# OPERATIONAL EXAMPLES OF IN-SITU BURNING: LESSONS FROM THE BURNING OF TWO RECENT DIESEL SPILLS ON THE B.C.COAST

*by*

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## ABSTRACT

*The future success of in-situ burning will require a series of effective operational burns in addition to continued experimentation to improve technique. Thus, two case histories based on spill reports and the recollection of those in attendance are described with reference to strategy, countermeasures options, feasibility, effectiveness, resource protection, government regulation, property damage and safety. Both spills had important similarities: the product was diesel, operations were logging, locations were remote, and spill containment and recovery capacity nearby was limited. Differences were also significant: in one, containment was on the water behind boomsticks; in the other, a trench close to shore. In both cases though government agencies were notified, neither was subjected to a formal review process. The paper recommends that burn plan forms (checklist) be part of contingency plans in order to facilitate the approvals process and the safe and environmentally responsible burning of fuel spills.*

## INTRODUCTION

In a recent tabulation of historical burns and studies, there were only nine cited operational instances of burning to deal with a spill (Fingas and Laroche, 1991). The remaining seventeen examples were experimental spills, or in one case the analysis of a series of experiments. It is likely that the nine operational burns represent a fairly complete listing for spills classified as large or catastrophic; in contrast, burning at small and medium spills may have occurred but was accompanied by limited or very local documentation and thereby be virtually unknown. If there are safe and operationally effective opportunities for burning, such opportunities must be exploited, and the results documented. The two case histories described here provide such documentation. It must be pointed out that systematic measurements which accompany experimental burns were not attempted with these. As well, they are entirely based on the recollections of those in attendance.

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SETTING

Both spills occurred at logging camps in remote parts of the British Columbia coast. There are large numbers of such camps, active ones number in the hundreds and at most there are substantial diesel fuel, gas, and other petroleum products in storage. At one logging division, fuel storage capacity at the sixteen separate operations (camps) amounted to 1,135,000 L of diesel, 215,000 L of gas, and 85,000 L of other petroleum based products. Cumulatively, there is a significant risk of spills from these facilities on the B.C. Coast. Moreover, because of their isolation and the limited amount of recovery equipment on site, most of what is accidently released is lost. Attempts have been made at least at the planning stage to airlift equipment to spill sites, but flying conditions vary and are frequently below minimum standards during the winter season. The boomsticks that are available at each camp can provide short term containment at best.

ST. VINCENT'S BAY SPILL, JANUARY, 1988

*Incident Details*: Over the Christmas period, 1987-1988, an estimated 9,000 L of diesel fuel leaked out of a mobile storage tank at a logging camp. The camp was situated along the shore of a West Coast inlet. The distribution of the storage tank, camp buildings, countermeasures activities, and shoreline are shown in Figure 1.

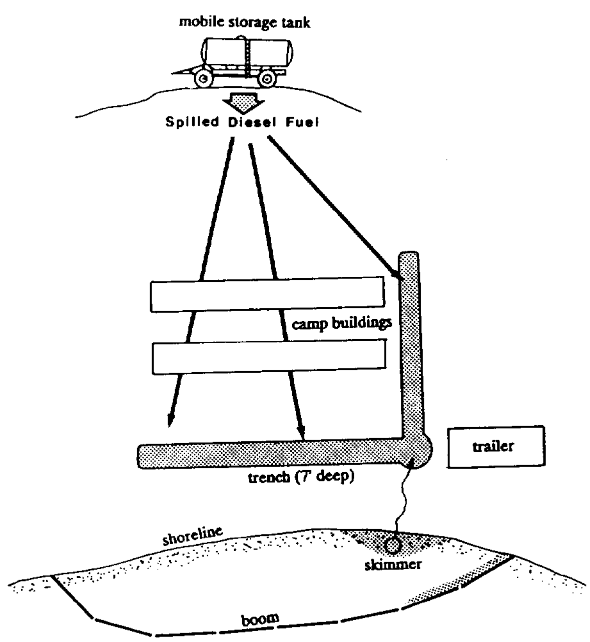


*Figure 1* *Approximate location of storage tank, camp buildings and trailer, countermeasures activities, and shoreline, St. Vincent's Bay spill, January, 1988*

