can be highly adhesive • Stranded and submerged oil tends to smother organisms

*Chart from (NW Area Committee, 2015)

130 - Group III Oil

Group III Oils are medium grade crude oils and intermediate products such as North Slope crude, South Louisiana crude, No. 4 fuel oil, IFO 180 and lube oils. These oils are moderately volatile with approximately 1/3 of the discharged oil evaporating within 24 hours. These oils are moderately to highly viscous and will spread at varying speeds depending on ambient air and water temperature. Cleanup will be required as Group III oils will leave a residue that will contaminate the surrounding environment.

- 131 - Phase I Discovery or Notification –

  - Upon discovery of a large discharge of Group III Oil immediately retreat and secure the area. Benzene may be present in levels that exceed the PEL, if possible, begin air monitoring or follow the evacuation table for the product found in the Emergency Response

130 - Group III Oil (Cont.)

Guide. The flashpoint for Group III Oils is 125°F/50°C, secure all ignition sources if it is safe to do so.

- Begin making notifications
  - Federal- National Response Center 800-424-8802
  - State- Virginia Emergency Operations Center 800-468-8892

- 131 - Phase II Preliminary Assessment and Initiation of Action –

  - Components such as benzene and hydrogen sulfide may be present at unsafe levels. Air monitoring should be initiated to monitor and minimize responder exposure.
  - Wind direction, outside temperature, and ventilation concerns will guide the response actions on whether containment and cleanup are feasible.
  - It is recommended to utilize containment boom to keep the product close to the source. If containment boom is utilized, it is recommended to conduct Air Monitoring to ensure no concentrations of flammable/toxic vapors develop.
    Attempt to secure all heat sources, such as lighting, exposed wiring, vehicle engines or other equipment capable of producing a spark or flame.
  - Utilize ESI maps and local knowledge to determine environmentally sensitive areas or critical infrastructure and take action such as exclusion or diversion boom to protect them.
  - Product spreads quickly, continually assess the need to increase safety distance.
  - Ensure on scene responders are not utilizing containment boom until the site is assessed for safety.

  132 - Phase III Containment, Countermeasures, Cleanup, and Disposal –

  - Having a Moderate to High Viscosity may restrict the type of recovery devices used. Drums with sorbent lining or groves, rope skimmers and absorbent materials can collect this product well; manual methods, such as brushes and rope mops may also be effective.
  - Exclusion booming will prevent oil from reaching critical infrastructure or environmentally sensitive areas.
  - On-site storage will need to be assessed if recovery operations are started.

133 - Considerations

Refined products may be toxic to the surrounding biota and will penetrate into the substrate. Unrefined products may present a smothering hazard to the surrounding biota and will adhere to the substrate. Identification of product discharged will help to determine protection and response strategies. Consultation with wildlife managers such as NOAA or USFWS to coordinate wildlife recovery and treatment is recommended.

Refined products may not be toxic through inhalation to humans but may create a flammable or explosive atmosphere. Unrefined products may contain volatile organic compounds that can be either toxic to humans, flammable or both. Consider responder exposure when determining defensive tactics. Due to the higher flash point of this Group of oil, fire and explosion risks are not as severe as Group I or II oils. Refer to Safety Data Sheets to assess the atmospheric risks.

