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# Standard Guide for In-Situ Burning of Oil Spills in Marshes[1]

This standard is issued under the fixed designation F2823; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This guide addresses in-situ burning as a response tool for oil spills that occur in marshes.

1.2 In-situ burning, mechanical recovery, treating agent application, and natural recovery are the usual options available to an on-scene coordinator for the control and cleanup of spilled oil.

1.3 The purpose of this guide is to provide the user with general information on in-situ burning in marshes as a means of controlling and removing spilled oil.

1.4 This guide outlines considerations that can be used to conduct an in-situ burn in marshes.

1.5 In making in-situ burn decisions, appropriate government authorities should be consulted.

NOTE 1—This guide does not supersede local regulations.

1.6 The values stated in SI units are to be regarded as standard. ~~No other units of measurement are included in this~~ The values given in parentheses after SI units are provided for information only and are not considered standard.

1.7 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate ~~safety~~ safety, health, and ~~health~~environmental practices and determine the applicability of regulatory limitations prior to use.*

1.8 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*



## 2. Referenced Documents

2.1 *ASTM Standards:*[2]

F1788 Guide for In-Situ Burning of Oil Spills on Water: Environmental and Operational Considerations

F1990/F1990M Guide for In-Situ Burning of Spilled Oil: Ignition Devices



## 3. Terminology

3.1 *airborne emissions*—compounds or substances that are emitted into the air as a result of a fire.

3.2 *fresh oil*—oil recently spilled that is un-weathered and un-emulsified.

3.3 *in-situ burning*—burning of oil directly on the water or marsh surface.

3.4 *marsh*—a wetland characterized by grassy surface mats that are frequently interspersed with open water or by a closed canopy of grasses, sedges, or other herbaceous plants.

3.5 *residue*—the material, excluding airborne emissions, remaining after the oil stops burning.

3.6 *wetland*—land that has the water table at, near, or above the land surface, or that is saturated for long enough periods to promote hydrophilic vegetation and various kinds of biological activity which are adapted to the wet environment.

## 4. Significance and Use

4.1 This guide is meant to aid spill response teams during planning, training, exercising, spill response, and remediation.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

4.2 In the marsh environment, removal of the oil by in-situ burning may be the only method available to responders. The soft, soggy soil and presence of water and the potential for ecological damage may inhibit the deployment of conventional oil recovery equipment and personnel, while the shallow water may not allow the deployment and operation of skimmers, booms, and storage devices.

## 5. Background

5.1 In-situ burning of oil has been conducted successfully in a number of marshes. Within several years, recovery was nearly complete in areas where water level was sufficient (exceeded 2 cm) to provide protection to plant roots. Where this was not the case, recovery was slower.

5.2 Ignition equipment for in-situ burning in marshes may be minimal. Ignition devices may be the only specific equipment required. Ignition equipment may include a variety of devices (Guide F1990/F1990M).

## 6. General Considerations for Making ~~In Situ~~ In-Situ Burn Decisions for Marshes

6.1 The decision of whether or not to use in-situ burning in a given spill situation is always one involving trade-offs. General considerations such as smoke plume generated and the potential for secondary fires, and specific factors such as marsh type, water level, season, wildlife present, and vegetation recovery should be considered. The human population, potentially affected by the smoke plume, should be considered as noted in Guide F1788. In certain cases, burning of oiled vegetation can also be considered.

6.2 Oil floating on water should be at least 2 to 3 mm thick to be burned efficiently. Natural containment of spilled oil can occur in marshes, providing such layer thickness. Wind may also concentrate the oil to the desired thickness (Guide F1788).

6.3 Oil spilled in marshes is less prone to emulsification than in higher energy, open water environments. The slower emulsification process provides responders with a wider window of opportunity in which to plan and execute in-situ burning operations.

6.4 In some areas, intentional and controlled burning of marshes is a common method of controlling vegetation and reducing organic debris, with beneficial results for the marshes (**1**).[3]



6.5 Water level has been shown to be a major factor affecting plant recovery following in-situ burning in marshes (**2**, **3**, **4**). When the water depth is at least 2 cm, it provides an insulating layer to plant root and rhizomes, keeping their temperature below 60°C and allowing faster recovery.

6.6 Fire spreading needs to be considered. Flattened vegetation and green, un-oiled vegetation may not provide adequate firebreaks, especially in the presence of strong winds. Wetting the perimeter may be beneficial.

6.7 In-situ burning in a timely manner will simplify ignition, reduce the area affected, and minimize the duration of vegetation exposure to the toxic effects of the oil.



6.8 Burning in the winter months may require special considerations because of ice and snow. Cold results in increased oil viscosity and reduced spreading potential. Several burns in ice and snow-covered marshes also proved to be effective and provided for good long-term recovery of the marshes.

6.9 In-situ burning of oil may generate a substantial smoke plume. If human exposure is possible, smoke plume monitoring near population centers should be considered as noted in Guide F1788.