The ground was frozen when camp staff returned after the New Year and the spill was not immediately noticed. On January 8, approximately two days after re-opening camp, with the arrival of warmer, wet weather diesel fuel was seen leaching out of the ground, travelling along the inclined slope to the water line, and creating a slick in the bay. Company staff at division headquarters were immediately notified, as well as government agencies. They in turn loaded a small disc skimmer from their own facilities plus several hundred feet of boom from the nearby petroleum cooperative and arrived at the site quickly.

*Containment/collection*: While this response was being mobilized, the logging company moved one of its large backhoes to the spill site where it quickly excavated a trench 50' long, 7' deep and 3.5' wide with a deeper pit at one end to intercept the spilled fuel. This was successful, and several hours later an estimated 3"-5" of diesel had collected in the trench. With the arrival of the equipment in the late morning, the boom and skimmer were deployed in the bay. A hose from the skimmer was directed into the trench. Very little fuel was collected in this way, probably owing to the fact the slicks in the bay were so thin.

*Ignition*: The intention of the operator appears to have been to burn any diesel which could be recovered. This explains why the hose from the skimmer was directed back into the trench. At no time was a skimmer placed in the trench to recover the lost product to storage or disposal. Several issues were considered by senior staff and a federal government official:

i) feasibility of burning seemed favourable, particularly in view of successful collection of diesel in the trench;

ii) safety and property damage considerations appeared to be met by excavating a deeper pit at one end of the trench (Figure 1), and by placing a mound of fill between the pit and the rest of the trench to limit the extent of individual burns.

iii) government agencies had been immediately notified, but no formal approval for burning appears to have been attempted.

iv) countermeasures options other than burning may have seemed limited from the operator's perspective.

Over the course of January 8 and 9, the collected diesel was ignited on several occasions. In each case, a handful of straw was ignited and thrown into the trench. In spite of the temperature (est. 6°C), overcast conditions, and a light rain, the diesel quickly ignited. Two factors above all others probably explain the successful ignition. First, according to observers several inches of diesel had already collected. Second, lying in a trench the fumes from the evaporating diesel fuel would have concentrated to a considerable and potentially dangerous extent. This may not have been appreciated by observers at the surface exposed to local circulation. No doubt, the high concentration of fumes assisted the ignition process.

*Burn Phase*: In all but one case the diesel burnt for several minutes before dying out. In that one case, within less than one minute, the fire jumped the earth mound and spread down the trench, was generating more heat than anticipated, and was threatening the nearby trailer. The contractor on scene recognizing this risk quickly restarted the backhoe, and with sideways sweeps of the bucket was able to backfill part of the trench and extinguish the fire. The elapsed time from ignition to extinguishing the fire was no more than five minutes. There was considerable external damage to the trailer.

On the following day (January 9), the collected fuel was burned safely on three or four occasions. Small amounts of diesel continued to migrate through the beach substrate, some of it collecting in the trench. Here it was burned off on several occasions during the next two weeks until the flow became negligible and the incident was terminated.

RIVERS INLET SPILL, NOVEMBER, 1990

*Incident Details*: During the morning of November 23, 1990 staff at the logging operation at Rivers Inlet reported a series of slides in the steep drainage immediately above their log dump and fuel storage area. Boulders hit the fuel tanks, and a leak was suspected, but the continuing heavy rains and risk of further slides precluded an examination of the damage. As a precaution, several hundred feet of boom sticks were deployed in the water around the storage facility. Short lengths of absorbent boom were secured in the gaps between individual sticks. The configuration of the storage tanks, shorelines and the boomed area are shown in Figure 2.