140 - Quick Response Guide Group IV

Table 4 * SAFETY MESSAGE, Guidance not legally mandating*

Characteristics Of The Five Types Of Oil Classifications				
Gasoline Products (Group I)	**Diesel-like Products and Light Crude Oils (Group II)**	**Medium-grade Crude Oils and Intermediate Products (Group III)**	**Heavy Crude Oils and Residual Products (Group IV)**	**Low API Oils - heavier than water (Group V)**
Examples – Gasoline	Examples – No. 2 fuel oil, jet fuels, kerosene, West Texas crude, Alberta crude	Examples – North Slope crude, South Louisiana crude, No. 4 fuel oil, IFO 180, lube oils	Examples – Venezuela crude, San Joaquin Valley crude, Bunker C, No. 6 fuel oil	Examples – Very heavy No. 6 fuel oil, Residual Oils, Vacuum Bottoms, Heavy slurry oils
• Very volatile and highly flammable (flash point near 100°F/40°C)	• Moderately volatile (flash point varies 100-150°F/40-65°C)	• Moderately volatile (flash point higher than 125°F/50°C)	• Slightly volatile (flash point greater than 150°F/65°C)	• Very low volatility
• High evaporation rates; narrow cut fraction with no residues	• Refined products can evaporate to no residue; crude oils do leave a residue after evaporation is completed	• Up to one-third will evaporate in the first 24 hours	• Very little product loss by evaporation	• No evaporation when submerged
• Low viscosity; spread rapidly to a thin sheen	• Low to moderate viscosity; spread rapidly into thin slicks • Specific gravity of <0.85; API gravity of 35-45	• Moderate to high viscosity • Specific gravity of 0.85-0.95; API gravity of 17.5-35	• Very viscous to semisolid • Specific gravity of 0.95-1.00; API gravity of 10-17.5	• Very viscous to semisolid • Specific gravity greater than 1.00; API gravity less than 10
• High acute toxicity to biota	• Moderate to high acute toxicity to biota; product-specific toxicity related to type and concentration of aromatic compounds	• Variable acute toxicity, depending on amount of light fraction present	• Low acute toxicity relative to other oil types	• Low acute toxicity relative to other oil types
• Does not emulsify	• Can form stable emulsions	• Can form stable emulsions	• Can form stable emulsions	• Can form stable emulsions
• Will penetrate substrate; non-adhesive	• Tend to penetrate substrate; fresh spills are not adhesive • Stranded light crudes tend to smother organisms	• Variable substrate penetration and adhesion • Stranded oil tends to smother organisms	• Little penetration of substrate likely, but can be highly adhesive • Stranded oil tends to smother organisms	• Little penetration of substrate likely, but can be highly adhesive • Stranded and submerged oil tends to smother organisms

*Chart from (NW Area Committee, 2015)

140 - Group IV Oils

Group IV Oils are heavy crude oils which experience little to no evaporation or dissolution in water. Due to low volatility, little to no evaporation of discharged product will occur. Heavy contamination of intertidal areas is likely and severe impacts to waterfowl and fur-bearing mammals often occur. Shoreline cleanup is challenging under all conditions. Additionally, this oil, although primarily considered a floating oil still may sink due to sedimentation or water behavior. "When oil is spilled and enters the environment there is the potential for it to change temperature. Any decreases in temperature will cause the oil's density to increase, further increasing the chance of becoming submerged." (Crosby, Fay, Groark, Kani, Smith, Sullivan, 2013).

- 141 - Phase I Discovery or Notification –
    - Upon discovery of a large discharge of Group IV Oil immediately retreat and secure the area the flashpoint for Group IV Oils is greater than 150°F/65°C.
    - Begin making notifications
        - Federal- National Response Center 800-424-8802
        - State- Virginia Emergency Operations Center 800-468-8892
- 142 - Phase II Preliminary Assessment and Initiation of Action –
    - Components such as benzene and hydrogen sulfide may be present at unsafe levels. Air monitoring should be initiated to monitor and minimize responder exposure.
    - Wind direction, outside temperature, and ventilation concerns will guide the response actions on whether containment and cleanup is feasible.
    - Attempt to secure all heat sources, such as lighting, exposed wiring, vehicle engines or other equipment capable of producing a spark or flame.
    - Air Monitoring must be conducted in order to utilize containment boom and should also be done prior to any close inspection of the discharge source.
    - Utilize ESI maps and local knowledge to determine environmentally sensitive areas or critical infrastructure and take action such as exclusion or diversion boom to protect them.
    - Although product spreads less quickly than lighter oils, continually assess the need to increase safety distance.
    - Ensure on scene responders are not utilizing containment boom until the site is assessed for safety.
- 143 - Phase III Containment, Countermeasures, Cleanup, and Disposal –

- Having a High Viscosity will restrict the type of recovery devices used. Drums with sorbent lining or groves, rope skimmers and absorbent materials can collect this product well; manual methods, such as brushes and rope mops will also be effective.
- Group IV oils have a specific gravity near 1 so oil may sink, underwater detection and monitoring may need to be utilized.
- Consider containment booming to keep the product close to the discharge source or minimize spreading.
- On-site storage will need to be assessed if recovery operations are started.