6.10 Utility lines, buildings, and other structures need to be protected from fire.

6.11 Smoke may impair visibility and impact air traffic in the burn area.

6.12 The spilled oil will not be consumed completely by the fire. Residue will be left after the burning has ended. The effects of the residue should be considered. A thick and dense layer of residue will impede revegetation. The effect of the residue should be weighed against impacts of removing the residue, and particularly the effects of movement over the marsh by people and equipment used to remove the residue.

6.13 The presence of endangered or threatened species must be considered before making the decision to burn.

## 7. Operational Considerations

7.1 Appropriate regulatory agencies and fire departments should be consulted prior to conducting a burn.

7.2 A burn plan should be developed with the help of a marsh and fire ecologist. Air, burn, and plume models should be run to predict the effect of the burn on the area. The burn plan and a fire safety plan should include: weather, fire calculations, plume modeling, and air and fire modeling protocols, sensitive ecological areas, marsh conditions, seasonal implications, and oil properties. The area should be surveyed for utility lines, pipelines, buildings, and other man-made structures. The risk posed by the burn to these structures should be assessed.

[3] The boldface numbers in parentheses refer to a list of references at the end of this standard.

7.3 When a marsh is impacted by an oil spill, all methods of response and cleanup should be considered and assessed for tradeoffs, feasibility, and net benefit to the environment.

7.4 Environmental risk considerations should include the effects of the plume, soot, heat flux, fire spread and remaining burn residue (Guide F1788).

7.5 Risks to human health and safety should be considered, both to personnel conducting the burn, and to the general public. Monitoring protocols should be implemented in accordance with local regulations, and the monitoring teams should be alerted (Guide F1788). Plume, air, and fire modeling results should be considered.

7.6 Prevention or control of secondary fires should be planned for. Provision should be made for changes in wind direction or speed.

7.7 Local aviation, navigation, and highway authorities should be notified before the burn is initiated.

7.8 The burn should be monitored and recorded, including direction, altitude, and behavior of the smoke plume. Still and video photography should be used for documentation.

7.9 After the burn has been extinguished, the area should be surveyed, and the effectiveness of the burn should be assessed and documented. A fire watch should be established to ensure that the fire is completely extinguished.

7.10 Residual oil contamination may be ignited, if possible.

7.11 If possible, burn residues should be collected and disposed of in accordance with local regulations. Oil residue collection may not always be advisable, and should be weighed against the potential damage from people and equipment used for residue collection.

7.12 Monitoring of marsh recovery and potential restoration should be conducted.

## 8. Summary

8.1 Oil spills in marshes may present unique challenges for response personnel. Access may be difficult, and the presence of water and soft substrate may preclude the use of conventional oil cleanup equipment and personnel. Shallow water may not allow the use of vessels and successful deployment of booms and skimmers. In-situ burning may provide the most suitable, and sometimes the only option for removing the spilled oil from the environment. Use of machinery and human foot traffic can result in mixing of oil with sediments, which can have an adverse effect on marshes.



8.2 The decision to conduct in-situ burning should consider a variety of factors including marsh type, vegetation recovery, water level, presence of wildlife, and secondary fires. Consultation with biologists, fire ecologists, and other experts is essential. For a successful burn to occur, the oil thickness should be greater than 2 to 3 mm. A water depth of at least 2 cm will encourage rapid vegetation recovery.

8.3 Before conducting the burn, an in-situ burning plan and fire safety plan should be completed. Appropriate regulatory agencies and fire departments should be notified, and burn permit(s) sought. Risk to human heath shall be considered. Monitoring of the burns and smoke plume should be conducted if necessary. When the fire has been extinguished, burn residues may be collected and disposed of, if advisable. Monitoring of the marsh should be conducted to follow recovery.

## 9. Keywords

9.1 ~~in situ~~ in-situ burning; marsh; oil spills; tradeoffs

## APPENDIX

**(Nonmandatory Information)**

### X1. CASE STUDIES

X1.1 Seven case studies are presented to exemplify the use of in-situ burning in marshes (Refs (**5-16**)).

X1.1.1 *Copano Bay:* (Ref (**5**))—On January 7, 1992, an underground pipeline ruptured by Chiltipin Creek near Copano Bay, Texas, spilling 460 $m^3$ (2900 barrels) of South Texas light crude oil into a salt marsh. Vacuum trucks, skimmer, pumps, and sorbents were brought to the scene but proved to be only marginally effective. After considering various options, a decision was made to burn the oil. The oil was ignited four days after it spilled, and burned for 20 h in various areas. The area was surveyed, and pockets of remaining oil were ignited later. At the time of the burn the marsh was covered with water from recent heavy rainfall, providing protection to plant roots and rhyzomes. A study to monitor marsh plant recovery over a period of five years suggested that plant diversity in the impacted area was reduced, but that total plant biomass was similar to the control area after two growth seasons.