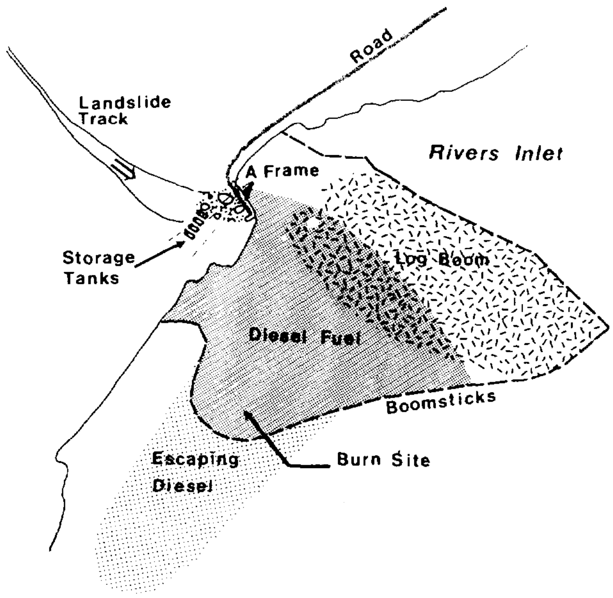


*Figure 2* *Location of tank farm, boomsticks, log boom, shoreline and burning site, Rivers Inlet spill, November, 1990.*

The following morning (November 24), staff and contractors approaching the site noticed diesel contained in the boomed area and several of the tanks punctured. Later estimates indicated the following losses: 68,000 L diesel, 15,000 L gas, and 2,000 L stove oil. Conditions at the time were calm (<5 km E), partially clear.

*Containment/collection*: Appropriate notifications and requests for assistance were made immediately. Containment using boomsticks was partially successful, but some fuel was leaking out at the seaward end of the boom. There was an ebbing tide creating sufficient current to weaken containment. For recovery, the camp had only several bales of absorbent pads. Neighbouring camps (10 - 100 km distant) had similar modest inventories, as determined during the preparation of the operations' contingency plan: adequate for a few litres, but not 85,000. Arrangements were being made to fly in a disc or weir skimmer from Vancouver Island, but that was several hours away. Another concern was the probable increase in wind velocity.

*Ignition*: Given the continued losses of diesel fuel out of the boom, and the temporary inability to recover the contained diesel at any significant pace, consideration was given to burning. The following issues were reviewed by senior staff and a federal government official:

i) property damage: risk to the existing tank farm and nearby log boom without adequate separation from the contained fuel;

ii) environmental approval;

iii) potential environmental damage under a variety of scenarios: the worst being losing containment and the fuel under deteriorating weather;

iv) safety of spill response personnel;

v) inadequacy of alternative countermeasures.

The decision was made to proceed with the burn.

The ends of the boom were released from their original placement and redeployed so as to provide separation between the collected fuel,and the tank farm and log booms. A recent helicopter survey had shown significant patches of uncontaminated surface water between these areas, thus supporting the notion that a safe burn could occur without flashback.

Ignition took place over a period of several minutes, starting at approximately 1415 hours. A fuel-soaked absorbent pad was reported to have been thrown from one of the two attending dozer boats onto the collected fuel. Ignition was slow, and the process was repeated. Whether gasoline was used to speed up this process has not been confirmed. After fifteen minutes, a substantial burn was taking place (Figure 3).

*Burn Phase*: Neither the precise timing of the burn, nor its dimensions were recorded at the time. Recollections indicate that the period from the initial attempts at ignition to the fire going out approximated 30 minutes. Burn dimensions have been estimated using the 16' dozer boats as a point of reference. This indicates a spill diameter of less than 40'. Fuel thickness was not determined. On the basis of this limited information, it would appear that the burn consumed no more than 10,000 L. While modest in relation to the total released from the various tank ruptures, the burn was a success and provides a model for future spills in remote locations.