144 - Considerations

Group IV Oils are not considered as toxic to organisms as other oil groups. The main hazard to organisms is from smothering. Group IV oils will not penetrate into the substrate but will adhere to it. Wildlife consultation shall be performed in accordance with the applicable wildlife response annex within the ACP.

This includes Group IV oil, which has a specific gravity of slightly less than 1.0 and “might mix into the water column and sink to the seabed after weathering and interaction with sediments” (National Research Council, 1999).

Group IV oils are extremely “sticky” especially at low temperatures, elevated temperature recovery methods may need to be utilized (i.e. high temp power washers) to decontaminate shorelines or structures.

Oil and petroleum products evaporate in a slightly different manner than water and the process is much less dependent on wind speed and surface area. Oil evaporation can be considerably slowed down, however, by the formation of a 'crust' or 'skin' on top of the oil. This happens primarily on land where the oil layer is not agitated by water movement. (International Spill Control Organization, 2014)

150 - Oil Response Procedures Group V

Table 5 * SAFETY MESSAGE, Guidance not legally mandating*

Characteristics Of The Five Types Of Oil Classifications				
Gasoline Products (Group I)	**Diesel-like Products and Light Crude Oils (Group II)**	**Medium-grade Crude Oils and Intermediate Products (Group III)**	**Heavy Crude Oils and Residual Products (Group IV)**	**Low API Oils - heavier than water (Group V)**
Examples – Gasoline	Examples – No. 2 fuel oil, jet fuels, kerosene, West Texas crude, Alberta crude	Examples – North Slope crude, South Louisiana crude, No. 4 fuel oil, IFO 180, lube oils	Examples – Venezuela crude, San Joaquin Valley crude, Bunker C, No. 6 fuel oil	Examples – Very heavy No. 6 fuel oil, Residual Oils, Vacuum Bottoms, Heavy slurry oils
• Very volatile and highly flammable (flash point near 100°F/40°C)	• Moderately volatile (flash point varies 100-150°F/40-65°C)	• Moderately volatile (flash point higher than 125°F/50°C)	• Slightly volatile (flash point greater than 150°F/65°C)	• Very low volatility
• High evaporation rates; narrow cut fraction with no residues	• Refined products can evaporate to no residue; crude oils do leave a residue after evaporation is completed	• Up to one-third will evaporate in the first 24 hours	• Very little product loss by evaporation	• No evaporation when submerged
• Low viscosity; spread rapidly to a thin sheen	• Low to moderate viscosity; spread rapidly into thin slicks • Specific gravity of <0.85; API gravity of 35-45	• Moderate to high viscosity • Specific gravity of 0.85-0.95; API gravity of 17.5-35	• Very viscous to semisolid • Specific gravity of 0.95-1.00; API gravity of 10-17.5	• Very viscous to semisolid • Specific gravity greater than 1.00; API gravity less than 10
• High acute toxicity to biota	• Moderate to high acute toxicity to biota; product-specific toxicity related to type and concentration of aromatic compounds	• Variable acute toxicity, depending on amount of light fraction present	• Low acute toxicity relative to other oil types	• Low acute toxicity relative to other oil types
• Does not emulsify	• Can form stable emulsions	• Can form stable emulsions	• Can form stable emulsions	• Can form stable emulsions
• Will penetrate substrate; non-adhesive	• Tend to penetrate substrate; fresh spills are not adhesive • Stranded light crudes tend to smother organisms	• Variable substrate penetration and adhesion • Stranded oil tends to smother organisms	• Little penetration of substrate likely, but can be highly adhesive • Stranded oil tends to smother organisms	• Little penetration of substrate likely, but can be highly adhesive • Stranded and submerged oil tends to smother organisms

*Chart from (NW Area Committee, 2015)

150 - Group V Oil

Group V oils are, by regulation, categorically separate from other oils based on their specific gravity; any oil that has a specific gravity higher than 1.0 or API (American Petroleum Institute) gravity value of less than 10 is classified as a Group V oil. This classification is based on concerns that these oils have characteristics and behaviors that may be very different from other lighter oils.

The key differences are in the exceptionally high density, viscosity, and adhesion properties of the bitumen component of the diluted bitumen that dictate environmental behavior as the crude oil is subjected to weathering, a term that refers to physical and chemical changes of spilled oil (National Academies of Sciences, Engineering, and Medicine, 2016).

One of the behaviors observed is the tendency for these oils to sink below the water and thus pose very different environmental impacts and response strategies. There are three distinct types of Group V oils with very different properties and behaviors. These types include:

150 - Group V Oil (Cont.)

Group V Residual Fuel Oils (GPVRFO), known by the industry term LAPIO (Low API Oil);
Asphalt and Asphalt Products; and **Orimulsion** - an oil-water emulsion produced in Venezuela, containing approximately 70% Orinoco bitumen and 30% water.

- 151 - Phase I - Discovery or Notification –
    - Begin making notifications
        - Federal- National Response Center 800-424-8802
        - State- Virginia Emergency Operations Center 800-468-8892
- 152 - Phase II - Preliminary Assessment and Initiation of Action –
    - Group V oils characteristics are different than the other groups. Group V oils are considered semisolid and resistant to flow. Fresh Group V oils will also act differently than Group V oils that have weathered. Group V oils tend to sink either initially or after weathering or exposed to lower ambient temperatures. Therefore, initial responders may need to plan for subsurface monitoring and recovery in which few methods currently exist (National Academies of Sciences, Engineering, and Medicine, 2016).
    - ESI maps and local knowledge to determine environmentally sensitive areas or critical infrastructure and take action such as exclusion or diversion boom to protect them.
    - Due to the semisolid nature recovery methods are generally limited to mechanical or manual removal.
- 153 - Phase III - Containment, Countermeasures, Cleanup, and Disposal –
    - Having a High Viscosity will restrict the type of recovery devices used. Drums with sorbent lining or groves, rope skimmers and absorbent materials can collect this product well; manual methods, such as shovels will also be effective.
    - Group V oils have a specific gravity greater than 1 so oil will likely sink; underwater detection and monitoring may need to be utilized.
    - Consider containment booming to keep the product close to the discharge source or minimize spreading.
    - On-site storage will need to be assessed if recovery operations are started.

154 - Considerations

Cleanup costs for submerged oils have historically been substantially higher than shoreline cleanup, options consist of,

150 - Group V Oil (Cont.)

- Containment Options:
  - **Bottom Boom** - weighted boom placed on the bottom
  - **Bubble Curtains** - massive amounts of bubbles released from a perforated manifold on the bottom contains oil through turbulence caused by their rising action
  - **Jackson Net** - a boom-type device consisting of a double layer of knotless net, with an impermeable plastic membrane between layers that end at the top and bottom which support tension lines
  - **Morgan Boom** - specialty boom consisting of a permeable membrane attached to air-inflated flotation chambers. The permeability of the membrane is designed to allow water to pass through while keeping oil molecules out
  - **Boom/Sorbent Net Combo** - Jackson net with oil snare attached
  - **Silt Curtain** - mesh curtains currently used for dredging operations

- Recovery Options:
  - **Vacuum Systems**, **Skimmers**, **Dredges**
  - **Airlift** - use of air wands to lift submerged oil/oil mat and return it to the water column
  - **IVMS** - the Integrated Video Mapping System is an on-line computer database that integrates video data with positioning data, allowing the operator to identify exactly where video data are being collected, thus easing recovery of oil
  - **Pre-Work** - pre-spill surveys of deep spots, currents, etc. as well as digging of trenches to contain spilled oil

200 - Notifications

National Response Center	Toll Free: (800) 424-8802 Toll Call: (202) 267-2675
USCG Sector Virginia Command Center	(757) 638-6641
Virginia Emergency Operations Center *(for incidents occurring in VA's jurisdiction)*	(804) 674-2400

* By notifying these organizations you will be notifying several response organizations within the incidents AOR. Check with both the NRC and VEOC to confirm the list of notifications.