## CONSIDERATIONS

Burning is a highly unique approach to dealing with spilled oil or petroleum products. Because it may be difficult to control, burning is accompanied by significant risks of personal injury, property damage, and air pollution not associated with other countermeasures alternatives. The various

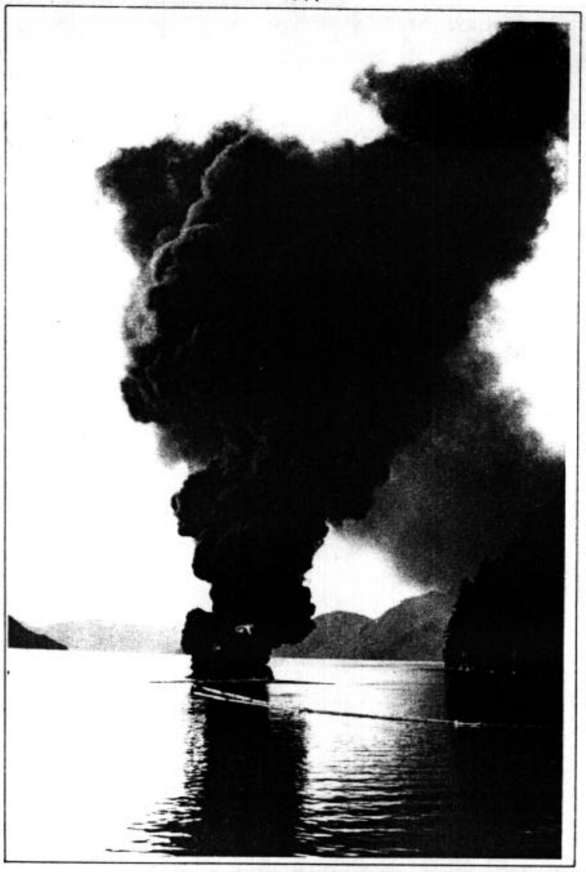

*Figure 3* *In-situ burning of spilled diesel fuel, Rivers Inlet November, 1990.*

technologies which comprise mechanical removal involve other risks. Mechanical means have tended to be slow and inefficient, thereby extending both the duration and areal extent of contamination. In many cases, such as the two described here, booming and mechanical removal equipment are available in limited supply, and therefore burning should be actively considered at the start.

To do so in a conscious fashion and meet statutory and regulatory requirements, responsible operators will have to be supplied with technical assistance, preferably beforehand. This assistance would best be in the form of a checklist, which upon completion would greatly facilitate the authorizing of a proposed in-situ burn. In British Columbia, spilled diesel is a special waste (D. Walton, B.C. Ministry of Environment, pers. comm.), but Section 52 of the Special Waste Regulation (Special wastes from accidental spills) empowers "a manager or the director [to] exempt a person from any of the requirements of this regulation in relation to special wastes originating from response to accidental spills of dangerous goods". In the absence of explicit guidance to such managers, there is considerable advantage to both the regulator and the spillor if an in-situ burning checklist is completed. A logical corollary of this point is that for appropriate facilities contingency plans should include this type of checklist.

An in-situ burning checklist prepared by the Alaska Regional Response Team in December, 1990 provides the elements of a useful model. In particular, its requirements for a burning plan cover the essential safety and environmental issues for the types of remote fuel storage facilities referred to in this paper. Among the twenty points in this plan, the following information requirements seem most germane to such operations:

- proposed burning location in relation to source, nearest ignitable slicks, and nearest land;
- location and type of nearest human habitation;
- proposed ignition method;
- method of oil containment;
- estimated smoke plume trajectory;
- proposed procedures to notify downwind residents.

At the conclusion of a burn, the spillor remains responsible for cleaning up the residue and the unburnt oil.

This paper concludes that in-situ burning is a feasible and environmentally responsible option for dealing with fuel spills, particularly in isolated locations. In view of the countermeasures options, it is a technique which warrants cautious promotion. This assumes the unknowns associated with burning can be addressed by the spillor completing a burn plan, which in consultation with regulators, should be straight forward to fill out and implement.

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Fingas, M. and N. Laroche. An Introduction to In-situ Burning of Oil Spills. Spill Technology Newsletter (In Press), 1991.