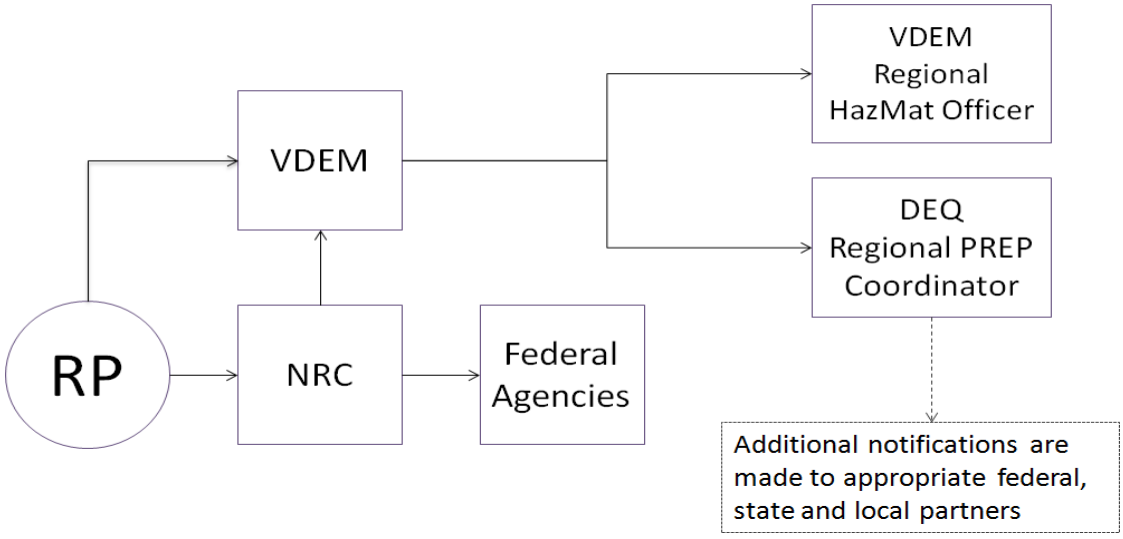
201 – Other Points of Contact

Municipal Fire Department Hazardous Materials Response *(above the RQ)*	911
Maritime Incident Response Team	Office: (757) 440-4012 Cell: (757) 646-2225
USCG District 5 Command Center	(757) 398-6231
National Strike Force Atlantic Strike Team	Front Desk: (609) 724-0008 OOD's Cell Phone: (850) 301-5200
National Strike Force Coordination Center	Front Desk: (252) 331-6000 x3025
Public Information Assist Team	OOD's Cell Phone: (252) 267-3458
Air Station Elizabeth City *(if overflights are required)*	(800) 338-6215 Option #3

US Department of Commerce/National Oceanic and Atmospheric Administration Scientific Support Coordinator: Mr. Frank Csulak *(oil discharge: potential/actual discharge ≥ 1,000 gallons; hazmat release: potential/actual ≥ 500 gallons)*	Office: (732) 872-3005 Cell: (732) 371-1005
Environmental Protection Agency Region III Response Center (VA)	(215) 814-9016
Center for Disease Control *(for medical waste)*	(404) 639-3311

** Notify the US Department of the Interior for the following discharges:*
a) Equal or exceed 5K gallons in Atlantic Ocean/Coastal Waters and 1K gallon spi inland waters (rivers and lakes and ICW) 33 CFR Section 2.05-20, Navigable Wate
b) Discharges that affect Department administered facilities, such as National Par Wildlife Refuge system.
c) Discharges that have impacted or threaten populations of federally listed specie designated critical habitats protected under the Endangered Species Act.
d) Discharges that have impacted or threatened Historical Properties protected un Historic Preservation Act.
e) Discharges that have resulted in fish kills or have impacted migratory birds.

State and Local Notifications



300 - Special Teams

The following are some of the special teams and other technical experts that could be considered as potential response resources when responding to an oil spill:

National Oceanic Atmospheric Administration (NOAA) Scientific Support Coordinator (SSC) – The National Oceanic and Atmospheric Administration (NOAA) provides SSCs in coastal and marine areas. The SSCs serve on the OSC's staff as the head of a scientific team. This support team provides expertise in environmental chemistry, oil slick tracking, pollutant transport modeling, natural resources at risk, environmental trade-offs of countermeasures and cleanup, information management, contingency planning, and liaison to the scientific community and the Natural Resource Trustees.

Atlantic Strike Team – The AST is one of 3 Special Teams that make up the National Strike Force. It is a vital national asset comprised of a unique, highly trained cadre of Coast Guard professionals who rapidly deploy with specialized equipment and incident management skills. The AST is recognized worldwide as an expert authority in the preparation for and response to the effects resulting from oil discharges, hazardous substance releases, weapons of mass destruction events, and other emergencies on behalf of the American public.
https://www.dco.uscg.mil/Our-Organization/National-Strike-Force/AST/

District 5 District Response Advisory Team – The DRAT is a team available to provide specialized support to the OSC concerning funding, equipment, and resources.

District 5 Public Affairs Detachment (Fifth Coast Guard District Media Relations and Governmental Affairs) – The Media Relations staff is dedicated to informing the public of the Coast Guard's missions through mass media, internal information and community events.
https://www.atlanticarea.uscg.mil/Our-Organization/District-5/publicaffairs/

Environmental Protection Agency (EPA) Environmental Response Team – is a group of highly trained scientists and engineers based in Edison, NJ and Cincinnati, OH. Its capabilities include multimedia sampling and analysis, hazard assessment, cleanup techniques and specialized technical support. The EPA ERT provides SSCs for the inland zone.

EPA On-scene Coordinators from Region III – The EPA Region III OSC oversees all responses to pollution incidents that occur within the Region III boundaries. The EPA OSC functions similarly to the Coast Guard OSC by providing response oversight or intervention to pollution incidents as necessary.

Navy Supervisor of Salvage - The U.S. Navy (USN) is the federal agency most knowledgeable and experienced in ship salvage, shipboard damage control, and diving. The USN has an extensive array of specialized equipment and personnel available for use

in these areas as well as containment, collection, removal equipment specifically designed for salvage related and open sea pollution incidents.

Coast Guard Atlantic Area Incident Management Assist Team – As a Deployable Specialized Forces (DSF) unit, the CG-IMAT's mission statement is to assist Operational Commanders to prepare for, respond to, recover from, and mitigate the effects of all risks and all hazard incidents and events.
http://www.uscg.mil/lantarea/cgimat/

National Strike Force Public Information Assist Team - The PIAT is a highly skilled unit of public affairs specialists prepared to complement the existing public information capabilities of the OSC.

NOAA Navigational Response Team – NOAA's navigation response teams, part of the Office of Coast Survey, survey the seafloor in ports and harbors that have undergone infrastructure updates, shoreline alterations, or seafloor changes. They measure depths and look for underwater hazards that could endanger vessels, to update nautical charts for commercial and recreational mariners.
http://oceanservice.noaa.gov/facts/nrt.html

Occupational Safety and Health Administration – The Occupational Safety and Health Administration (OSHA) is an agency of the United States Department of Labor. OSHA's mission is to assure safe and healthful working conditions for working men and women by setting and enforcing standards. These standards include limits on hazardous chemical exposure, employee access to hazard information and requirements for the use of personal protective equipment.

United States Fish and Wildlife Service – The US Fish and Wildlife Service is a bureau within the Department of the Interior. Their functions are to enforce federal wildlife laws, protect endangered species, manage migratory birds, restore nationally significant fisheries, conserve and restore wildlife habitat such as wetlands, and help foreign governments with their international conservation efforts.

Animal Plant Health Inspection Service – The Animal Plant Health Inspection Service protects the health and value of American agriculture and natural resources. APHIS is a multi-faceted Agency with a broad mission area that includes protecting and promoting U.S. agricultural health, regulating genetically engineered organisms, administering the Animal Welfare Act and carrying out wildlife damage management activities. These efforts support the overall mission of USDA, which is to protect and promote food, agriculture, natural resources and related issues.

Virginia Department of Historic Resources –The Virginia Department of Historic Resources is the State Historic Preservation Office. Their mission is to foster, encourage, and support the stewardship of Virginia's significant historic architectural, archaeological, and cultural resources.

Water Intake Specialist – There are two main types of water intakes in the State of Virginia, Industrial and Public Consumption, overseen by different agencies.

Industrial- The county/city Emergency Manager

Public Consumption- The county/city Public Health Department.

Army Corps of Engineers, Norfolk District – The U.S. Army Corps of Engineers supports the nation's river-based commerce, protects established population centers, provides disaster response and constructs military facilities to protect the nation's shores.

* Information pulled from Area Contingency Plan, State Partners, National Contingency Plan and *Hazardous Materials Response Special Teams* guidebook created by the Coast Guard.

400 - References Used:

American Fuel & Petrochemical Manufacturers, *A Survey of Bakken Crude Oil Characteristics Assembled*. Dangerous Goods Transport Consulting, Inc. 14 May 2014.

Cloutier M. and Cushmac G. *Emergency Response Guidebook.* 2012. PHMSA.

Crosby S., Fay R., Groark C., Kani A., Smith J. Sullivan T., *Transporting Alberta's Oil Sands Products: Degining the Issues and Assessing the Risks.* 17 March 2013. University of Washington.

ExxonMobil Research and Engineering Company, *Oil Spill Response Field Manual.* 2014. HBP printing and reproduction.

International Spill Control Organization, *Behavior of Diluted Bitumens***,** ISCO NEWSLETTER, Issue 460, 24 November 2014.

International Spill Control Organization, *Oil and Petroleum Product Properties* ISCO NEWSLETTER, Issue 459, 24 November 2014.

Joint Analysis Group, Deepwater Horizon Oil Spill. (2012). *Review of Subsurface Dispersed Oil and Oxygen Levels Associated with the Deepwater Horizon MC252 Spill of National Significance*. NOAA Technical Report NOS OR&R 27, pp. 140. Joint Analysis Group, Deepwater Horizon Oil Spill.

Jokuty, P., M. Fingas, S. Whiticar, and B. Fieldhouse, *A Study of Viscosity and Interfacial Tension of Oils and Emulsions,* Manuscript Report EE-153, Environmental Protection Service, Environment Canada, Ottawa, ON, 43 p, 1995.

National Academies of Sciences, Engineering, and Medicine. 2016. *Spills of Diluted Bitumen from Pipelines: A Comparative Study of Environmental Fate, Effects, and Response*. Washington, DC: The National Academies Press. Retrieved from: http://www.nap.edu/21834

National Research Council, Marine Board (MB). Commission on Engineering and Technical Systems (CETS). (1999). *Spills of Nonfloating Oils: Risk and Response*. Washington, DC: The National Academies Press.

NW Area Committee*, Bakken Crude Oil*, February 2015. EPA Region 6.

Pipeline and Hazardous Materials Safety Administration. *2016 Emergency Response Guidebook.* U.S. Department of Transportation. 2016. Retrieved from: http://www.phmsa.dot.gov/hazmat/outreach-training/erg

United States Coast Guard, *Hazardous Materials Response Special Teams*.

United States Coast Guard National Strife Force, *Responder Awareness – North American Crude Oil Shipments*.

United States Enviornmental Protection Agency (EPA), *Bakken Shale Crude Oil Spill Evaluation Pilot Study-April 2015,* April 2015. EPA Emergency Response.